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A REVIEW TO MEASURE THE EFFECTIVENESS OF LEAN CONSTRUCTIONS PRACTICES ON PROJECT PERFORMANCE WITH MEDIATING ROLE OF COST OF QUALITY

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Abstract

There are several defies and difficulties fronting the construction industry in Pakistan. Lean construction technique is a new technique that was introduced to the construction business to advance the project management in order to progress the total show of the project after observing its positive impacts on the manufacturing industry. The tenacity of this study is to quota the usefulness of employing lean techniques and approaches on the performance of Pakistani construction projects. With the help of questionnaire surveys the current mindfulness of the Lean Construction Technique was observed in the big construction firms of Pakistan. It is concluded that the defendants do not have the sound knowledge about of the Lean techniques but they are conscious about other new administration methods. The survey also depicts about the most efficiently used lean techniques in the Pakistani Construction Projects and they include waste reduction, perpetual development, client attention, and decrease unevenness. Secondly the Price of Quality of the project was taken as the mediator between the Lean Construction Techniques and Overall Project Performance. Model is proposed after the thorough literature review done from the prior studies that was found strengthening the proposed model justification. The relationship of Lean techniques with the COQ, COQ with Project Performance and lastly Lean techniques with Project Performance was found by the certain statistical analysis techniques using SPSS 21 and Amos Graphics. Different analysis was performed on the on the data gathered through the questionnaire surveys for the most accurate and comprehensive results so the conclusions drawn have the reliability. Future implications will also be recommended and proposed.

Keywords: Constructions Practices, Cost of Quality, Measure.

1. 1 I N T R O D U C T I O N

1.2 Background:

Construction management and latest instrumentality square measure the 2 key factors prompting the enlargement of the development trade. Over the past a few years, varied new techniques square measure implicit however the progress rate of the development trade is kind of low (P. Koushki, K. Al-Rashid, N. Kartam 2005, 2000 and 1998). Even within the developed countries like USA and Japan the expansion of the development trade is incredibly slow. the essential reason is that even the new technologies don't seem to be sufficient enough for the satisfactorily completion of the project. for instance, CAD will increase the potency of the work however cannot cut back the errors therefore the prospect of the work on continues to be there which can evidently take time and further price. this is often a in the main pertinent matter for Building and style comes, wherever the most concern is to reduce price and increase quality by a much better constructability of the project.
Lean construction may be a new observe with the aim of improved conference to client desires with the minimum use of price and time, a word devised by the worldwide teams for Lean Construction in 1993, Gleeson and Townend in 2007 had been explored by many investigators in latest years. This denotes to the utilization of lean production doctrines and performance in style similarly as construction procedures to take advantage of worth and to scale back waste.

Quality prices square measure connected with conception of quality, assessment of correspondence with quality, and significances of failure to satisfy provides each within the workshop and within the hands of clienteles (Feighenbaum, 1991). during this analysis Quality prices are basined with relation to PAF (Prevention, Appraisal, Failure) model. during this model, quality prices square measure characterised into four main sorts as interference, appraisal, internal failure and external failure (Giakatis, 2000).
Lean construction is a method to scheme and design the manufacturing systems to diminish waste of materials, time, and effort to make supreme production (Koskelaet al., 2002). Lean Construction and production uses the similar techniques to lessen waste and upturn the output in construction work.

1.2.1 Linking Lean Principles, COQ and Project Performance:

Waste decrease, visual administration, just-in-time, partnership, benchmarking are leans principles which effect construction cost of quality & project performance and COQ have direct relation with project performance. In this study, the impact of lean construction practices on enactment of construction projects will be analyzed with the mediating role of Construction cost of quality.

1.3 Statement of the Problem:

It would take a great deal of time for the lean practices to be implemented inside the construction projects and organization in Pakistan. Most of the literature available so far has been collected and tested from outside the Pakistan or Asia as such which is why it resulted in lack of data. Very few projects or studies have been executed inside the Pakistan so far, which is why the current study investigate to measure the effectiveness of LEAN Constructions Practices on Project Performance with Mediating Role of Cost of Quality in the Pakistan.

1.4 Purpose of the Study

The following study serve the purpose to investigate the influence of lean construction practices on presentation of construction projects inside the Pakistan.

1.5 Significance of the Study

This research will demonstrate the Project performance regarding the LEAN practices implemented in Pakistan Construction industry. It will also discover the nature of LEAN practices and Construction cost of quality impact on Project performance. It will expose whether COQ mediates the link between LEAN practices and Project performance.

1.6 Research Question

The research question which is proposed in this study as followed:

Q: To what extent Construction firms in Pakistan are aware of the Lean Construction Practices?

Q: Are lean techniques fully implemented in the Projects in Construction Projects?

Q: what are the Lean Construction Practices and how they improve the project performance?

Q: How does cost of quality mediate the effect of Lean Practices on organizational performance?

Q: What are the Cost of Quality and its categories and how they improve the project performance?

LITERATURE REVIEW

2.1 Lean construction

Structure industry is undergoing from numerous difficulties such as inadequate quality, low output, time and cost invades, poor safety, reducing the value of the end product. The innovative approach in construction is the adoption of Lean manufacturing principles for improving and managing construction activities by take full advantage of value seeing the customer needs and reducing cost (Koskela et al. 2002). Reducing waste at early stages, same as factoring principles, indication of an improved value and thus effective scheme in expressions of cost and time. Due to application of lean principles to the manufacturing, the manufacturing development has seen clear progressions and growth.

2.2 Waste Elimination

Below par achieved systems and activities that end in extreme time and value area unit to blame for waste generation. Five hundredth of the extent of waste has been reported that is related to construction comes, and is said to inadequacies through style, construction, mobilization and maintenance activities (Oconnor et al., 2013). Waste reduction is the key

objective of lean construction (Sacks et al., 2010). Defining the approach of pinpointing leftover in building plans is the basic challenge in waste reduction. Waste elimination should commence from the design phase. Kinds of trashes should be acknowledged, in command to eradicate the leftover in the erection course.

2.3 Lean Project Delivery System

This structure focused on the values of using the lean production philosophy to construction projects- a project-based producing theme. LPDS as a part of their mission in deed a unique suggests that to fabricate and construct assets amenities was introduced by LCI (Lean Construction Institute). LCI established the Lean Project Delivery System (LPDS) that employs lean construction principles and apparatuses throughout the development method to help prognostication and monitor, increase quality and cut back waste (Ballard, 2000).

2.4 L e a n Construction Principles

According to Howell and Lichtig (2008) the goal of forthcoming comes is to vary the assembly of labour in beside set up and construction to reinforce project show as production systems (Howell and Lichtig, 2008). Lean principles gift entire method improvement by distributing the value anticipated through the end-user through cooperation, continuous improvement, and demolition of waste and client satisfaction (Enache-Pommer, et al. 2010). Lean construction philosophy utilised to manufacture schemes on location has maximized the consciousness of the values of constant labour, of withdraw course of teams and resources to reduce lists of labor current (WIP), and of procedure clearness to thoroughly convoluted (Sacks et al., 2009). Lean construction focusses on the makes an attempt on interference of defect (O. Salem, et al. 2006).

2.5 Construction Industry and usage of LEAN

In recent times, to modify the conventional construction managing method, the lean thinking has apprehended the construction industry. In various construction divisions lean thinking was applied and examined such as structure, supply chain, finishes, and real and office related tasks. In different jobs in construction, the following sum up some of the various application of lean.

- **Construction supply chain**

Being complex, to illustrate the possible developments in utilizing lean ideas to construction trade in chains, a study was conducted as a result of awarding the situation of pipeline provisions utilized in power plants. The result was concluded as, some of the lean concepts, value stream analysis, to enhance supply chain performance, and is a reliable tool, such as the situation assisted in pinpointing trashes in the procedure. Correspondingly, for enhancing the enactment like decreasing consignment size, former contribution of contractors in plan phase, Procedure standardization, and enhance contractor assortment, various lean principles were employed (Tommelein, 2002).

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- **On-Site Subcontractor Evaluation**

Subcontractor assessment can perform a significant part in the course of a construction scheme in enhancing their productivity. Headed for improvement of work place assessment approach for subcontractors, a research was done in Chile founded on lean principles and associating rehearses. Through regular evaluations and visualization tools, this process was attained to enhance the communication between the main contractors and subcontractors. This method aided the subcontractors' managers to supervise their workforces' on-site enactment and also helped in resolving several clashes. It furthermore aided the chief service provider in future works to choose the appropriate subcontractor centered on their former enactment. This verify the concept of cooperative connection using the subcontractors which steadily carry out soundly (Maturana, et al. 2007).

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- **Final Trades**

Using rank board has aided the trade controller to competently allot his crew through inspecting the nearby forthcoming job, job must not be done and the revise work is prerequisite. Records assortment for improvement observing, developing job position data accessible to entire management stages is also done by using status board. Subsequently, new-computer aided visualization tools exhibited its capability by enlightening the mark of progress and the blockages of the process in enhancing the work flow (Sacks et al., 2009).

- **Construction Submittals**

By using lean ideas in a workplace activity like the submittals course in few construction companies in San Diego, significant developments have been observed. These developments contain time minimization by eradicating wastes and decreasing non-value adding tasks (Garrett & Lee, 2011).

- **Improving employment work**

For enhancing the workflow management in construction process, Thomas et al., (2003) emphasized the rank of the Labor flow as a result of utilizing records as of three projects comprised building of 3 bridges obscuring 137 days of work. Possible area for refining construction presentation, the Flexible Capacity approach was addressed.

- **Formwork Engineering**

Using lean ideas, a study was done in Taiwan to adjust conventional formwork engineering. Diminutions in source leftover and upturns in operating worth by utilizing value stream mapping to pinpoint the progression leftover are the improvements. It was concluded that using lean ideas can minimize wastes generated commencing ambling and examining in molding assemblage and machining (Ko et al.,2011).

- **Construction projects (Assembly and Cessations)**

A survey was completed in Nigeria for the evaluation of effectiveness of applying few Lean Construction Techniques in 80 sheltering unit's construction. These methods include Last Planner, Everyday Group Assemblies, and Upsurge Imagining. The outcomes presented developments in schedule controlling which corresponds to a huge reserves in the project budget. Instead of 90 days the plan was done in 62 days utilizing lean techniques (Samalia Adamu 2012).

- **Infrastructure projects**

Study conducted on tunneling project showed the positive use of lean ideas in infrastructure industry. Lean techniques employed in this research contain regularization, plotting, fishbone diagrams, and 5S methods. 43% productivity has been increased, as a result and the project was within the timetable and no postponements were experienced. Moreover, the project revenue was doubled up (Wodalski et al., 2011).

2.6 What is Quality in construction projects?

Many quality definitions were delivered by experts. Among these definitions are value is an expected degree of homogeneity and reliability, at little budget and matched in the direction of the marketplace (Deming, W. Edwards,2000), quality is the suitability for use (Joseph M. Juran,1988), conformance to necessities (Philip B. Crosby,1979) .

2.6.1 Definition of Quality

Consideration of the difficulties linked with quantification and measurement of quality are also the difficulties regarding the specific definition of quality. Thus, a little effort to evaluate quality would start by means of the quality meaning and resolving the aspects of quality. As discussed above, the quality description in the construction industry is related with customer's contentment and the application of a quality management system is an important device in constantly and consistently handling the aim of customer contentment (Rwelamila and Hall 1995). Latham (1996) has distinguished that generally acknowledged sense for quality is "value for money". It could be understood as 'the greatest for the customer, for specified capital'.

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2.7 Cost of Quality

The COQ idea was initially stated as the "cost of reduced quality" by Juran (1951). Conferred by Crosby (1979), COQ is the value of non-conformance. COQ is typically implicit as the sum of conformance and above non-conformance expenses, where amount rewarded for avoidance of reduced quality is the cost of conformance, and cost of non-conformance is the expenditure of insignificant value affected by manufactured goods and provision failure (Hany Shoukry Tawfek, 2012). The costs related by way of delivering modest quality manufactured goods or provision refers to the term 'Cost of poor'. Amount of capital an industry misses due to the aforementioned manufactured goods or provision wasn't complete accurate in the initial place is the COQ. The recommendation of the cost of reduced quality can extend from 15%-40% of industry expenses (Visha Vasant Waje, 2011).

2.7.1 Types of Cost of Quality

Relating our above discussion the Cost of Quality in the construction schemes has been categorized.

- **Avoidance costs** are experienced with the service provider for tasks that are commenced to avoid interior or exterior non-conformance problems.
- **Evaluation costs** are experienced by the service provider in the course of managing assessments, creating estimations and gathering information.
- **Interior Letdown** costs are acquired upon the service provider because of inadequate outcomes earlier than the possessor's approval of the structure (failure).
- **Exterior Letdown** costs acquire by the way of the supplier when reduced quality is exposed subsequently the proprietor agree to take the structure (defect).

2.7.2 Mediation of Cost of Quality between LEAN Construction Practices and Project Performance:

Our research work will focus on checking the Mediation of COQ between LEAN Construction Practices and Project Performance which have not been discussed in Previous Literature. Next Chapter defines the complete Research Methodology of the Research work and Chapter 4 details out the Research Analysis Techniques Applied and Results that are deduced.

Research Methodology

3.1 Research Hypothesis: Following hypothesis are used:

H1: Lean Construction practices have a significant indirect effect on enactment of Construction Cost of Quality.

H2: Construction cost of quality has a significant indirect effect on enactment of Construction project.

H3: Lean Construction practices have a positive significant impact on the Project enactment.

H4: Construction mediates the relation among Lean Construction practices and project performance.

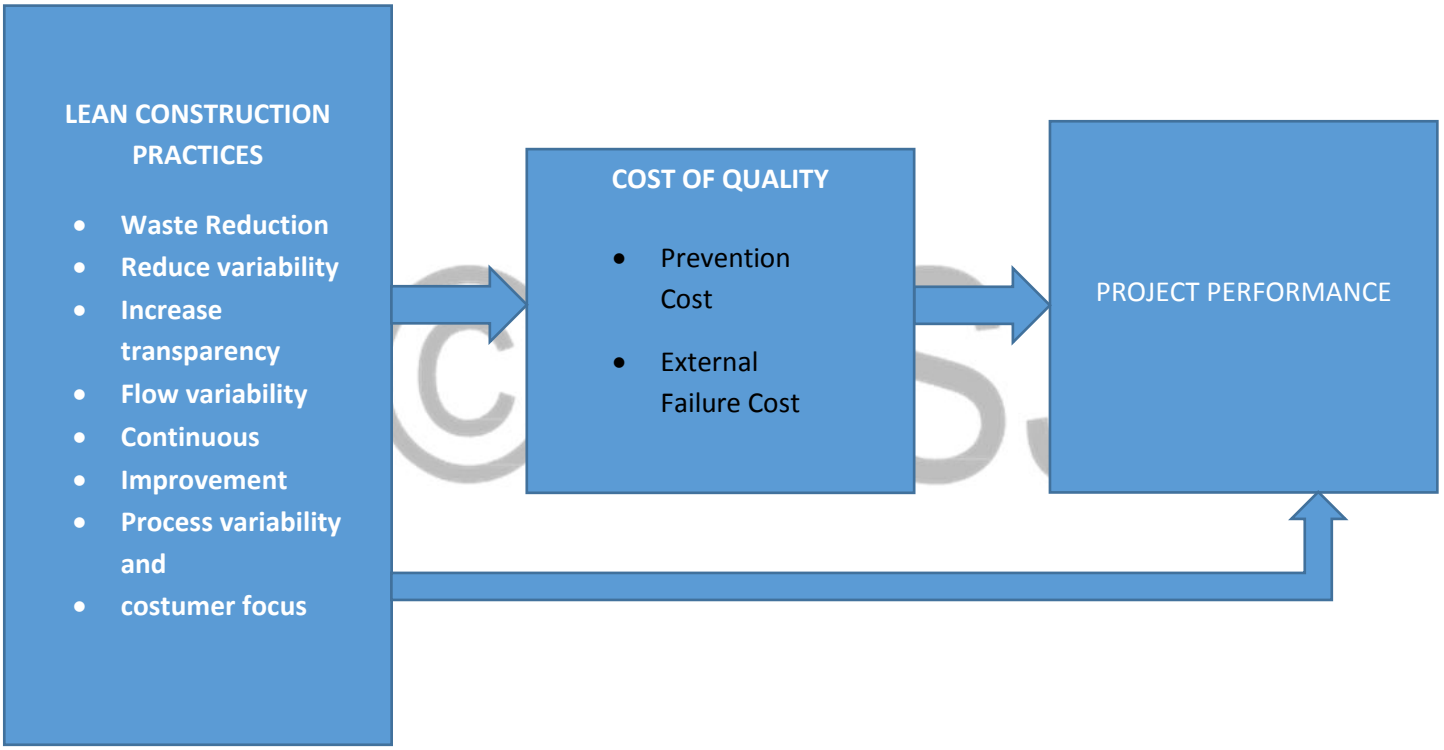


Figure: Hypothesized Model

3.3 Data Collection

3.3.1 Design of research

The quantitative analysis method was used in investigation design for examining the effect of Lean Construction practices on project enactment through meditation of Cost of Quality. A Survey was conducted through questionnaires to collect the data.

3.3.2 Total Population

The total population was based on top management, middle management and first line management of different the working units of the Big Construction firms. The General Manager, Finance Manager, Commercial Manager and Supply-Chain Manager were requested to fill the questionnaire because they set the longer term plans and objectives for the company and take decisions. They have the better knowhow of results of current and past projects and through which techniques they were implemented. The Project Managers and Production Managers were targeted because they have the direct coordination with the top management and they have the knowledge about the Workers working on the specific project.

3.3.3 Data Collection Method

This population was approached via email to fill online survey and through courier service. Data collection was done through maximum personal visits to ensure that questionnaires were only filled up by the relevant people. All Construction firms contacted through personal visits and through email & courier, almost all the large construction firms responded back. Response rate was normal because usually top level management does not respond in the manner, as other employees do.

3.3.4 Instrument

Our research variables include Construction lean practices (independent variable), Cost of Quality (Mediating Variable), and Project Performance (dependent variables). The questionnaire was adopted from prior studies in the same area. The study used 5 point rating scale that is shown below to measure responses.

3.3.5 Data Analysis

After collecting data from respondents, Statistical Program for Social Sciences (SPSS 20) was utilized for record entry, analysis and inference. The analysis of Chronbach's Alpha was employed to calculate the reliability of the constructs of measure. Using AMOS rationality of the measures was checked from end to end confirmatory factor analysis (CFA). To check the connection among three variables, whether it is positive or negative, significant or insignificant, correlation analysis was executed. The magnitude and form of Hypothesized relationships among variables was evaluated through multiple regression analysis

(Cohen et al., 2003). Baron and Kenny steps were used for checking mediation impact of COQ. The analysis of data was conducted in steps.

Analysis

4.1 Descriptive analysis

In descriptive analysis, frequency and statistics were calculated.

4.1.1 Population Composition by demographics:

In this section population composition will be shown by all demographic variables. In descriptive analysis, different descriptive statistics like mean, standard deviation and frequency of demographics i.e. gender, total expertise, experience in current organization are calculated. They are shown through tables along with pie charts for better understanding.

4.2.3 Population composition by Gender:

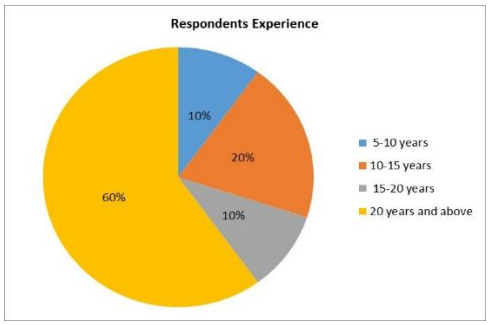
Gender	Frequency	%	Gender	Frequency	%
Male	180	86.5%	Female	28	13.46%

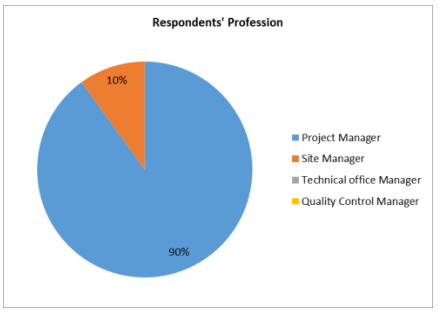
Frequency descriptive for Gender

Table shows the descriptive results for the frequency descriptive of gender wise composition of respondents in the present study. There were 208 respondents in total from whom data collection was made. According to the results, out of 208 respondents, 180 were male and 28 were female that shows male respondents were in majority. Percentage wise, there were 86.5% of male defendants and 13.46% of female defendants as shown in table

Gender

To analyze general info concerning the project and contextual concerning the respondents expertise. The expertise of the defendants varied between one years' expertise and on top of thirty as illustrated and ninety you look after them have a grip of project managers as shown.





4.2 Factors affecting project enactment in Pakistan

The tenacity of segment is to spot the issues poignant the general enactment of the project in present observe. The impact of many issues on the project performance was restrained. These styles of question provide a sign of the main issues that come upon the project manager within the operation part. These issues cause plenty of distractions to the development method. Table below shows the occurrence of the factors impacting the general project enactment.

The frequency of factors impacting the project performance in Pakistan

		Frequencies			
	Factors Impacting	**Costs**	**Times**	**Quality ys**	**Produ Ctivity'**
1	Change orders by owners	100 %	100%	55%	90%
2	Rework errors	71%	74%	41%	71%
3	Poor site management	56%	61%	46%	45%

	Factors Impacting	Cost	Time	Quality	Productivity
4	Difficulties in financing	51%	44%	32%	41%
5	Poor statement and organization	45%	67%	44%	52%
6	Futile preparation and forecast	44%	55%	22%	47%
7	Improper construction approaches	64%	65%	67%	62%
8	Poor qualification	82%	84%	85%	81%
9	Errors and inconsistencies in design documents	95%	100%	74%	96%
10	Un-use of progressive engineering	55%	45%	45%	30%
11	Insufficient details in drawings	66%	81%	64%	62%
12	Difficulty of project design	61%	62%	33%	55%
13	Inadequate data gathering	41%	40%	26%	36%
14	Postponement in material delivery	70%	91%	31%	61%
15	Changes in material types and conditions	84%	74%	55%	74%
16	Injury of sorted material while they are needed immediately	45%	45%	26%	21%
17	Low productivity and competence of equipment	61%	54%	14%	54%
18	Absolute workforce	54%	52%	44%	54%
19	Low output of labors	75%	80%	40%	80%
20	Site doubts	60%	64%	33%	62%

Respondents were requested to rampant the factors, employing a Rating Gauge (1-5), as either Very High, High, Average, Low, Very Low . The subsequent describes the main factors wedged

the price, Time, quality, and productivity as per the positions done by the respondents. The key factors impacting the project performance area unit known supported the following:

1. Factors and its occurrence of prevalence over fifty nada
2. Factors with entire influences of average, high and extremely high stages bigger than or equal five hundredth of the full respondents of every issue

4.3 Reliability of Constructs

Reliability linked to the disparity accounted for by analyzing the real count of fundamental construct. Construct is defined as theoretical variable which is to be measured. Cronbach's alpha is an indicator which gives the reliability value of the construct (Hatcher, 1994).

Construct	No. of Item's	Cronbach's Alphas
Waste Reduction	**7**	0.831
Reduce Variability	**3**	0.827
Increase Transparency	**5**	0.729
Flow Variability	**7**	0.840
Continuous Improvement	**8**	0.862
Process Variability & Customer Focus	**5**	0.722
Cost of Quality	**5**	0.712
Inside Failure Cost	**2**	0.772
Outside Failure Cost	**2**	0.772
Appraisal Cost	**4**	0.839

Prevention Cost	**4**	0.739
Project Performance	**8**	0.775

Reliability of Constructs

Table given above depicts the reliability of different construct. As shown in table reliability of Waste Reduction, Reduce Variability, Flow Variability, Continuous Improvement, Appraisal Cost are 0.831, 0.827, 0.840, 0.862 and 0.839 respectively which is very good and acceptable range of Crobach's alpha and shows that scale is very reliable to utilize. Cronbach's alpha value for Increase Transparency, process variability & Customer Focus, Cost of Quality, inside failure cost, external failure cost, Prevention Cost & Project Performance 0.729, 0.772, 0.712, 0.77, 0.772 and 0.775 respectively which are acceptable values for reliability because they are more than 0.7 (Nunally & Bernstein, 1978).

4.4 Validity Analysis:

Validity analysis is conducted to know whether the measuring scale used essentially measures, what/which it is anticipated to measure.

4.5 Descriptive Analysis

4.5.1 Project Performance

Summed scores were wont to calculate means that vary, median and variance with the aim of conducting descriptive analysis of Innovative work behavior. Sample of 208 workers was used for analysis purpose, vary of score was one.38 with minimum a pair of.63 to most four whereas means that and variance for the variable of main interest square measure (M = three.1442, SD = 0.29425).

4.6 Descriptive Analysis of Independent Variables

4.6.1 Lean Practices

Summed scores were wont to calculate suggests that vary, median and variance with the aim of conducting descriptive analysis of Job demands. Sample of 208 workers was used for analysis purpose, vary of score was one.01 with minimum beginning price of three.08 to most price of four.09, as our mean and variance square measure (M = three.5778, SD = .27640).

4.6.2 Cost of Quality

Summed scores were accustomed calculate suggests that vary, median and variance with the aim of conducting descriptive analysis of Job demands. Sample of 208 workers at totally different organization was used for analysis purpose, vary of score was one.64 with minimum vary ranging from three.29 to most vary of four.7, whereas our mean and variance ar (M = three.2904, SD = 0.47740).

Descriptive analysis of study variables

Variables	Range	S.D	Mean	Median
Project Performance	1.38	.29425	3.1442	3.1250
Lean Practices	1.01	0.27640	3.5778	3.4897
Cost of Quality	1.64	0.47740	3.2904	3.400

4.7 Divergent Validity

Two variables area unit aforementioned to be related to if they have a tendency to to at the same time vary in some direction. If each the variables incline to extend along, the correlation is alleged to be direct or confident. If one variable tends to extend because the different variable decreases, the correlation is alleged to be undesirable or inverse. For the purpose of Divergent validity quantity correlation was used that is applied mathematics activity of the connection between 2 variables. attainable correlations vary from +1 to -1. Correlation model specifically Pearson correlation is employed to live the degree of association between completely different variables. The constructs that area unit not purported to be connected mustn't be connected and should be freelance with a definite identity. thus so as to take care of construct validity divergent validity should be ensured so, during this study a combine wise correlation technique was used to live divergent validity. Results reveal vital positive correlations among variables, the inter-

correlation among variables, customary deviations and means that of the variables of the study are illustrated.

4.8 Correlation Analysis:

The Pearson correlation coefficient is used to degree the significant or insignificant linear relation among the involved variables in the study (Sedgwick, 2012). There were three constructs involved in the study.

4.8.1. Correlation interpretation:

Results shows that there's vital relationship among LEAN practices and Project performance as p-value is zero.001 that is a smaller amount than zero.01 level of significance and there's positive relation among LEAN CONSTRUCTION PRACTICES and PROJECT PERFORMANCE as r=0.621 shows the positive mediocre related to relationship between the 2 variables as shown in table four.18. therefore this result supports the statement that CONSTRUCTION LEAN practices have vital positive impact on Project performance. therefore if total Lean Construction management practices are going to be practiced during a project Activities then they'll maximize the general impact on Project Performance.

Results conjointly shows that there's vital relation among price of Quality and Project performance as a result of p-value is zero.001 that is a smaller amount than zero.01 level of significance and
there is positive association between price Of Quality and Project Performance as in table r=0.604 shows the positive mediocre related to relationship between the 2 variables as shown in table four.18. therefore this result disclosed price of quality has vital positive impact on Project performance. therefore if we tend to incorporate the value of quality rules within the project activities, it'll raise the work project performance.

Results conjointly shows there's a major relation among Lean Construction Practices and value of Quality as a result of p-value is zero.01 that is a smaller amount than zero.05 level of significance and there's positive association between LEAN PRACTICES and Project performance as r=0.597 shows the positive related to relationship between the 2 variables as shown in table four.18. therefore this result showed that LEAN practices have vital positive impact on price of quality.

Mean, Standard Deviation and Correlation Matrix

SR no.	Variables	M	SD	LEAN PRACTICES	PROJECT PERFORMANCE	COST OF QUALITY
1.	LEAN	3.577	0.2812	1		
2.	PROJECT	3.144	0.2993	0.621**	1	
3.	COST OF QUALITY	3.2904	0.48568	0.597**	0.604**	1

**Correlation is significant at the 0.01 level (2-tailed)

Multiple Regressions to Test the Mediation within the Model:

Rules of the mediation are as follows:

- If c' is insignificant then there is full mediation exists.
- If all the paths a, b, c, and c' are significant then there is partial mediation exists.
- If anyone path of a, b and c is insignificant then is no mediation exists.

Baron & Kenny (1986) has presented four steps to testify the mediation impact of the mediator among variables. Full or partial mediation depends upon the satisfaction of all the steps given in figure 4.8 according to the above stated rules.

Path	Coefficients	s.e.	T	Sig(two)
c(YX)	0.6609	0.581	11.3668	.000
a(MX)	1.031	.0965	10.678	.000
b(YM.X)	.223	.0391	5.717	.000
c'(YX.M)	.4307	0.675	6.3831	.0000

Table4.10: Path Analysis

X= LEAN COBSTRUCTION PRACTICES (Independent variable)

Y= PROJECT PERFORMANCE (Dependent variable)

M= COST OF QUALITY (Mediator)

Above Table 4.10 shows that

1. LEAN CONSTRUCTION is the significant predictor of PROJECT PERFORMANCE by using regression analysis.

2. Total LEAN CONSTRUCTION PRACTICES is the significant predictor of
COST OF QUALITY by using regression analysis.

3. COST OF QUALITY is a significant predictor of PROJECT PERFORMANCE where the analysis is controlled for LEAN CONSTRUCTION practices.

4. There is a significant relationship present for path C'. There is a significant relationship between LEAN (independent), COST OF QUALITY (mediator) and Project performance (dependent). So there is partial mediation exist for this relationship. These steps are conducted by using SPSS Macro for Simple Mediation developed by Preacher and Hayes (2004).

Model Summary for DV Model					
R-sq	**Adj R-sq**	**F**	**df1**	**df2**	**P**
.4700	.4648	90.8817	2	205.00	.0000

Model summary

Interpretation:

In Model Summary the value of adjusted R^2=32.2%explains how much variability in project performance (dependent variable) is shared by cost of quality (mediating variable) and Lean construction practices (independent variable). The model shows high significance and portrays that how sufficiently variance is described through the model. It also shows how sensibly a dependent variable can be predicted.

4.9 Discussion

As a whole all the results of the current study recommend that there exists a positive relation among the extent to which Construction Firms employ Lean Construction Practices and the Performance of their projects. The whole findings of the current study are in accordance with the findings of the studies of (Koskela et al., 2002, O. Salem, et al. 2006, Reginato and Graham 2011, Samalia Adamu 2012 and O'Connor and Swain 2013). Koskela et al., (2002) authenticated and operationalized Lean Construction as a single variable in the analysis rather than as distinct practices and gave the definition of Lean Construction as a new administration technique that is to improve the project performance after his detailed research work. The unaccompanied justification of the Lean Construction is vital because for the examination of correlation of Project Performance and Lean Construction. As according to Palich et al. (2000), to demonstrate the simplification and power of the findings in a study, obtaining the results of various researches which are consistent with your study is very important. One more finding of current research proves the validation of interrelationship among project performance and Lean construction practices. The results of this study which give the validated proof of the positive impact of Lean Construction Practices on the performance of Construction Project give the practitioners a clear indication for the implementation of Lean Construction Practices in their firms in order to get the more effective outcomes. At the initial level the implementation of Lean Construction practices can take place at different organizational levels. The findings also recommend to the top administration of the big firms which are operating in quality driven markets and in the extremely competitive environment at the global level, to implement the Lean Construction Practices in the different departments of their organization to obtain a competitive edge and to get high performance rate. In addition to it, this finding about the link of Project performance and Lean Construction Principles can also be equally useful for the Top management of firms in taking the initiative to obtain and promote the relevant assets required for the improvement and application of Lean Construction Practices in their organizations as LC practices has a lot of benefits for their development and success. There can be many unsuccessful attempts for the application of the Lean Construction practices but it should not be demoralizing because there might be problem lie in the way of implementation despite of the practices of Lean Construction themselves. Although for improving the Cost of Quality in the Construction firms is risky, and it is not guaranteed that it will result in the successful outcomes, but in different times, many researchers proposed through their studies that there exists a positive link Project performance and Cost of Quality (Samadony et al., 2006). The current study also proposed in its findings that performance of project is predicted by which is also in align with the findings of Irani et al., (2003) that the established model Project Management Quality Cost System to define quality costs

in construction schemes and proves consequently that improving the management practices in future projects improves project performance. Likewise Samadony et al. (2006) proved that the mechanism to ongoing success in quality management is the capability to gather the condensed quality information to enhance the performance of the construction process which consequently proved that the COQ has a direct impact on the Performance of the construction project. The results of the current study also suggest that firms should give equal importance to Appraisal and Prevention and Failure Costs of Quality when implementing COQ measures as they both equally affect the project performance. Hence, the current study suggests that when it comes to COQ, the senior management and departmental heads of the firms should consider it as the most pivotal element in improving the quality of the project. The same point was given by the researcher Abdulrahman (1995) specified that deprived quality causing from non- conformance during construction project indicates extra cost and time to all members of the project team and also will disturb the performance of the project. Moreover, it is also suggested that the present study suggests that GM's and heads of public as well as private construction firms should have a welcoming behavior towards new practices, ideas and processes that can improve the performance of their project.

4.10 Conclusion

The fundamental aim of this analysis was to refine the comprehensive execution of construction comes in Asian country by smearing the suitable lean administration approach to the method from the Contractor viewpoint. This study could be a noteworthy contribution to the world of quality management, as very little literature on the Lean Practices normally and notably in context of Construction. This study was designed to spot the impact of Lean Construction practices in housing industry of Asian country. A linear relationship model is conferred among LEAN practices, value OF QUALITY and performance of comes. Lean Practices is accessed through the information collected from project managers of construction comes in Asian country, United Nations agency have expertise of the many comes. Results show considerably positive relation among practices of LEAN PARACTICES and PROJECT PERFORMANCE likewise as positive and vital relationship between value of Quality and Project Performance. This framework was developed supported the subsequent points: 1) Writings survey to analyze the advantages of mistreatment lean method in structure and value of quality on project performance 2) form in several construction comes in Asian country to judge the factors touching projects' routine, live the attention of engineers regarding lean construction of quality and value their considerations regarding the most lean values and their relationship among them 3) ancient Project internal control approach and its impact on the development method being a sensitive approach. Additionally thereto, results additionally show that value of Quality mediates the link among LEAN practices and project performance. of these results expose that relationship among

Lean Practices and performance of the development comes is stronger wherever value of Quality is concerned in their govt functions.

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