

# The Degree of Using Methods of Quality Management in the Implementation of Construction Projects in Jordan

Dr Ahmed Ali Khatatbeh

Department of Civil Engineering Faculty of Engineering, Al Al-bayt University P.O.Box 130040,  
Mafraq 25113, Jordan

\*Tel: 00962795120806 E-mail: ahmd\_khatatbeh@hotmail.com

## Abstract:

In light of the renewed activity of construction sector, it shows the need for increased attention to quality as a cultural attitude and an economic necessity at the same time. Although construction industry had prospered since long time ago and achieved advanced degrees in its products and ways to implement them, it has been criticized for its poor performance and productivity in relation to other industries. Quality products in this industry will not be achieved without using appropriate methods of quality management during projects lifecycle. This study investigates the degree of using methods of quality management in the implementation of construction projects in Jordan. The study sample consisted of (50) managers of construction projects in Jordan. The researcher used descriptive method and develop questionnaire to collect data. The researcher used means, standard deviations the results of the study showed that there are high degrees of using the testing and inspection method, quality control method, the Quality Assurance method, and the Total Quality Management method in the implementation of construction projects in Jordan. This study recommended the founding a Staff from company or outside it for training and employees and to exercises particular programs to contract with the requirements of changes.

**Keywords:** Quality Management, Construction Projects.

## Introduction

Construction industry is considered as the oldest industry known by human. It had prospered since long time ago. Moreover, it achieved advanced degrees in its products and ways to implement them. Old monuments as pyramid in Egypt, old roman theater and the Great Wall of China witnessed the greatness of this industry and its prosperity. Also, it witnessed the products of this industry which reflects the great culture and sophistication. The great diversity of its modern and civilized products, in which we live and with which we deal, emphasizes all that prosperity. These products affect human's daily life socially, politically and economically.

Quality management has increasingly been adopted by construction companies 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, p. 1): 'if ever an industry needed to take up the concept of TQM it is the construction industry'. Alfeld (1988) advances the view that construction very probably promises a greater payback for Performance improvement than any other service industry because of its magnitude. However, implementing TQM principles in construction is particularly difficult because of a lack of standardization and the many parties involved.

Achieving quality in the construction industry has many economical sequences lead to reduce the production costs by cancellation Defects and errors Rectification costs, re-implementation of some rejected business costs , achieving users satisfaction and Reducing maintenance costs during the use period (Khatatbeh,2009). This would contribute in increasing facilities economical life .Furthermore, it provides executing parties confidence in their works, increases their shares in the labor market and gives them a chance to compete and continue (Hoonakker and Carayon et al, p.954 ,2010 ).

## Problem of statement

By referring to some researches on quality management in construction projects, the construction industry has been criticized for its poor performance and productivity in relation to other industries (Alarcon & Ashley, 1992; Forbes, 1993; Kanji & Wong, 1998; Lou shine, Hoonakker, Carayon, & Smith, 2006; Nesan & Holt, 1999; Oglesby, Parker, & Howell, 1989). Many of the management practices used to support construction organizations are being challenged. The industry's clients are moving forward. Clients demand improved service quality, faster building and innovations in technology.

The most significant problems that face the quality management in construction projects in Jordan as well as hinder its application and development are summarized in the following:

1. Inadequate commitment by the senior management in exerting required efforts to apply a successful quality management
2. A lack of effective communication and adequate coordination among the members of the working team in construction projects (owner, designer, implementer and supervisor) and between the senior management and work sites.
3. A Lack of efficiency and training in the frameworks beside failure to perform their duties effectively.
4. A lack of the General codes and specifications that must be followed during the construction process.
5. Instability of the volume of work in the construction industry and it is influence by the national economy.
6. A lack of planning for applying and achieving the effective quality management.
7. A Lack of sufficient clear in the range of quality responsibilities.
8. A lack of legislation and regulations relating to quality.
9. Weakness of some participants' moral values (Business owners, consultants and those who conduct tests and examinations...etc).

### **Question of study:**

The study has a main question which is "what is the degree of using methods of quality management in implementation construction projects in Jordan?"

### **Sub-questions study:**

- What is the degree of using the testing and inspection method in implementation construction projects in Jordan?
- What is the degree of using the quality control method in implementation construction projects in Jordan?
- What is the degree of using the Quality Assurance method in implementation construction projects in Jordan?
- What is the degree of using the Total Quality Management method in implementation construction projects in Jordan?

### **Purpose of study:**

The study has a main aim which is "identify the degree of using methods of quality management in implementation construction projects in Jordan"

### **Sub-aims study:**

- Identify the degree of using the testing and inspection method in implementation construction projects in Jordan
- Identify the degree of using the quality control method in implementation construction projects in Jordan
- Identify the degree of using the Quality Assurance method in implementation construction projects in Jordan
- Identify the degree of using the Total Quality Management method in implementation construction projects in Jordan

### **Significance of the study:**

This study also shows how the using of methods of quality management in implementation construction projects in Jordan

### **Limitation of the study:**

This study is limited to construction projects in Jordan at 2013/2014 year.

### **Literature review**

### **Introduction**

### **Quality Definition and Concept:**

The word "Quality" is derived from the Latin word "Qualitas" which means the essence or person or degree of his goodness. To clarify what quality means is a complicated issue to some extent. As quality meaning differs from one person to another since every one has different thought on what quality means. The concept of quality changes with time. So, thoughts about quality concept one century ago is completely different from the current thoughts (Tirupathi, p.2, 2009).

Quality has various definitions such as the following (United Nations Industrial Development Organization, p.1, 2006):

- Quality means being appropriate for use and purpose.
- Quality means Corresponding to requirements and specifications.
- Quality means satisfying the customer
- Quality means overall product qualities and characteristics that satisfy customer needs and expectations.
- Quality means Degree of excellence.

Where the researcher found through his experience as a civil engineer and through his study of previous researchers that quality essence in general is achieving the product and serving quality basic needs. Therefore, the quality of construction work means the necessity of finding safety Factors, durability and usability in these works mainly to be convenient to the purpose of investing them and gaining confidence of their users.

In general, the meaning of quality and its concept is to some extent ambiguous as well as it often associates with customers' or users' own opinions, their purpose of using the products and their needs. The content of quality in construction can mainly be linked to the following aspects and concepts (Amanor-Boadu, Martin, p.2 2000):

- 1- Occupation: Does the building achieve the needed purpose?
- 2- Economic "Does the building represent a financial value?"
- 3-Age: Is the building Solid and capable to endure with time?
- 4- Aesthetic: Is the building appearance satisfying? , and Does it proportionate to the surrounding buildings?
- 5- Depreciation and the economical power: Is the building a good investment?

It can be concluded that quality and quality management in construction is related to many factors and expectations surrounding the construction process. Sophistication, durability and reliability are the most important factors. To achieve quality in construction needs to look through construction projects as a set of activities that starts with the user's need and ends with achieving users' contentment. It should be noted that quality management is many parties' responsibility who are themselves construction projects parties, (owner-designer- implementer-supervisor) (Arditi and Gunaydin, 1997).

### **The methods of managing and supervising quality**

There are four levels to manage and supervise quality which are (TECHBRIEF, p.2, 2012):

- 1-Examination or inspection
- 2- Quality control
- 3- Quality Assurance
- 4- Total Quality Management

#### **1-Examination or inspection:**

All the activities concerned in measuring, testing and defining the product's features or service. Then, these activities are compared with Specific requirements. In event a mismatch happens materials will be replaced and the unmatched work is re-implemented (AECOM Technical Services, p.5-1, 2012).

#### **2- Quality control**

Quality Control is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The Quality Control system is designed to control the quality in construction projects needs the following (A guide for public practitioners, p.5, 2010):

- Formulating specific standards for implementation through Schemes, specifications and technical requirements describing every part of the construction process.
- Measuring all the differences from the required standards through making sure that the construction

projects are Compatible with all schemes specifications and technical requirements

- Remedial actions are applied to the negative variances in order to reduce them to the normal and accepted standards
- Planning to improve standards and increase the congruence by utilizing of the negatives and error that appear during implementation as well as avoiding them

### 3-Quality Assurance

Quality Assurance activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably by independent third parties, should be performed upon a finalized inventory following the implementation of procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the quality assurance programme (Bartram and Ballance ,p.3,1996).

- Consent and third-party certification requires the participation of a third party. It is turn to check and evaluate the level of the performed work at every stage of the construction project.
- System verification through making sure of its capability to achieve the required level of quality.
- Formulating advanced quality planning by finding specialized qualified and expert frameworks in quality management of construction works in order to organize implementation programs and practical procedures must be conducted through the construction project.
- Comprehensive Brochures to clarify the importance of achieving quality in construction works.
- Using quality costs by calculating the expenses of quality assurance activities.
- Involving non-productive process like the supportive works of implementation process by Supplying resources, equipments, calculating expenses and planning ...etc

### 4- Total Quality Management

Quality management systems can be considered one of the important management systems that industrial companies deal with to improve the level of their performance. The competition between them is a good Stimulus that makes these companies adopt this system in order to crown their works by quality without forgetting time and cost (Kaura,p.2, 2005).

The contractor (one of the parties in the project contract) is responsible for planning and developing a program, which assures that all his management and technical responsibilities for achieving quality are effectively executed at the site. The program is aimed primarily to ensure an efficient quality control system at the construction site and take corrective actions, when necessary. The project management team PMT must be responsible for applying the quality control requirements at the site (Westinghouse, p.14, 2013).

#### Methods and Procedures

This section contains description of study methodology, population and sample in addition to the chosen method as well as tool used to collect data, also procedure of construction or development necessary steps to ensure its veracity and consistency. Furthermore, practical procedures and statistical processing are used in the treatment of the study data as the following:

#### Study Methodology:

Researcher used descriptive analytical method which is based on the data collection, classification, organization and analysis.

#### Study population:

Population of the study consisted of all employees and officials in the construction industry also quality management facilities managers and facilities managers in Jordan.

#### Study Sample:

The study sample was selected randomly based on Demographic variables (age, gender, academic qualification, and experience) from the population of the study equivalent to (50) managers of construction projects in Jordan.

#### Instrument of the study:

To realize the degree of using methods of quality management in implementation construction projects in Jordan

in this study, the researcher built and developed preliminary which questionnaire consists of (24) items for this matter through revising the literature review and the previous studies which related to the content.

### Reliability

To ensure instruments reliability and validity researcher presented preliminary questionnaire for the number of questionnaire arbitrators and judges whom are experts and specialized in this field were selected in intentionality manner from some of quality manger of construction projects in Jordan In order to ensure that each statement clarity and accuracy of the context, and how suitable is the form of the field which is being measured and their suitability to the aims of the study. and the arbitrators for the study tool preliminary form an approval of 80% and more on evidence of items sincerity was based on proposals members of the arbitration, and has become in its final form consisting of four fields through (24) items. The level of scale answer for each paragraph was according to five point Likert scale identified follows: one represents Strongly Agree, two represents agree, three represents normal, four represent disagree, five represents strongly disagree. Likert scale was used to judge the results which were divided to High, Average and Low according to the following standard:

The highest value - minimum value of alternatives/ Number of levels

Therefore, the level of response as follows:

Low level if it was  $1+1.33=2.33$

Average level if it was  $2.34+1.33= 3.67$

High level if it was 3.86 and more = 5.00

### Validity

To ensure stability, the researcher adopted the method of testing and retesting. Questionnaire has been distributed for number of quality manger of construction projects in Jordan. Twenty manger of construction projects are from outside the study sample, as it was re-applied to them after two weeks, where as the value of Pearson's correlation coefficient is (0.83), its high value and acceptance for the purposes of this study. The equation of Cronbach alpha also used of internal consistency reliability coefficients were as follows:

**Table (1)**

#### Stability Rate

| Field   | Number of statements | Cronbach Alpha |
|---|----------------------|----------------|
| the degree of using the testing and inspection method in implementation construction projects in Jordan   | 6                    | 94%            |
| the degree of using the quality control method in implementation construction projects in Jordan          | 6                    | 88%            |
| the degree of using the Quality Assurance method in implementation construction projects in Jordan        | 6                    | 83%            |
| the degree of using the Total Quality Management method in implementation construction projects in Jordan | 6                    | 90%            |

Table (1) shows that all Cronbach alpha values for all fields exceeds 60%, in which the first, and third, had (94%, 83%, 90%, 88%) respectively, while the second, fourth field got (90%) which have been accepted for the research.

#### Statistical treatment:

For achieving the purpose of statistical treatment, the following statistical methods were used:

1. mean and standard deviations.
2. T-test statistical (One Way Anova) and (Shaffee) test for dimensional comparisons where necessary.
3. the equation of Cronbach alpha and Pearson's correlation coefficient.

Furthermore, practical procedures and statistical processing are used in the treatment of the study data as the following:

## Stability Rate

To ensure stability, the researcher adopted the method of testing and retesting. Questionnaire has been distributed for number of quality managers of construction projects in Jordan.. Twenty (20) managers are from outside the study sample, as it was re-applied to them after two weeks, where as the value of Pearson's correlation coefficient is (0.83), its high value and acceptance for the purposes of this study.

After identifying the research design an analysis should be identified to the answers of the questions that been asked inside the questionnaire, the means and standard deviations for the answers of the questionnaire that used to gather data, are presented here after.

To answer the questions inside the questionnaire, means and Standard deviations were found for:

- To answer the first question which states: What is the degree of using the testing and inspection method in implementation construction projects in Jordan? It has been found means and standard deviations of the field, which measures degree of using the testing and inspection method in construction projects in Jordan, the table (3) show that:

Table (3) it has been found means and standard deviations of the field, which measures degree of using the testing and inspection method in implementation construction projects in Jordan

| Applicability | Rank | Standard Deviation | mean | Paragraph  | n |
|---------------|------|--------------------|------|--|---|
| High          | 1    | 0.56               | 4.47 | Inspection and testing of materials and Implementing work and compared it with the specifications requirements       | 3 |
| High          | 2    | 0.76               | 4.19 | Measuring and testing of the product or service and compare it with the specific requirements                        | 1 |
| High          | 3    | 0.62               | 4.04 | Replace the material and re-implementation the non-conforming work with the specifications requirements              | 4 |
| High          | 4    | 0.82               | 3.99 | Determine the attributes and characteristics of the product or service and compare it with the specific requirements | 2 |
| High          |      | 0.66               | 4.17 | Performance As whole   |   |

The table (3) shows that the mean of the paragraphs of the study came high within the domain , which measures degree of using the testing and inspection method in implementation construction projects in Jordan to the answers of the study sample , where he was the arithmetic mean of the total degree of applicability of the high was ( 4.17 ) and standard deviation ( 0.66 ) where it came from paragraph (3) which states that " Inspection and testing of materials and Implementing work and compared it with the specifications requirements " in the first place with a mean ( 4.47 ) degree of applicability of the high and came in second paragraph (1) which states that " Measuring and testing of the product or service and compare it with the specific requirements " a mean ( 4.19 ) degree of applicability as high as they came to paragraph (4) which states that " Replace the material and re-implementation the non-conforming work with the specifications requirements " with a mean ( 4.04 ) degree of applicability of the high came in ranked last paragraph (3) , which states " Determine the attributes and characteristics of the product or service and compare it with the specific requirements," a mean ( 3.99 ) degree of applicability of the high.

- To answer the second question which states: What is the degree of using the quality control method in implementation construction projects in Jordan? It has been found mean and standard deviations of the field, which measures degree of using the quality control method in construction projects in Jordan, the table (4) show that:

Table (4) mean and standard deviations of the field, which measures degree of using the quality control method in implementation construction projects in Jordan

| Applicability | rank | Standard Deviation | mean | Paragraph  | n |
|---------------|------|--------------------|------|--|---|
| High          | 1    | 0.69               | 4.35 | Ensure during implementation by measuring the differences in standards and compliance with the implementation work schemes                           | 2 |
| High          | 2    | 0.85               | 4.13 | Put specific standards for implementation during the schemes construction process  | 1 |
| High          | 3    | 0.79               | 3.84 | Take corrective action for negative differences in standards and decrease it to the allowable limit of the safety aspects of the implementation work | 3 |
| High          | 4    | 0.71               | 3.78 | Planning to improve standards and to increase congruence with them to take advantage of them in the work of other construction projects              | 4 |
| High          |      | 0.73               | 4.03 | Performance As whole   |   |

The table (4) shows that the arithmetic mean of the paragraphs of the study came high within the domain , which measures degree of using the quality control method in implementation construction projects in Jordan to the answers of the study sample , where he was the arithmetic mean of the total degree of applicability of the high was ( 4.03 ) and standard deviation ( 0.73 ) where it came from paragraph (2) which states that " Ensure during implementation by measuring the differences in standards and compliance with the implementation work schemes " in the first place with a mean ( 4.47 ) degree of applicability of the high and came in second paragraph (1) which states that Put specific standards for implementation during the schemes construction process " a mean ( 4.13 ) degree of applicability as high as they came to paragraph (3) which states that " Take corrective action for negative differences in standards and decrease it to the allowable limit of the safety aspects of the implementation work " with a mean ( 3.84 ) degree of applicability of the high came in ranked last paragraph (3) , which states " Planning to improve standards and to increase congruence with them to take advantage of them in the work of other construction projects," a mean ( 3.78 ) degree of applicability of the high.

- To answer the third question which states: What is the degree of using the Quality Assurance method in implementation construction projects in Jordan? It has been found mean and standard deviations of the field, which measures degree of using the Quality Assurance method in construction projects in Jordan, the table (5) show that:

Table (5) mean and standard deviations of the field, which measures degree of using the Quality Assurance method in implementation construction projects in Jordan

| Applicability | Rank | Standard Deviation | Mean | Paragraph   | n |
|---------------|------|--------------------|------|---|---|
| High          | 1    | 0.70               | 4.19 | Adopt the Method of modeling failure And analysis of its causes | 4 |
| High          | 2    | 0.72               | 4.02 | Advanced Quality Planning                                       | 2 |
| High          | 3    | 0.68               | 3.92 | The involvement of non-productive operations                    | 3 |
| High          | 4    | 0.51               | 3.68 | Approval or ratification of a third party                       | 1 |
| High          |      | 0.62               | 3.95 | Performance As whole  |   |

The table (5) shows that the arithmetic mean of the paragraphs of the study came high within the domain , which measures degree of using the Quality Assurance method in implementation construction projects in Jordan to the answers of the study sample , where he was the arithmetic mean of the total degree of applicability of the high was ( 3.95 ) and standard deviation ( 0.62 ) where it came from paragraph (4) which states that " Adopt the Method of modeling failure And analysis of its causes " in the first place with a mean ( 4.19 ) degree of applicability of the high and came in second paragraph (2) which states that " Advanced Quality Planning" a mean ( 4.02 ) degree of applicability as high as they came to paragraph (3) which states that " Take corrective action for negative differences in standards and decrease it to the allowable limit of the safety aspects of the implementation work " with a mean ( 3.92 ) degree of applicability of the high came in ranked last paragraph (1) , which states " Planning to improve standards and to increase congruence with them to take advantage of them in the work of other construction projects," a mean ( 3.68 ) degree of applicability of the high.

- To answer the fourth which states: What is the degree of using the Total Quality Management method in implementation construction projects in Jordan? It has been found means and standard deviations of the field, which measures degree of using the Total Quality Management method in construction projects in Jordan, the table (6) show that:

Table (6) averages and standard deviations of the field, which measures degree of using the Total Quality Management method in implementation construction projects in Jordan

| Applicability | rank | Standard Deviation | Mean | Paragraph  | n |
|---------------|------|--------------------|------|--|---|
| High          | 1    | 0.93               | 4.20 | The participation of all operations  | 3 |
| High          | 2    | 0.57               | 4.08 | Measuring the achievement  | 4 |
| High          | 3    | 0.63               | 3.84 | improve the permanent work for the development of codes, standards and the dissemination of quality concepts | 1 |
| High          | 4    | 0.84               | 3.82 | Participation of suppliers and customers   | 2 |
| High          |      | 0.67               | 3.99 | Performance As whole   |   |

The table (6) shows that the arithmetic mean of the paragraphs of the study came high within the domain , which measures degree of using the Total Quality Management method in implementation construction projects in Jordan to the answers of the study sample , where he was the arithmetic mean of the total degree of applicability of the high was ( 3.99 ) and standard deviation ( 0.67 ) where it came from paragraph (3) which states that " The participation of all operations " in the first place with a mean ( 4.20 ) degree of applicability of the high and came in second paragraph (4) which states that " Measuring the achievement " a mean ( 4.08 ) degree of applicability as high as they came to paragraph (1) which states that " improve the permanent work for the development of codes, standards and the dissemination of quality concepts " with a mean ( 3.84 ) degree of applicability of the high came in ranked last paragraph (2) , which states " Participation of suppliers and customers," a mean ( 3.82 ) degree of applicability of the high.

### Conclusion and recommendations:

#### Conclusions

As a result of this study conducted in the Jordan indicated that management commitment to quality and to continuous quality improvement is very important for construction project, by the way there is great possible for quality development in the construction project. In today's competitive world, the term 'quality' and its concepts are very important for the construction project. There is no time or reserves enough to squander cause that the construction project in Jordan do hard to reach A high degree of using deferent methods of quality management in construction projects in Jordan, where construction projects in Jordan applied testing and inspection method in construction projects by Inspection and testing of materials and Implementing work and compared it with the specifications requirements, and used the quality control method by measuring the differences in standards and compliance with the implementation work schemes, also construction projects the Quality Assurance method by Adopt the Method of modeling failure And analysis of its causes, the projects in Jordan do another step by use the Total Quality Management method in construction projects through the participation of all operations and Measuring the achievement.

#### Recommendations:

1. Founding a Staff from company or outside it for training employees and to exercises particular programs to contract with the requirements of changes.
2. The need to give a choice for employees to make decisions in company also stimulated to choose solutions for problems.
3. Take on a policy of quality project for the configuration of long-term relationships with dealers.
4. Management's option must be done during competent and efficient devices suggestions.
5. Holding training courses for managers and employees on how to apply the quality in construction projects

#### Directions of future research:

1. All construction projects contain risk. It's important to study the effect of risk management on projects possible risk.



2. Regarding projects, change management is one of important and integrated process that should be taken into account to better achieving project goals, so there is a need to investigate how it affects project management.

## References

- A guide for public practitioners Revised October(2010),” Quality Control Manual”.CPA Australia.
- AECOM Technical Services,(2012),” CONSTRUCTION QUALITY ASSURANCE PLAN”. TGRS Construction Montrose Superfund Site 20201 S. Normandie Avenue Los Angeles, California
- Alarcon, L.F., & Ashley, D.B. (1992). Performance modeling: A methodology for evaluating project execution strategies (No. Source document 80). Austin, TX: Construction Industry Institute (CII).
- Alfeld, L.E. (1988). “Construction productivity “. New York: McGraw-Hill.
- Amanor-Boadu, Vincent and Martin, Larry (2000)” Quality Management in a Changing Organizational Environment”. George Morris Centre.
- Arditi, David and Gunaydin, Murat(1997)” Total quality management in the Construction process “.International Journal of Project Management Vol. 15, No. 4, pp. 235-243, 1997 © 1997 Elsevier Science Ltd and IPMA.
- Bartram, Jamie and Balance, Richard(1996) .“ Chapter 9 - ANALYTICAL QUALITY ASSURANCE” Published on behalf of United Nations Environment Programme and the World Health Organization © 1996 UNEP/WHO ISBN 0 419 22320 7 (Hbk) 0 419 21730 4 (Pbk) .
- Forbes, L. (1993, September 8–10). Productivity and quality improvement in the construction industry. Paper presented at the Second International Symposium on Productivity and Quality Improvement with a Focus on Government Highway Projects “TECHBRIEF
- Hoonakker, P.L.T., Loushine, T., Carayon, P., Kallman, J., Kapp, A., & Smith, M.J. (2005). “The effect of safety initiatives on safety performance: A longitudinal study. Applied Ergonomics”, 36(4), 461–469.
- Hoonakker, Peter (2010),” Barriers and benefits of quality management in the construction industry: An empirical study” Total Quality Management Vol. 21, No. 9, September, 953 –969.
- Kanji, G., & Wong, A. (1998).” Quality culture in the construction industry. Quality Management”,9(4–5), 133–140.
- Khatatbeh Ahmed (2009) Utilizing System Engineering and the logical Conditions in the Integration of Participants in the Management of Complex Projects, World Applied sciences Journal 7(8): 978-986.
- Nesan, L.J., & Holt, G.D. (1999).” Empowerment in construction: The way forward for performance improvement”. Hertfordshire: Research Studies Press LTD.
- Oakland, J., & Aldridge, A. (1995).”Quality management in civil and structural engineering consulting “. International Journal of Quality and Reliability Management 12(3): 32-48.
- Oglesby, C.H., Parker, H.W., & Howell, G.A. (1989). “Productivity improvement in construction”. New York: McGraw-Hill.
- TECHBRIEF.(2012),” Construction Quality Assurance For Design-Build, UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
- Tirupathi, (2009),” Quality Concepts” Cambridge University Press. 978-0-521-51522-1 - Quality and Reliability in Engineering
- Vienna, (2006),” Product quality”. Work paper,UNIDO
- Westinghouse,(2013)” Quality Management System”.Westinghouse

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:  
<http://www.iiste.org>

## CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

**Prospective authors of journals can find the submission instruction on the following page:** <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

## MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

## IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

