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A Study on Factors Influencing Quality of Construction Projects

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Abstract— The construction industry plays a vital role in the economy. The construction industry is complex in its nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals. The need for achieving quality of the finished product in the building construction is very important. Quality is an essential element for sustainability and customer satisfaction. Quality in its simplest form can be defined as 'meeting the customer expectations', or 'compliance with customer specification'. No matter what definition we follow for quality, it becomes very complex when we try to put it into actual practice. This study is intended to provide clients, project managers, designers, and contractors with necessary information needed to better manage the quality of a construction building projects by identifying the factors that affect process quality of construction projects and to rank them by degree of importance.

Keywords— the factors that affect process quality of construction projects and to rank them by degree of importance.

I. INTRODUCTION

A. General

The construction industry plays a vital role in the economy. The construction industry is complex in its nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals.

Quality has become a very popular subject in recent years due to conceptual changes in the industry. Quality and quality systems are topics which have been receiving increasing attention worldwide. The product in any industry should be manufactured to a required standard, one that provides customer satisfaction and value for money. The need for achieving quality of the finished product in the building construction is very important.

The high cost of buildings makes it necessary to ensure quality of the finished product. Quality is an essential element for sustainability and customer satisfaction. In construction projects, quality performance is considered as vital for client satisfaction.

1) *Quality Management In Construction:*The construction industry is typified by highly differentiated, fragmented and loosely structured system. Developing a quality system is the first step towards improving quality in construction industry. A quality system consists of the following,

a) Quality policy
b) Organization structure
c) Procedures
d) Processes
e) Training
f) Quality manual

2) Scope of the Project: In the modern construction market, quality is a major function in construction Organization. This project helps the future projects to reduce the construction defect, minimizing rework and enhancing safety. The maintenance of quality management creates a high-performance team atmosphere and a culture of continuous improvement, making it possible to work toward a zero rework environment

3) To improve their products quality
4) To minimize the rework
5) Helps to meet the customer requirements

6) Helps to raise the company's image

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Quality is playing a pivot role during the construction phase of the project.

There is a need to develop a specified method to measure quality due to lack of quality measurement methods.

It is noticed that there are a number of problems in the construction industry caused by bad quality control, and the situation seems to getting worse. Projects are frequently late, over budget and suffer from poor workmanship and materials. Conflict is increasing, resulting in litigation and arbitration with depressing regularity.

Understand the quality criteria for the building construction projects and its impacting factors will make it possible to handle the quality problems much better.

II. METHODOLOGY

The methodology adopted in this study is the collection of data by the method of survey. Several methods for collecting information from the industry were evaluated from various literatures. The flowchart below represents the methodology adopted for the study. After literature study, the company has to be identified. Then the questionnaires have to be prepared and given to contractors and project consultants. Then the data's from the company have to be collected and analyze by using SPSS software. The ranking of the factors is done by using Relative Importance Index. Using that data's the major factors that affecting the quality have to be identified. Then from the results suitable suggestions have to be given to the companies for improving their product quality.

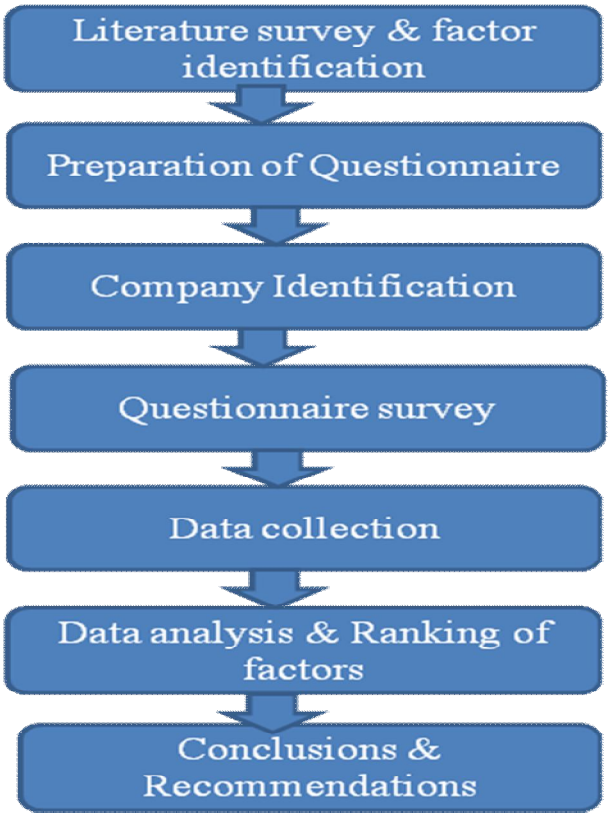

Fig 1 Methodology

Field work

Direct contact with,

Consultants

Contractors

Assessment method

Three point scale
Low important
Important
Very important

Analytical tool

A. Relative importance index (RII)

This method is used to determine consultants and contractors perceptions of the relative importance of the identified quality factors. RII is calculated by,

$$RII = \frac{\sum w}{AN}$$

Where, RII - Relative Importance Index,
W = weighting given to each factor by the respondents (ranging from 1 to 3)
A = highest weight (i.e. 3)
N = total number of respondents.

C. *t-Test*

The data is to be analyzed using SPSS package. T-test is used to find out if there is a significant difference between the ranking of contracting and consulting companies towards the importance of quality factors.
The null hypothesis: H0: There is no significant difference in perception of quality factors between contracting and consulting companies.

III.DATA COLLECTION

A. General

A survey by means of a questionnaire survey was adopted for data collection. It offers time-saving in case of administrative manipulation.

B. Questionnaire Design

A through literature review was initially conducted to identify the factors that affect the quality of construction projects as a whole. Based on these factors the questionnaire for the survey was prepared. The questionnaire is divided into two parts. The first part consists of general information like Name of respondent, Designation, Company name, Type of the project and the second part consist of the quality influencing factors for evaluation. The major factors identified from the literature survey are,

1) Design
2) Lack of communication
3) Conformance to codes and standards
4) Selection of designer
5) Co-operation of parties
6) Management factors
7) Selection of contractor
8) Top management support
9) Labor
10) Work execution
11) Material
12) Equipment

C. Method of Surveying

The general methodology of this study relies largely on the questionnaire survey which was collected from the building contractors and consultants of different sizes by direct contact. Questionnaire developed was circulated to the construction companies.

D. Method of Analysis

SPSS Statistics is a software package used for statistical analysis. It is now officially named "IBM SPSS Statistics". SPSS Statistics (originally, Statistical Package for the Social Sciences, later modified to read Statistical product and Service Solutions) was released in its first version in 1968 after being developed by Norman H. Nie, Dale H. Bent, and C. Hadlai Hull. SPSS is among the most widely used programs for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations and others. The graphical user interface has two views which can be toggled by clicking on one of the two tabs in the bottom left of the SPSS Statistics window. The 'data view' shows a spreadsheet view of the cases (rows) and variables (columns). Unlike spreadsheets, the data cells can only contain numbers or text and formulas cannot be stored in these cells. The 'variable view' displays the data dictionary where each row represents a variable and shows the variable name, variable label, value label, print width, measurement type and a variety of other characteristics. Cells in both views can be manually edited, defining the file structure and allowing data entry without using command syntax. This may be sufficient for small database.

IV. RESULTS AND DISCUSSION

A. General

Totally for forty companies the questionnaires were given, out of which twenty four had an effective reply. Thus the response rate is 60% which is considered a good response in this type of survey. All the questionnaire survey was done from project manager or project engineer, site engineer, contractor of the project at the construction site. In the twenty four questionnaires12 collected from contractors and 12 consultants.

TABLE 1 : THE RELATIVE IMPORTANCE INDEX (RII

Factors	Contractor		Consultant	
	RII	Rank	RII	Rank
Design	0.6111	11	0.6527	11
Lack of communication	0.6944	8	0.7221	7
Conformance to codes and standards	0.8472	1	0.8055	1
Selection of designer	0.5138	15	0.5972	14
Co-operation of parties	0.6388	10	0.7500	6
Management factors	0.6110	12	0.6388	12
Selection of contractor	0.7777	6	0.6528	10
Top management support	0.6527	9	0.6805	8
Labour	0.8055	3	0.7916	2
Execution	0.7778	5	0.7777	4
Material	0.8056	2	0.7638	5
Equipment	0.7916	4	0.7778	3
Financial issues	0.7638	7	0.6250	13
Systems (Quality, Safety)	0.5694	13	0.6666	9
Contract documents	0.5416	14	0.5971	15

Fig 2 Rank of factors affecting the quality of construction projects-contractors view

Conformance to codes and stan0.5416dards has been ranked by the contractors respondents in the first position with RII equal to 0.8472.This factor is the most important one for contractors because this factor is an important to owner's satisfaction. The owner usually seeks to implement project according to standard codes specification. This factor is significant for contractors because this factor is strongly related to client satisfaction.

Quality and availability of equipment's in project has been ranked by the contractor's respondents in the fourth position with RII equal 0.7916. Equipment work products are having more quality than manual work and the speed of work is higher for equipment than manual. So that this factor is significant for contractors. Execution of work has been ranked by the contractors in the fifth position with RII equal to 0.7778. The contractors give importance in executing the work as per the specification only. Proper inspection in the work phase will improve the quality.Selection of contractor is ranked in the sixth position with RII equal to 0.7777. The selection of contractor and application of suitable performance evaluation system to check the contractor's performance will improve the quality of work. The financial issues with RII equal to 0.7638 ranked in the seventh position. The unavailability of fund may leads to the delay in work or poor quality.

This is followed by lack of communication, Top management support, Co-operation of parties, Design, Management factors, Systems (quality, safety), Contract documents and Selection of designer up to next 15 positions. Participation of top managerial levels with decision-making placing a greater role. If managerial levels share with decision making, this will lead to better performance of project and this will satisfy both of consultant and owner with more degree. Quality assessment system in organization is rarely achieved or implemented in our sites. This factor is not that much important to contractors because of absence of quality assessment systems in our construction projects. The application of new management technologies will improve the quality of work.

B. Consultants View

Fig 3 Rank of factors affecting the quality of construction projects-consultants view

Conformance to codes and standards has been ranked by the consultants respondents in the first position with RII equal to 0.8055. This factor is an important to consultant's representative satisfaction because it is mainly related to owner satisfaction.

Availability of labors with high experience and qualification has been ranked by the consultant's respondents in the second position with RII equal 0,7916. This factor is the most important one for consultants because availability of personals with high experience and qualification assist consultants to supervise the project with a good professionalism and also this assist them to satisfy the owner with a successful performance of project.

Quality and availability of equipment's in project has been ranked by the consultant's respondents in the third position with RII equal 0.7778. This factor affects the project performance, work quality and the degree of owner's satisfaction which is one of the main responsibilities of consultants. Execution of work has been ranked by the consultants in the fourth position with RII equal to 0.7777. The consultant's give importance in executing the work as per the specification only. Proper inspection in the work phase will improve the quality. Quality of raw materials in project has been ranked by the consultant's respondents in the fifth position with RII equal 0.7638. Consultants usually want materials used in supervised project with a good quality and according to specification. This factor affects the project performance and the degree of owner's satisfaction.

C. t-Test

The t-test was conducted to find if there is a significant difference between the ranking of contracting and consulting companies towards the importance of quality factors. T-test was carried out on the average weighted factors resulted from ranking the factors affecting quality.

1) The research question:
2) Do contracting and consulting companies perceive quality factors differently?
3) The research hypothesis:
4) There is a significant difference in perception between contracting and consulting companies with regard to factors affecting quality.
5) The null hypothesis:
6) There is no difference in perception of quality factors between contracting and consulting companies.
7) Level of significance
8) Fix 5% level of significance
9) T statistics

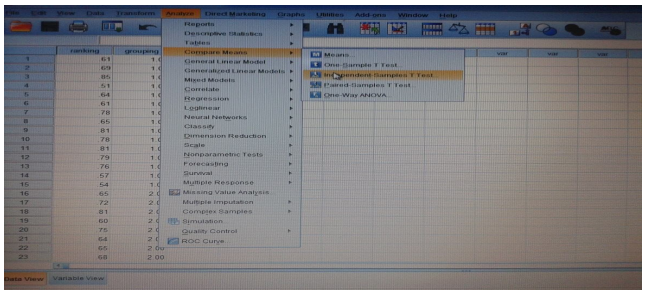

Fig 4 Entering data in SPSS software

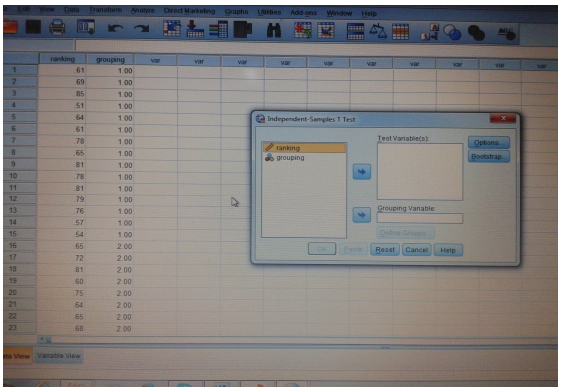

Fig 5 Defining of test variable and grouping variable

D. Result

TABLE 2 GROUP STATISTICS

Grouping		N	Mean	Std. Deviation	Std. Error Mean
Ranking	1.00	15	.6935	.10907	.02816
	2.00	15	.6999	.07327	.01892

Table 2 presents the output for the Independent-Sample T Test. This output consists of two major parts: Group Statistics and Independent Samples Test. The Group Statistics output provides the sample sizes (N), means, standard deviations, and the standard error of the mean (the standard deviation divided by the square root of n) for the continuous variable, separate for each group. With respect to our current study, there were 15 factors in our sample, and for group 1 ie, contractor's having an average of 0.6935, with a standard deviation and standard error of the mean of 0.10907 and 0. 02816 respectively. Similarly, for the group2,they are having an average of 0.6999, with a standard deviation and standard error of the mean of 0.07327 and 0.01892, respectively. The Independent-Samples Test output presented in Table 4.3 is further split into two parts. The first part of this output consists of "Equal variances assumed" and "Equal variances not assumed," respectively. To decide which t test results to use, we must look at the significance level (Sig.) of Levine's Test for Equality of Variances . If the significance level is greater than .05, then we can assume that group variances are equal and need to use the first row of t test results. If the significance level is .05 or less, then we should assume that the group variances are not equal and need to use the second row of t test results. In this case the significance level is .040 (smaller than .05), so we can use the second row of t test results. Part B of the Independent Samples Test output provides us with the t obtained, degrees of freedom(df), the two tailed level of significance (Sig.), and the mean difference (Group 1 mean - Group 2 mean). In our current data, we see that we have a t obtained of -0.191 and, with 24 degrees of freedom. In this data, since the Sig. value is .850 (which is greater than .05), we can accept the null hypothesis say that there is no difference in perception of quality factors between contracting and consulting companies

E. Result

The p value of 0.850 is greater than alpha of 0.05. Therefore the null hypothesis is accepted.

V. CONCLUSIONS

The aim of this study is to find out the various factors which affecting the quality of construction project, so as to improve the quality of product, work, and service, while strengthen the quality management system, and raise the overall level of quality management. In order to establish the corporate image and strengthen competitiveness, the quality of construction is required constant improvement. There are still some suggestions for the quality management and control of construction project to improve the quality,

A. Both contractors and consultants give more importance to quality than anything
B. To achieve the client satisfaction both contractor and consultants give more importance to the factor, conformance to codes and standards.
C. Quality of raw materials and its timely availability will affect the quality of work
D. Availability of labors with high experience and qualification helps to complete the projects with a successful and suitable performance.
E. Equipment work products are having more quality than manual work
F. Proper inspection in the work phase will improve the quality
G. The unavailability of fund may leads to the delay in work or poor quality.
H. Quality and safety system s are rarely implemented in our construction sites.
I. There is no difference in perception of quality factors between contracting and consulting companies.
J. Strong coordination and motivation between labor level and managerial level will improve the productivity
K. Co-ordination between owner and project parties will lead to strong relationship between them and the client will be more satisfied

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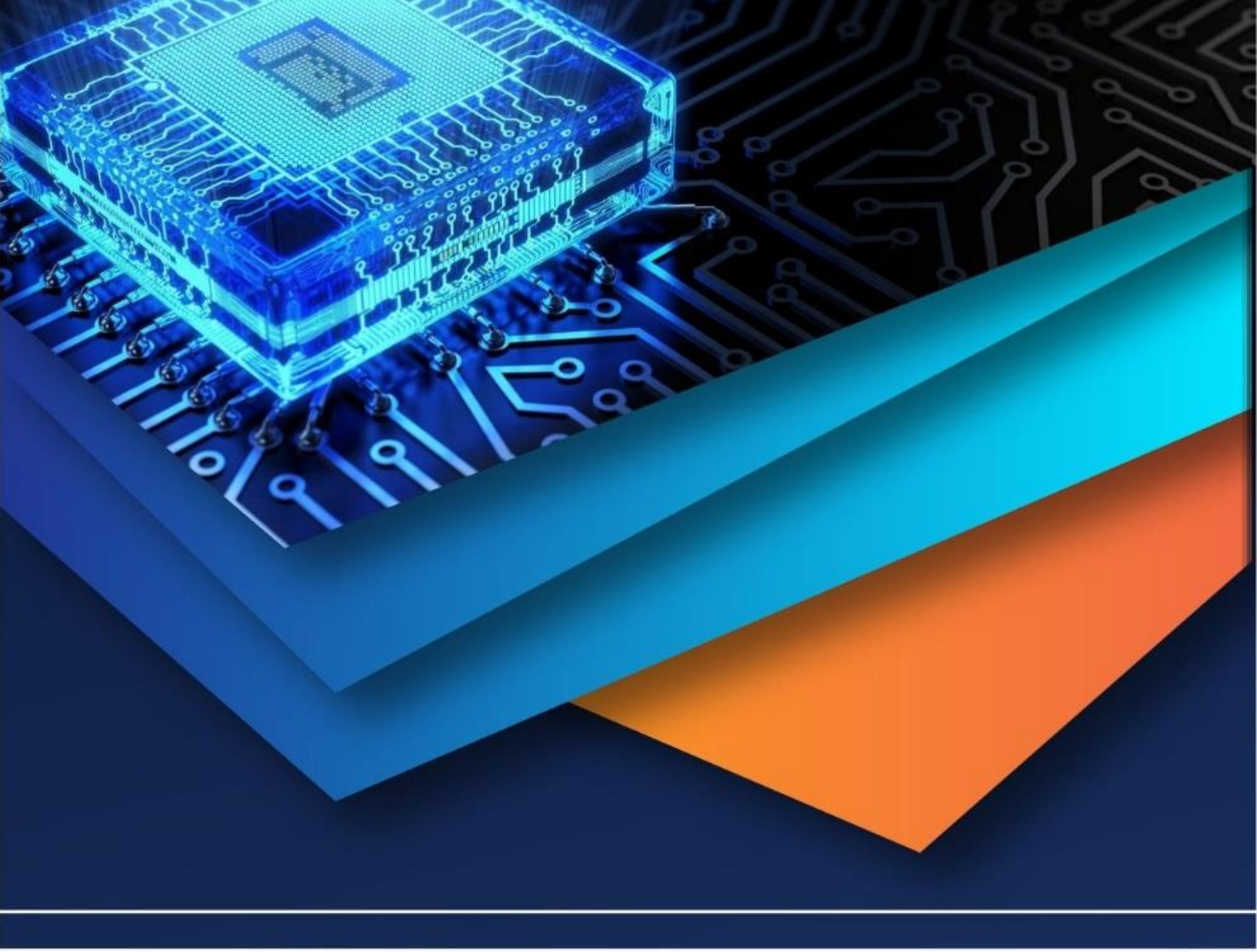

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