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An Empirical Study on Performance Measurement Factors for Construction Organizations

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Abstract

Like any other organization, it has become essential for the organizations in the construction industry to measure their performance effectively for long-term survival in today's competitive business environment. Therefore, it is imperative for a construction organization to know about various performance measurement factors to evaluate its performance. However, most of the previous studies have focused on identification of factors for measuring performance at the level of projects only. Moreover, the majority of these studies have been undertaken in context to the developed construction markets. The present study addresses these gaps in the literature by identifying critical factors for examining the performance of construction firms at the organizational level. A total of 20 organizational performance attributes were identified and analyzed using a questionnaire survey conducted on 106 respondents among 90 different organizations operating in the National Capital Region (NCR) of India. It was found that attributes such as timely completion, relationship with the client, and satisfaction (in terms of both product and services) carry more weight than the cost performance of a construction organization. In addition to this, factor analysis conducted on the performance attributes of high importance has resulted in six performance factors: (1) profitability and asset management, (2) satisfaction of key stakeholders, (3) predictability of time and cost, (4) environment, health, and safety (EHS), (5) quality consciousness, and (6) low staff turnover. The performance factors obtained from the study may provide useful guidelines to the construction organizations enabling them to examine and improve their performance.

Keywords: *key performance indicators, factor analysis, construction organizations, methodology, questionnaire survey*

1. Introduction

There is a strong need for identification of a set of factors to measure the performance of construction organizations nowadays to ensure competitiveness and profitability. Performance measurement is a process of collecting and reporting of information about the inputs, efficiency, and effectiveness of construction organizations. According to Kagioglu *et al.* (2001), "performance measurement is the process of determining how successful organizations or individuals have been in attaining their objectives and strategies." Therefore, it helps organizations to determine the objectives and optimize their operations. Moreover, it enables organizations to focus on the long-term objectives and thereby developing a strategic plan.

Traditionally, for the measurement of business performances, organizations have relied mainly on financial parameters such as profit, annual turnover, return on investment, sales per employee, etc. which has been criticized (Love and Holt, 2000). However, these financial indicators only evaluated the past performance of the organizations, without mentioning the factors that led to that performance (Kagioglu *et al.*, 2001; Kim and Arditi, 2010). Moreover, financial performance measurement cannot cope with the recent changes taking place in the industry, particularly due to the development of new technologies and increased competition in the business (Isik, 2009). Therefore, it is also important for organizations to identify the ways through which a particular performance was achieved. However, top management needs current and mostly nonfinancial parameters to take better decisions (Bassioni *et al.*, 2004).

The first step towards the measurement of performance of the construction organizations is the identification of appropriate Key Performance Indicators (KPIs) (Lin *et al.*, 2011). Next, these identified sets of KPIs assist in developing a proper performance measurement framework for construction organizations (Lin *et al.*, 2011). Performance indicators can be defined either by quantitative measures such as dollar ($)/unit or qualitative measures such as worker behavior on the job (Cox *et al.*, 2003). According to Morrison (2009), "a key performance indicator is a financial and non-financial measure used to help an organization measure progress towards a stated organizational goal or objective". It helps top management to monitor the performance of the company or department at regular intervals.

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Various industries have developed and used different conceptual models and measurement systems to compare their performance with competitors. Increased levels of competition and higher customer requirements in the business have forced construction organizations to create a new philosophy to measure their performance beyond the widely used financial performance measures (Love and Holt, 2000; Isik, 2009). Therefore, construction organizations need to employ both financial and non-financial aspects to evaluate their performances and compare the performance with competitors to improve the efficiency and effectiveness of the organization.

Although measuring the performance of any construction organization in terms of success or failure looks simple, it is in fact very complex process. Since modern construction organizations involve the participation of various stakeholders like client, contractors, and Project Management Consultants (PMC), the objectives of all the stakeholders may not be same in a given organization. Performance attributes for measuring the success of a construction organization for one stakeholder may be different from the other stakeholder depending on the perspective with which each stakeholder is looking at the outcome. For one stakeholder, an organization achieving high profit can be successful while for the other stakeholder, the performance parameter for judging the success can be customer satisfaction. As a result, defining the performance in terms of success or failure without specifying the interested stakeholders and various criteria for judging the performance holds little significance.

This paper discusses the factors by which the performance of a construction organization regarding success can be judged. While the researchers in the past have identified various attributes for performance measurement of a construction organization, most of the studies are project specific and are mainly from the developed countries. Very few researchers have focused on the performance factors of construction organizations operating in developing construction market such as that of India. Further, these researchers have identified the critical attributes for the performance measurement of a construction organization for a particular region, which may not be applicable in other regions. There are also certain other attributes by which performance can be measured. This study tries to identify all such performance attributes for performance measurement of construction organization in developing countries.

2. Literature Review

The aim of the current study is to find out those performance factors based on which a construction organization can be called as successful. Very few studies are reported in the literature in this area. These are mentioned below in brief.

Mbugua *et al.* (1999) developed a framework that can enhance the knowledge and hence provide improved construction performance based on financial (liquidity ratio, profitability ratio, efficiency ratio, size, growth and input and output) and non-financial (leadership, management, customer's satisfaction, human resources, impact on society, learning and growth, relationship, strategic quality control and information and analysis) measures. Cox *et al.* (2003) developed a correlation between quantitative and qualitative performance indicators to determine the most extensively used indicator. They found that quality control, on-time completion, cost, safety, $/unit and Unit/MH (man-hour) are the highly significant indicators for the construction industry. However, they neither included corporate level indicators like company's financial standing, market condition, relationship with external agencies, etc. nor evaluated the effectiveness of these indicators.

Elyamany *et al.* (2007) presented a performance evaluation model based on financial ratios as well as economic and industry factors and found that the company with better financial performance index is more successful. The model considers four construction categories: general building, heavy construction, special trade, and real estate. Balatbat *et al.* (2010) used market performance, equity evaluation and performance ratio, and profitability ratio to measure the performance of publicly listed Australian company with other Australian listed companies. Yu *et al.* (2007) developed an implementation model and practical methodology to measure and compare the performance of construction organizations using calculated performance score and identified practical issues for the implementation of performance measurement system. The study suggests that it is necessary to develop an integrated method to measure project performance and company performance both simultaneously as the construction industry is project oriented. The Construction Industry Institute (CII) in the United States of America (USA) developed a benchmarking system for continuous improvement of construction projects. The matrices developed by CII are cost, schedule, safety, change, and rework (Marković and Kovačević, 2011).

Kagioglou *et al.* (2001) developed a performance management process framework based on the balanced scorecard to be adopted by construction organizations and added two important perspectives: project and supplier, to the construction industry. Bassioni *et al.* (2004, 2005) also suggested a conceptual framework using balance scorecard and business excellence model to measure business performance of construction organizations. The framework was divided into performance driving factors (leadership, strategic management, resource management, risk management, work culture, capital management, etc.) and performance results factors (people, customer and society results, partnership and supplier results, organizational business results, project results, etc.).

Wong (2004) developed a logistic regression model for predicting contractor's performance during contractor selection and evaluation process. Such prediction model makes the selection process easy during tender evaluation by identification and classification of contractor's performance. Singh and Tiong (2006) also developed a prediction model for predicting contractor's performance during contractor selection but used computer interactive multi-criteria decision system for model development. The experience of the

contractor on similar work, qualification and experience of project managers, technical staffs and management staffs, type of project completed in last three years, liquidity, working capital, and demerit point in past projects were considered critical for assessing the performance of the contractors. Shen *et al.* (2006) evaluated the relative importance of 45 competitiveness indicators using an index value to identify key competitiveness indicators (KCIs) to assess the competitiveness of contractors in the Chinese construction industry. The top 10 key competitiveness indicator identified were: construction time, tendering price, site management ability, experience in operating similar projects, quality plan, technology plan, technology capacity, availability of key personnel, construction program and existing human resources. Ali *et al.* (2013) evaluated 47 performance indicators for performance measurement of construction organizations in Saudi Arabia using relative importance index (RII). The top 10 KPIs (key performance indicators) identified were profitability, quality of service and work, growth, financial stability, cash flow, external customer satisfaction, safety, business efficiency, market share and effectiveness of planning. Fong and Choi (2000) developed an Analytical Hierarchy Process (AHP) model to identify the contractor's selection criteria in Hong Kong. The eight criteria identified for the selection of contractor were tender price, financial capability, past performance, experience, resources, current workload, past client-contractor relationship and safety performance. Hassaan *et al.* (2013) applied Multi-criteria Decision-making (MCDM) Analytical Hierarchy Process (AHP) with a fuzzy set theory for performance assessment of contractors on 34 qualitative and quantitative criteria during a tender decision in Egypt. According to the respondents, the financial stability and past performance were the most important criteria for contractor selection. Ibadov (2015) used Fuzzy Preference Relation (FPR) to identify the criteria for contractor selection for construction projects. The criteria identified for contractor selection were reputation, technical capabilities, financial situation and organizational skills. Pongpeng and Liston (2003) conducted factor analysis on a set of 53 contractor's ability measures in Thai construction industry which extracted 9 contractor's ability criteria namely engineering/construction, procurement/contract, project managers, human resources, quality management systems, health and safety, plant/equipment, financial strength and public relations. Doloi (2009) conducted factor analysis on a group of 43 performance attributes as pre-qualification criteria during contractor selection and identified seven factors namely soundness of business and workforce, planning and control, quality management, past performance, risk management, organizational capability, and commitment and dedication. Alarcon and Mourgues (2002) developed a conceptual model to evaluate the performance criteria for contractor selection in the United Kingdom. The variables considered for performance evaluation of contractors were cost, quality, schedule, and safety.

Skibniewski and Ghosh (2009) identified two types of KPIs namely, project performance indicators (construction cost, construction time, predictability of cost and time and client satisfaction) and company performance indicators (safety, profitability and productivity) to measure the performance of construction companies across the United States of America (USA) using questionnaire survey and face to face interviews. Nemcova-Zuzana (2009) used economic KPI's (client satisfaction in terms of product and services, profitability, cost and time predictability, productivity, safety, defects, cost, and time) and respect for people KPI's (employee satisfaction, staff turnover, sick absence, safety, qualifications and skills, equality and diversity, training and pay) and also included environmental KPI's (impact on the environment, energy use, mains water use, waste, commercial vehicle movements, impact on biodiversity, area of habitat created/retained and whole life performance) to measure the performance of companies with respect to others. Rimbalova and Vilcekova (2013) studied the KPIs for prediction of performance of facility services providers using multi-criteria decision making which is based on mathematical modeling. They found that the most important indicators are economic, social, and, environmental indicators. The environmental indicators have received the lowest weight of significance among these indicators due to increasing financial cost of building management.

El-Mashaleh *et al.* (2007) developed a benchmarking model using the Data Envelopment Analysis (DEA) that allows construction firms to be evaluated on a company-wide basis and specify a specific area for individual firms in which improvement is required. The model developed by them addresses the limitations of previously identified benchmarking models such as Fisher *et al.* (1995), Hudson (1997), Construction Industry Institute (2000) and Construction Best Practice Programme (1998). Horta *et al.* (2010) presented a web-based job performance evaluation model using the DEA. Performance indicators used for the study were mainly organizational performance indicators (productivity, profitability, accident frequency rate, and hanging invoice) and operations performance indicators (contractor satisfaction with customer cooperation, contractor satisfaction with payments availability, and contractor satisfaction with cooperative work and cost predictability). This study may prove to be useful for the organizations involved in benchmarking to improve their effectiveness. Tsolas (2011) also developed a framework integrating the DEA and the ratio analysis to evaluate the performance of the construction organizations in terms of profitability and effectiveness of the construction firms listed on the Athens Exchange.

Luu *et al.* (2008) performed the strengths, weaknesses, opportunities, and threat (SWOT) analysis to evaluate the strategic performance of large contractors in Vietnam. The KPIs identified were from four perspectives: financial, customer, internal process, and learning and growth. Chan (2009) developed a systematic performance measurement framework for the Malaysian construction industry to monitor their progress towards achieving the goals set out in the Construction Industry Master Plan 2006-15. The performance measures identified were same as the ones identified by Luu *et al.* (2008).

From the above literature review, it is clear that some researchers have developed various frameworks/models to evaluate the

performance of construction organizations. Most of the researchers have carried out the study focusing developed countries like European countries, Australia, USA, etc. but none of the researchers have carried out the research work for developing countries like India. Although, a few researchers have identified performance factors that can be used to measure the performance of construction projects, yet no insight is provided into the overall performance of construction organizations. In most of the research work, researchers have only considered contractors for their study. With the help of present study, authors have tried to fill these gaps. For example, the present study tries to incorporate all possible performance attributes relevant for a construction organization for the performance measurement. Besides, the opinions of stakeholders other than the contractors such as the clients and PMC have also been considered in the study.

3. Objectives and Research Method

The objectives set for the study are as follows:

- Identification and evaluation of performance attributes for construction organizations.
- Identification of performance factors (PFs) for construction organizations.

To achieve the above objectives, an extensive data set of company's information and the annual financial report was required. No owner agrees to reveal data of their organization to the public due to the data preservation and privacy reasons and company's financial reports are susceptible to be manipulated. Hence, a questionnaire survey and structured interview approach were adopted for this study. The steps in the study are described in the following sections.

3.1 Identification of Performance Attributes and Questionnaire Preparation

As the case study is like experiments, generalizable to only theoretical propositions and not to populations or universes (Yin, 2009), a literature review was conducted which revealed twenty performance attributes that can be used to evaluate the performance of a construction organization. However, while compiling such performance attributes, it was noticed that a large number of attributes had been cited by researchers in different contexts. Therefore, to restrict the number of attributes to a reasonable level, only those performance attributes were considered which were cited in at least two different studies. The attributes which were cited by only one researcher were clubbed with other similar attributes. Following these two rules, twenty performance attributes were compiled. These attributes were discussed in detail personally with three experts having more than 30 years of working experience at the senior position in the construction industry to check their applicability and validity under Indian

Table 1. Sources of Performance Attributes

Sl. No.	Performance attributes	Id	Sources														
			Mbugua *et al.* (1999)	Cox *et al.* (2003)	Chan. (2009)	Elya-many *et al.* (2007)	Luu *et al.* (2008)	Skib-niewski and Ghosh (2009)	Horta *et al.* (2010)	Rimba-lova and Vilce-kova (2013)	Delgado and Aspin-wall (2005)	Yu *et al.* (2007)	Menches and Hanna (2006)	Balatbat *et al.* (2010)	Kagiog-lou *et al.* (2001)	Nem-cova-Zunana (2009)	Bassioni *et al.* (2004)
1	Size of the organization	P1	✓		✓												
2	Productivity of employees	P2	✓	✓	✓			✓	✓	✓		✓			✓	✓	✓
3	Good track record of timely completion of the projects	P3		✓	✓		✓	✓		✓			✓		✓	✓	✓
4	Health and safety consciousness	P4		✓	✓		✓	✓	✓	✓			✓		✓	✓	✓
5	Customer satisfaction in terms of product and services	P5	✓				✓			✓	✓		✓				
6	Client satisfaction in terms of product and services	P6			✓			✓		✓					✓	✓	✓
7	Cost performance of projects	P7		✓			✓	✓					✓		✓	✓	✓
8	Impact on society	P8	✓							✓						✓	
9	Impact on environment	P9								✓						✓	
10	Optimum liquidity ratio	P10	✓			✓								✓			
11	Higher profitability ratio	P11	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
12	Higher annual growth rate of the organization	P12	✓		✓		✓		✓			✓		✓			
13	Predictability of cost in design and construction	P13			✓			✓	✓	✓					✓	✓	✓
14	Predictability of time in design and construction	P14			✓			✓		✓					✓	✓	✓
15	Rework/defect rectification	P15	✓	✓			✓			✓			✓		✓	✓	✓
16	Adopting learning and growth culture	P16	✓		✓		✓			✓						✓	
17	Higher wages of the employees	P17								✓						✓	
18	Low staff turnover	P18			✓					✓		✓				✓	
19	Good relationship with client	P19	✓								✓		✓				
20	Annual construction demand/ market share	P20			✓		✓					✓					

Table 2. Extract of the Part 1 of Questionnaire

Please put a tick mark (√) or highlight the relevant cell to rate the following parameters (on five-point scale from very low importance = 1 to very high importance = 5) with respect to the degree of their importance in measurement of the success of the construction organisations.

Sl. No.	Performance attributes	Very low importance	Low importance	Moderate importance	High importance	Very high importance
		1	2	3	4	5
1	Size of the organisation (measured in terms of turn over, market share, number of employees etc.)					
2	Productivity of employees (value added per employee)					
3	-- --Attributes as given in Col. 2 of Table 3					

scenario. All experts were satisfied with the identified list of attributes, and no further changes in the attributes were suggested. Table 1 shows the complete list of performance attributes along with their sources.

A questionnaire based on twenty performance attributes as shown in Table 1 was subsequently designed. A pilot survey was then undertaken to test the wordings and understanding of the questions, and necessary modifications were done in the questionnaire. Three experts with more than 30 years of working experience participated in the pilot survey. The questionnaire consisted of three parts: Part 1 included questions on organizational performance attributes; Part 2 contained information on respondent's organization and Part 3 had a question to collect respondent's information. An extract of Part 1 of the questionnaire has been shown in Table 2.

A five-point Likert's scale was used to measure the relative importance of various performance attributes on the performance of construction organizations. In the scale, 1 represented 'very low importance,' 2 represented 'low importance,' 3 represented 'moderate importance,' 4 'high importance,' and 5 represented 'very high importance.'

3.2 Sample Selection

After identification of performance attributes, the next step is sample selection. All the construction organizations operating in India are indexed with several government bodies or some other autonomous bodies set up under the guidance of government of India. These are Central Public Works Department (CPWD), State Public Works Department (PWD), Military Engineering Services (MES), Coal India Ltd. (CIL) National Thermal Power Corporation (NTPC), Builders Association of India (BAI), Confederation of Real Estate Developers Association of India (CREDAI) and so forth. The sample selection of construction organizations used in this study was done from two groups. The first group consisted of 154 members of the Builders Association of India (BAI) and the second group consisted of 209 members of the Confederation of Real Estate Developers Association of India (CREDAI) working in the NCR of India. As the focus group of this study was the organization involved only in building construction projects, authors selected these two groups only as these organizations are executing largely building projects. The members of the BAI were largely contractors, and the members of the CREDAI were real estate developers. Some more members were later included in the study that were neither from the BAI nor from the CREDAI but had extensive experience in construction industry and are PMC. The sample size that represents the population was calculated using the following formula (Ali *et al.*, 2013).

$$n = \frac{n'}{\left[1 + \frac{n'}{N}\right]} \quad (1)$$

Where,

$$n' = \frac{p*q}{V^2} \quad (2)$$

where n = The required sample size,
n' = The first estimate of sample size,
N = The population size,
p = The proportion of the characteristic being measured in the target population,
q = 1 - p,
V = Standard error of sampling population

To get the maximum sample size, the values of p and q were taken as 0.5. The standard error used in determining the sample size was kept at 5%, (maximum standard error allowed is 10%). Based on the above formula, the required sample size was 78. However, the sample size of 106 for this study was comparable to or larger than the previous studies by Cox *et al.* (2003), Delgado and Aspinwall (2005), El-Mashaleh *et al.* (2007), and Lin *et al*. (2011), etc.

3.3 Respondents' Profile

A total of 106 respondents selected for this study were from 90 different organizations. Out of 106 responses, 29 responses were received via email for which 58 questionnaires were distributed, and 77 responses were received via personal interview. Out of the total, 49 (46.23%) responses were from developers, 46 (43.39%) from contractors, and 11 (10.38%) responses were from PMC. The experience of 13 (12.26%) respondents was below ten years, 35 (33.02%) respondents were between 10 to 20 years, 50 (47.17%) respondents were between 20 to 30 years, and 8 (7.55%) were above 30 years. Out of 90 organizations, 39 (43.33%) were developers, 42 (46.667%) were contractors and 9 (10.00%) were PMC. The respondent's group of PMC was small as compared to contractors and clients because, in India, most of

the clients deploy their own team for the management of the projects. Very few of them hire an external agency for this purpose. The experience of 20 (22.22%) organizations was below ten years, 26 (28.89%) organizations were between 10 to 20 years, 18 (20.00%) organizations were 20 to 30 years, and 26 (28.89%) organizations were above 30 years. The survey was conducted in the months of May and June 2015.

3.4 Analysis Method

From the five-point scale used in the questionnaire, the performance attributes were ranked according to their mean value and standard deviation obtained for all responses of the questionnaire survey. If two or more attributes had the same mean value, then the attribute with lower standard deviation was ranked higher. The ranking of performance attributes by various respondent's group and overall ranking is shown in Table 3.

To check the level of agreement between any two survey groups on their rankings of the performance attributes, Kendall's coefficient of concordance (W) and Spearman's rank correlation coefficient (R) tests were conducted. Both these tests are non-parametric tests and require ranked data. The coefficient W ranges from 0 to 1, with 0 indicating complete disagreement and 1 indicating complete agreement. The coefficient (R) ranges between -1 and +1. A positive value indicates a positive linear correlation, 0 indicates no linear correlation whereas negative values indicate a negative linear correlation between the two groups on the ranking of variables (Chan *et al.*, 2010). The Kendall's coefficient of concordance (W) is suitable when the number of attributes in the test is less than or equal to 7. The value of coefficient W is always lower than the coefficient R. If the values of coefficients W and R are statistically significant at an allowable significance level of, say 5%, then the null hypothesis that there is no significant correlation between the two groups on the rankings can be rejected (Chan *et al.*, 2010). Table 4 shows that there is a significant agreement between the various groups on the ranking of attributes.

The mean value of responses is not a whole number as indicated in the questionnaire, hence for interpretation purpose, the various effects may be considered to lie between mid-points of two adjacent scales. The attributes can be categorized as per Table 5 based on their mean value.

The statistical significance of the attributes at a certain mean value can be checked with a parametric t-test or a non-parametric one sample sign test and one-sample Wilcoxon test. In the present study, the statistical significance of the attributes at mean value 3.5 was tested with one sample t-test as data was free from outliers and normally distributed. The result of one sample t-test is given in Table 6. This test determines whether the sample mean is statistically different from the population mean. It is seen from Table 5 that the three attributes: size of the organization (P1), impact on society (P8), and higher wages of the employees (P17) have a significance level of more than 0.05 and thus they do not pass the one sample t-test at 3.5 test value. It indicates that these performance attributes do not have high importance in measuring the performance of a construction organization. Incidentally, it can also be seen from Table 3 that these three

Table 3. Ranking of Performance Attributes of Construction Organization

Sl. No.	Performance attributes	Id	Contractor group		Developer group		PMC group		All group	
			Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
1	Good track record of timely completion of the projects	P3	4.391	4	4.571	1	4.100	4	4.448	1
2	Good relationship with client	P19	4.543	1	4.265	4	4.600	1	4.419	2
3	Customer satisfaction in terms of product and services	P5	4.457	3	4.327	2	4.500	2	4.400	3
4	Client satisfaction in terms of product and services	P6	4.500	2	4.286	3	4.500	2	4.400	4
5	Predictability of time in design and construction	P14	4.239	7	4.224	5	4.100	7	4.219	5
6	Productivity of employees	P2	4.196	9	4.204	6	4.100	4	4.190	6
7	Predictability of cost in design and construction	P13	4.217	8	4.122	7	4.000	8	4.152	7
8	Higher annual growth rate of the organisation	P12	4.283	6	3.918	9	4.000	8	4.086	8
9	Cost performance of projects	P7	4.152	10	4.102	8	3.600	15	4.076	9
10	Annual construction demand/market share	P20	4.304	5	3.878	13	3.900	11	4.067	10
11	Health and safety consciousness	P4	4.022	12	3.878	12	4.000	8	3.952	11
12	Optimum liquidity ratio	P10	4.109	11	3.898	10	3.300	18	3.933	12
13	Low staff turnover	P18	3.804	14	3.898	10	4.100	4	3.876	13
14	Rework/defect rectification	P15	3.652	18	3.878	13	3.800	12	3.771	14
15	Higher profitability ratio	P11	3.978	13	3.653	18	3.200	19	3.752	15
16	Impact on environment	P9	3.674	15	3.755	16	3.800	13	3.724	16
17	Adopting learning and growth culture in the organisation	P16	3.652	17	3.776	15	3.500	16	3.695	17
18	Size of the organisation	P1	3.674	15	3.633	19	3.700	14	3.657	18
19	Impact on society	P8	3.522	20	3.673	17	3.500	17	3.590	19
20	Higher wages of the employees	P17	3.565	19	3.469	20	3.100	20	3.476	20

Table 4. Kendall's Coefficient of Concordance and Spearman's Rank Correlation Test between Various Groups of Respondents on Performance Attributes

Sl. No.	Comparison of rankings between groups of respondents	Kendall's coefficient of concordance, W	Spearman's rank correlation coefficient, R	Significance level, p	Conclusion
1	Contractor ranking vs developer ranking	0.653	0.847	0.00	Reject H0 at p = 5%
2	Contractor ranking vs PMC ranking	0.591	0.759	0.00	Reject H0 at p = 5%
3	Developer vs PMC ranking	0.685	0.831	0.00	Reject H0 at p = 5%

H0 = No significant correlation on the rankings between two groups

Table 5. Categories of Attributes

Sl. No.	Mean value (μ)	Degree of importance	Attributes
1	≥ 4.5	Very high	Nil
2	4.5 > ≥ 3.5	High	P2-P7, P9, P16, P18-P20
3	3.5 > ≥ 2.5	Moderate	P1, P8, P17
4	2.5 > ≥ 1.5	Low	Nil
5	1.5 >	Very low	Nil

Table 6. Result of One Sample t-test

Performance attributes	Id	Test Value = 3.5		
		t	df	Sig. (2-tailed)
Size of the organisation	P1	1.817	104	.072
Productivity of employees	P2	10.854	104	.000
Good track record	P3	15.665	104	.000
Health and safety consciousness	P4	5.542	104	.000
Customer satisfaction	P5	15.420	104	.000
Client satisfaction	P6	15.021	104	.000
Cost performance of projects	P7	7.804	103	.000
Impact on society	P8	1.035	104	.303
Impact on environment	P9	2.375	104	.019
Optimum liquidity ratio	P10	6.353	103	.000
Higher profitability ratio	P11	3.118	104	.002
Higher annual growth rate	P12	7.637	104	.000
Predictability of cost	P13	9.146	104	.000
Predictability of time	P14	10.630	104	.000
Rework/defect rectification	P15	2.698	104	.008
Learning and growth culture	P16	2.470	104	.015
Higher wages of the employees	P17	-.271	104	.787
Low staff turnover	P18	4.789	104	.000
Good relationship with client	P19	15.670	104	.000
Annual construction demand	P20	7.973	103	.000

attributes occupy the last three ranks based on their mean values. Thus, out of the 20 attributes only 17 attributes (see Table 5 and 6) show high importance in measuring the performance of a construction organization.

However, a user interested in measuring the performance of a construction organization would find it quite difficult to utilize all the 17 performance attributes mentioned above in measuring the performance. A large number of observed variables (attributes) can be reduced to a manageable number of latent variables (factors) mainly by two methods. In the first method, the attributes are grouped based on the results or theories of the previous studies to create a factor. In the second method, factors are identified using factor analysis (Hair *et al.*, 2006). In the present study, factor analysis is performed on all 17 attributes to identify underlying factors that explain the pattern of correlation within a set of observed attributes. This method is often used by many researchers for data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of observed attributes. Factor analysis is performed for responses of all respondents taken together.

The reliability of data for the application of factor analysis can be checked by five models: (1) Model Cronbach's alpha, (2) Model split half, (3) Model Guttman, (4) Model parallel, and (5) Model strict parallel. Model Cronbach's alpha is the most important coefficient as it is a measure of internal consistency of the attributes, which is based on the average correlation among the attributes and the number of total attributes in the sample (Giossi, 2012). Model split half divides the measurement scale into approximately two halves and examines whether the two parts have any correlation. Model Guttman is an alternative split half model, which estimates the lowest limits of the coefficient for the actual reliability. Model parallel tests if all items have equal variances and error variances in the measurement scale. Model strict parallel tests for equal variances, equal error variances, and equal population means across items.

To test the internal consistency in the present study, the Cronbach's alpha (Cα) test was performed on all the attributes with high importance as given in Table 5. The value of Cα varies from 0 to 1. Higher value Cα indicates the greater internal consistency or greater inter-criteria correlations and vice versa. As a rule of thumb, Cα > 0.7 is acceptable (Doloi, 2009; Pongpeng and Liston, 2010). In this analysis, the value of Cα is 0.844 which indicates a good overall internal consistency of the attributes.

4. Performance Attributes

The most important performance attribute is 'good track record of timely completion of the projects' with the highest mean value of 4.448 (see Table 3). It simply indicates that the performance of an organization is directly measured by its ability to complete projects on time. Good track record of timely completion of the projects shows that the construction organizations have completed most of their projects on/before schedule. It is measured solely on the basis of time taken in completing the project on the planned duration of the project in the contract. It

can be measured in terms of percentage of time projects are delivered on schedule or ahead of schedule in a given fiscal year. If an organization is not able to deliver the project in time, then it can be inferred that the performance of the organization is not good.

The second most important performance attribute is 'good relationship with client' with a mean value of 4.419. It is one of the important non-financial performance measures of the construction organization. No business could be run for a long time if the client is not retained. Client retention can be maintained by understanding and fulfilling their requirement. Different clients have different requirements. Some of the clients are quality driven whereas some of them are cost driven. It can be expressed in terms of repeat business, low dispute, and litigation, timely payment from the client. This attribute is followed by customer satisfaction in terms of product and services, client satisfaction in terms of product and services and predictability of time in design and construction with a mean value of 4.400, 4.400 and 4.219 respectively. Many clients measure the performance of the constructed product to understand how well the delivery systems of the project have satisfied the requirements of the customer. They usually track the satisfaction of their customer by using survey on customer feedback and their concerns and rating provided by them accordingly. In construction, the satisfaction of a client is determined by conformance to specifications and completion of the project within planned cost and time. Other factors that affect client satisfaction are the quality of the products and response to complaints, and so forth.

Predictability of time and cost in design and construction is an attribute, which allows the client/customer to rely on the service rendered by the organization in terms of scheduled time and budgeted cost. If clients/customers are not sure about timely delivery of projects in scheduled time and budgeted cost, they would get aggravated and stop dealing with the organization thereby affecting the business. Therefore, the predictability of time in design and construction is an important attribute for all organizations to measure their performance. It can be measured in terms of a percent on target.

All the above attributes depict an image of the organization that fits the needs of the clients. The result obtained from the analysis is in line with Cox *et al.* (2003) and Skibniewski and Ghosh (2009). The other important performance attributes are productivity of employees (value added per employee), predictability of cost in design and construction, higher annual growth rate of the organization, cost performance of projects, and annual

Table 7. Measurement Methods of Performance Attributes

Sl. No.	Performance attributes	Measurement methods
1	Good track record of timely completion of the projects	$\left[\frac{\text{Number of projects delivered on or before schedule}}{\text{Total number of projects}}\right]$
2	Good relationship with client	• $\left[\%\text{ of repeat client}\frac{\text{Number of repeated clients}}{\text{Total number of clients}}\right]$ • Low dispute and litigation • Timely payment from clients
3	Customer satisfaction in terms of product and services	Customer satisfaction survey after project completion
4	Client satisfaction in terms of product and services	Client satisfaction survey after project completion
5	Predictability of time in design and construction	$\left[\frac{\text{Actual time} - \text{Anticipated time}}{\text{Anticipated time}}\right]$
6	Productivity of employees	$\left[\text{Productivity}=\frac{\text{Work units completed during a given period of time}}{\text{Associated cost in terms of man-hours or dollors}}\right]$
7	Predictability of cost in design and construction	$\left[\frac{\text{Actual cost} - \text{Anticipated cost}}{\text{Anticipated cost}}\right]$
8	Higher annual growth rate of the organisation	• $\left[\text{Return on assets (ROA)}=\frac{\text{Company's annual earnings}}{\text{Total assets}}\right]$ • $\left[\text{Return on equity (ROE)}=\frac{\text{Net income after tax}}{\text{Share holder's equity}}\right]$ • $\left[\text{Return on capital (ROC)}=\frac{\text{Net income} - \text{Dividends}}{\text{Total capital}}\right]$
9	Cost performance of projects	$\left[\text{Cost performance}=\frac{\text{Number of projects completed within tender cost}}{\text{Total number of projects}}\right]$
10	Annual construction demand/market share	$\left[\frac{\text{Company's volume of work in the market}}{\text{Total volume of work in the market}}\right]$

Table 7. (continued)

Sl. No.	Performance attributes	Measurement methods
11	Health and safety consciousness	$\left[\text{Safety performance} = \frac{\text{Number of reported accident in a year}}{\text{Average number of employees in that year}}\right]$
12	Optimum liquidity ratio	$\left[\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}\right]$
13	Low staff turnover	$\left[\text{Staff turnover} = \frac{\text{Number of employees leaving the organisation in a year}}{\text{Average number of employees in that year}}\right]$
14	Rework/defect rectification	$\left[\text{Rework factor} = \frac{\text{Total cost of rework}}{\text{Total construction cost}}\right]$
15	Higher profitability ratio	• $\left[\text{Sales growth} = \frac{\text{Sales in current financial year} - \text{Sales in previous financial year}}{\text{Sales in previous financial year}}\right]$ • $\left[\text{EPS growth} = \frac{\text{EPS in current financial year} - \text{EPS in previous financial year}}{\text{EPS in previous financial year}}\right]$ • $\left[\frac{\text{P}}{\text{E}}\text{ratio} = \frac{\text{Market value per share}}{\text{Earning per share}}\right]$ • $\left[\text{Gross profit margin} = \frac{\text{Profit before tax and interest}}{\text{Total revenues}}\right]$
16	Impact on environment	• Use of low natural resources • Low production of wastes • Preservation of plants and trees etc.
17	Adopting learning and growth culture in the organisation	$\left[\frac{\text{Amount spent for learning and growth in the organisation}}{\text{Turnover of the organisation}}\right]$
18	Size of the organisation	• Turnover of the organisation • Market share • Number of employees
19	Impact on society	• Low noise pollution • Less disturbance to the occupants due to vehicle movement etc.
20	Higher wages of the employees	Wages of the employee with respect to the average wages in the industry.

construction demand/market share.

The productivity is a measure of efficiency expressed in terms of the output to input ratio (Li and Liu, 2010). The construction organizations usually track the productivity of the employee in terms of work units completed during a given period and the associated costs in terms of man-hours or dollars. Measuring the productivity of the employees helps the organizations to predict the impact of productivity on project cost and schedule, and identify opportunities for productivity improvement. The higher annual growth rate of the organization is also one of the important financial performance measures of the construction organization. It determines the growth of market share. It can be measured in terms of sales growth %, EPS (earning per share) growth %, P/E (price- to- earnings) ratio, and so forth. Cost performance of the project may also be used to predict the success or failure of the overall construction effort. It is measured by comparing the actual costs incurred to the budgeted costs allocated for the work. It can be measured in terms of percentage of the time projects are delivered on/under the budgeted cost in a given fiscal year. Annual construction demand is an important measure of the financial capability and sustainability of the construction organizations. It can be measured in term of yearly order received. From the above discussion, it is clear that respondents assign more weights to the timely completion, relationship with the client, and client and customer satisfaction (in terms of product and services) on the cost attribute in determining the performance of construction organizations. Table 7 shows the measurement methods of the 20 performance attributes. For example, to measure track record of timely completion of the projects, one needs to use the information on some projects delivered on or before schedule and the total number of projects. In a similar manner, other attributes can be measured by referring to Table 7.

5. Performance Factors

In the previous sections, a brief discussion on some of the most significant performance attributes was presented. As mentioned in the research method section, factor analysis was performed on the 17 performance attributes out of 20 having their mean value 3.5 and above. There are various methods of factor extraction, such as principal components, unweighted least squares, generalized least squares, maximum likelihood, principal axis factoring, alpha factoring, and image factoring. For this study, the most

commonly used principal components method of extraction is used along with varimax rotation. The principal components method of extraction begins by finding a linear combination of a component that accounts for as much variation in the original attributes as possible. It then finds another component that accounts for as much of the remaining variation as possible and is uncorrelated with the previous component, continuing in this way until there are as many components as original attributes (Newing, 2011). Usually, a few components will account for most of the variance, and these components can be used to replace the original attributes. In the present analysis, the attributes with factor loading more than 0.5 were only considered (Leung *et al.,* 2010). The output of factor analysis shows that the Bartlett test of Sphericity is 136 and the associated significance level is 0.000 which indicates that correlation matrix is not an identity matrix. The Kaiser Meyer Olkin (KMO) value is 0.793, which is more than 0.5, which shows that sample is adequate for factor analysis. Based on the factor loading of rotated component matrix of varimax rotation, six performance components called factors with an eigenvalue greater than one are extracted which accounts for 67.448 % of the variance. Details of performance factors are given in Fig. 1 and are explained in the following paragraphs.

5.1 Profitability and Asset Management (PF1)

Asset management is the process of managing money for individuals, typically through stocks, bonds and cash equivalents. Liquidity is one of the most important characteristics with which an asset can be turned into cash. Organizational performance is gauged by profitability and asset of the organization. Yu *et al.* (2007) also considered in their study, profitability as one of the most important indicators for performance measurement of a construction organization. This factor includes higher annual growth rate of the organization measured in terms of sales growth %, EPS growth %, P/E ratio, higher profitability ratio measured in terms of gross profit margin, Return on Assets (ROA), Return on Equity (ROE), Return on Capital (ROC), optimum liquidity ratio measured in terms of current ratio and productivity of employees. Since, all the attributes point towards profitability and asset management of the organization, hence the name. This factor explains a variance of 13.893%.

5.2 Satisfaction of Key Stakeholders (PF2)

Satisfaction of key stakeholders, such as client and customers, is a major factor for the measurement of the performance of construction organizations (Ali *et al*., 2013; Kim and Arditi, 2010). Client satisfaction can be defined as a function of the quality of the product, quality of service, and quality of manner to customers (Tang *et al.*, 2003). It is found to be fundamental to the business success. Client satisfaction and customer satisfaction are highly correlated to each other. Client satisfaction is proposed to measure the quality of services rendered by construction organization from the perspective of the customers. As the customers are the end users, their satisfaction is of prime importance

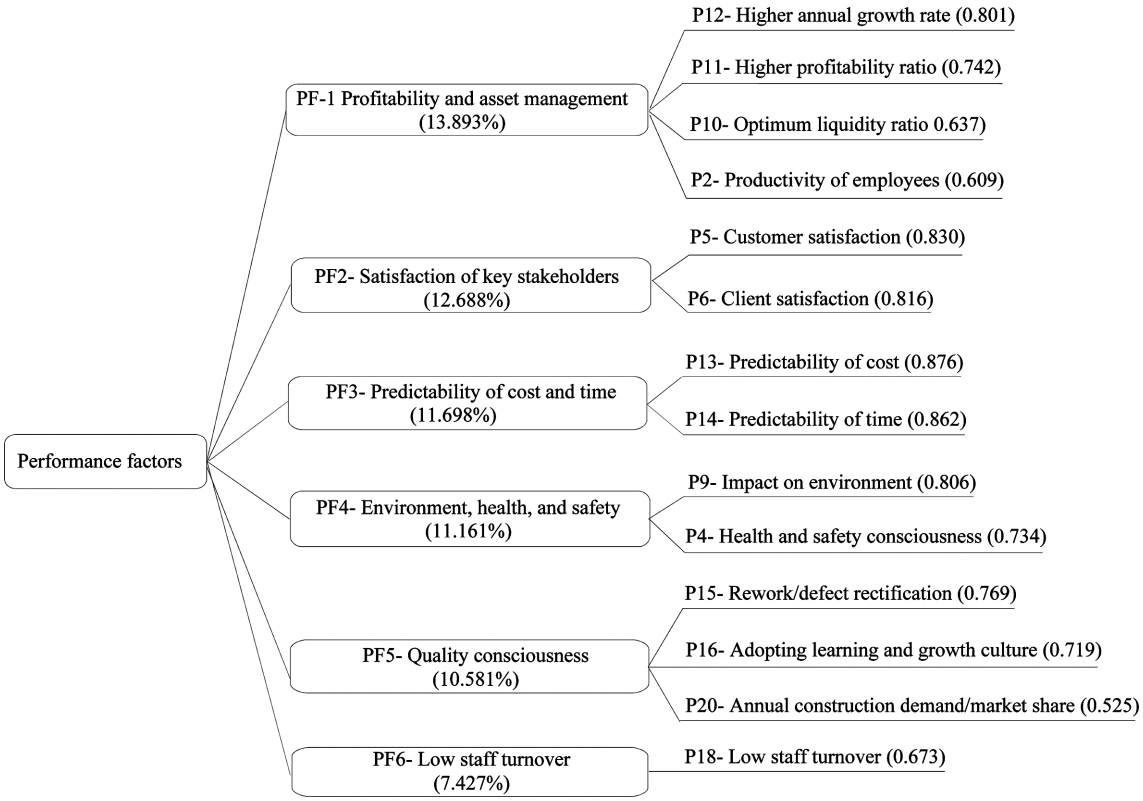

Fig. 1. Performance Factors

for all other stakeholders involved. Construction organizations always try to maximize client/customer satisfaction through high quality of products and services, innovations, technical supports, cost optimization, timely delivery, and so forth. They organize their various resources in such a manner that the client/customer objectives are identified and successfully met to get repeat business. This factor explains a total of 12.688% variance.

5.3 Predictability of Time and Cost (PF3)

Predictability is critical for any organization as it creates a positive psychological impact on client/customer. If, clients/ customers are assured that their project will be delivered in scheduled time and within the cost, they can deal with the organization. In contrast, the lack of predictability in the organization, affect client/customer negatively and distract them from doing business with the organization. Predictability provides a sense of control, trust and safety, and reliability to the clients/ customers. Ultimately, predictability impact client/customer satisfaction and in turn overall business. Therefore, predictability is important for all organizations to possess because without it, their clients/ customers will decrease and this will also impact their profits. Castro-Lacouture and Skibniewski (2003) developed an e-work model for the automation of construction material by redesigning the error in the manual processes of quantity take-off, bidding and quantity revision of construction materials which improves cost predictability. Time predictability can also be improved by adopting an integrated information resource based 4D construction process simulation model developed by Dawood *et al.* (2003) Wang *et al*. (2004), and Chau *et al.* (2005). Both attributes under this factor address above characteristics and hence the name. This factor explains a total of 11.698% variance.

5.4 Environment, Health, and Safety (EHS) (PF4)

Environment, health, and safety can be viewed as a part of the social and environmental responsibility both for an individual or an organization although the extent of responsibility may vary. We live in an age in which companies control much of the earth's resources that help reduce environmental nuisance. Apart from reducing environmental nuisance, environment-friendly construction reduces the cost of construction as well. For example, energy-efficient construction permits environmental friendliness as well as cost effectiveness throughout the lifecycle of construction. Utmost care should be taken for proper health and safety management in the organization as poor health and safety performance on project site causes loss of life, block the progress of the project and increases costs associated with compensations due to the accident and other hidden costs. Therefore, corporates must be responsible towards environment and society because they intervene in so many areas of social life. Both attributes under this factor address the above characteristics, hence the name. This factor explains a total of 11.161% variance.

5.5 Quality Consciousness (PF5)

Quality consciousness is an essential area for understanding quality and its integration in an organization. In simple words, it can be defined as having knowledge of quality. In today's world, clients/customers are more concerned with the quality rather than the cost. Minor defects in the construction may require even re-construction and may harm the facility's operations. Correction of poor quality requires money and causes inconvenience to the end users. Hence, quality consciousness is an important attribute for the measurement of the success of an organization. Organizations can enhance the market share by improving customer satisfaction and by providing them a better product. Implementing Total Quality Management (TQM) can prove to be one of the ways to improve the quality (Pheng and Teo, 2004). The quality of the product during construction can be enhanced by visualization of modeled construction operations. Kamat and Martinez (2001, 2002) illustrated the application of various software based tools like simulation models and the computer graphics technology based on the concept of the scene graph to visualize construction operation in 3D. The first two attributes under this category represent the quality consciousness of the organization, which may be in terms of product /service reliability, ease of use, etc. This factor explains a total of 10.581% variance.

5.6 Low Staff Turnover (PF6)

Turnover is defined as the percentage of the employees leaving the organization during one year. Staff turnover is a key factor relating to knowledge retention and distribution (Robinson *et al*., 2001). For any organization, the goal should be to have low staff turnover to maintain the consistency in the workforce and develop more skilled employees. High turnover is due to employee dissatisfaction with the job. Some of the reasons might be poor working conditions, low salary, long working hours, not enough benefits, etc. High staff turnover adds cost to the business because it requires time and resources to be spent on filling the position and training a new employee. Also, high turnover can lower employee morale and can also make the remaining employees more stressed out because they have to fill in the gaps until a new employee is hired and trained. A company with low staff turnover is quite productive due to employees being more loyal to the organization and more willing to spend their energy on the job. Low staff turnover also allows the organization to focus on the business at hand rather than making the new employees adapting to the organization needs. Hence, low staff turnover is an indicator of the good performance of an organization. This factor explains a total of about 7.427% variance.

The attributes grouped under a factor in factor analysis collectively explain the same measure or not can be checked by (1) Pearson's correlation coefficient, (2) Kendall's tau-b, and (3) Spearman's correlation coefficient. Pearson's correlation coefficient test is the most widely used correlation test to measure the degree of the relationship between variables. This test assumes that the variables are normally distributed and linearly related. Kendall's tau-b is a non-parametric test that measures the strength of dependence between two variables. Spearman's correlation test is also a non-parametric test which is used to measure the degree

Table 8. Correlation Coefficient of Attributes Within the Factors

	PF1				PF2		PF3		PF4		PF5			PF6
	(P12)	(P11)	(P10)	(P2)	(P5)	(P6)	(P13)	(P14)	(P9)	(P4)	(P15)	(P16)	(P20)	(P18)
(P12)	1													
(P11)	.549**	1												
(P10)	.315**	.343**	1											
(P2)	.418**	.444**	.366**	1										
(P5)					1									
(P6)					.608**	1								
(P13)							1							
(P14)							.750**	1						
(P9)									1					
(P4)									.484**	1				
(P15)											1			
(P16)											.457**	1		
(P20)											.251*	.391**	1	
(P18)														1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

of association between two variables. Spearman's correlation test assumes that data is ordinal. All these tests explain the amount by which the two variables are correlated. This study utilizes Pearson's correlation test to measure the coefficients by which the attributes grouped under a factor are correlated (Doloi, 2009). The correlations among the attributes under each factor PF1 to PF6 is shown in Table 8. From the Table 8, it is clear that attributes are correlated in the range of 0.0.251 to 0.750. This test ensures that all the attributes grouped under the six factors are positively correlated.

6. Discussion

Top management of construction organizations needs to assess the performance of the organization from the perspective of various stakeholders simultaneously. No single parameter can evaluate the performance of the organization to focus on the critical areas of business. Many researchers have criticized the financial measures due to the inadequacy of their documentation, reflecting only past performance of the organization and inability to reflect what contributed to achieve that performance. Hence, a set of parameters that balances financial as well as non-financial measures should be the basis of performance measurement system of the construction organizations.

This study was conducted to identify the parameters on which the performance of the construction organizations can be measured. Among the top 10 performance attributes, financial performance attributes included higher annual growth and annual construction demand that received rank eighth and tenth among the 20 performance attributes. Growth and annual construction demand can be seen as a measure of success for the organization. Financial performance indicators help top management to specify the actions to be taken by the employees and then measure to check whether the employees have, in fact, taken those actions (Ali *et al.*, 2013). The higher profitability ratio which is a financial measure of performance was placed at the fifteenth position by respondents whereas it is considered as one of the most important measures by many researchers (Yu *et al.,* 2007; Ali *et al.*, 2013).

Non- financial performance attributes included a good track record of timely completion of projects, good relationship with the client, customer satisfaction, client satisfaction, the predictability of time, the productivity of employees, the predictability of cost, and cost performance of a project that received rank from one to seventh and ninth respectively. These attributes are considered highly important in measuring the performance of the construction organizations. There is no doubt that construction business depends on their clients and customers. Therefore the construction organizations should understand and meet their needs. Satisfaction of clients, customers, and other stakeholders is necessary for the success of the construction organization. Increased satisfaction of stakeholders can be achieved through effective planning, reduction in time and cost, productivity and process improvement to stay in the competitive business environment. Chau *et al.* (2003) developed a Construction Management Decision Support System (CMDSS) employing the integration of the 'data warehouse' technology with an online analysis processing to provide information for employees to analyze situations and make decisions to do their jobs more efficiently. Application of CMDSS can keep control over the time and cost of the project and can also improve the productivity of the employee.

Moreover, health and safety consciousness, rework/defect rectification, impact on the environment, impact on society, and adopting learning and growth culture in the organization are the low ranked attributes for measuring the performance of construction organization. Comparing with the results of other studies in different countries, the above attributes are considered highly important when the performance of the construction organisation are assessed (Mbugua *et al.,* 1999; Cox *et al.,* 2003) whereas in

the study of Enshassi *et al.* (2013) health and safety received very low rank indicating a lack of awareness of people about the importance of health and safety. However, the low ranking of these attributes does not mean that the attribute is not important. The low ranking may be due to ignorance of this attributes by the construction organizations.

The present study reveals that the construction organizations realized that traditional financial measures are no longer a comprehensive measure of organization performance. The inadequacy of traditional financial measures has led to increased interest in non-financial measures, such as client and customer satisfaction, the predictability of time and cost, good relationship with clients, good track record, etc. Many construction organizations have a long-term vision that focuses on the client and customer satisfaction. Therefore, how the organization is performing from the perspective of its clients and customers has become a priority for the top management.

In order to reduce the large number of performance attributes into a manageable number, factor analysis was performed which extracted six performance factors: profitability and asset management, satisfaction of key stakeholders, predictability of time and cost, environment, health, and safety (EHS), quality consciousness, and low staff turnover. These factors could be utilised as a basic guideline for the top management of Indian construction organisations that are willing to develop further and grow. Most of the clients, while selecting the construction organization would like to have these parameters fulfilled by the organization to reduce the risk of time overruns, budget overruns, low quality of work, a large number of claims and litigation, suffering from scarcity of workforce and lack of supervision, etc. If the construction organizations improve their performance by meeting these criteria, they are most likely to get more and more businesses even in a competitive market. Construction organizations that achieve success and growth will ultimately contribute to the growth of the nation. Findings of the current study are similar to that of Chan (2009) and Ali *et al.* (2012).

As the construction industry is very complex, the study was limited to the construction organizations, involved only in the real estate business operating in the NCR of India. The construction organizations working in NCR also operate in other parts of India. Hence, the study should apply to India and the South Asian countries such as Pakistan, Bangladesh, Nepal, Afghanistan, Sri Lanka, Maldives, Bhutan and other developing countries due to the similarity in work environment and other conditions. As the respondents from different professional groups namely, contractors, developers, and PMC, consisted of medium-large organizations, were engaged in building projects only, their viewpoints will not be significantly different. However, the findings of the study may further be refined by focusing on specific respondents group and similar size of organizations.

Despite these limitations, the study provides some useful insights to construction organizations in India and other similar developing countries on some factors that may be considered necessary for the measurement of their performance.

7. Conclusions

This study attempts to find a set of criteria to measure the performance of the construction organization engaged in real estate business. A questionnaire survey and structured interview approach were adopted for the study. From the literature review, 20 attributes were selected for this study. Only 17 attributes were found to be having high importance based on the t-test and were selected for performing statistical factor analysis. The analysis of questionnaire survey on the performance attributes has revealed some significant findings.

The findings of ranking analysis using simple statistics indicate that good track record of timely completion of the projects, good relationship with client, customer satisfaction in terms of product and services, client satisfaction in terms of product and services, predictability of time in design and construction, productivity of employees, predictability of cost in design and construction, higher annual growth rate of the organization, cost performance of projects and annual construction demand/market share are some of the significant performance attributes based on the mean value. It is clear that stakeholders give more importance to the timely completion of the project, good relationship with client, customer and client satisfaction in terms of product and services as compared to the cost parameters for determination of the performance of the organization, which is perhaps for long-term survival in the construction business.

Factor analysis of the responses on performance attributes, extracted six performance factors. The findings of factor analysis indicate that there is a considerable change in the perception of the construction organizations to measure their performance. Due to rapidly changing and challenging environment in the construction industry, the traditional criteria of performance may not be adequate in developing satisfactory results to the stakeholders. It has been seen that only high financial performance is necessary but not a sufficient condition for good performance of an organization. Therefore, apart from the traditional short-term financial performance criteria, construction organisations consider long-term non-financial performance criteria such as satisfaction of key stakeholders in terms of quality products and better services, timely delivery of products, cost optimisation, better technical support, and so forth. The methods of construction should be environment friendly and less hazardous in order to save environment and life. The culture and working environment in the organization should be such that, it attracts the skilled employee and capable of retaining them for a long time to increase loyalty and thus improve productivity. All these factors contribute to enhance their performance leading to sustainability of the organization. To ensure improved value for money and overall satisfaction, clients should appoint the construction organization, which fulfills the above criteria

It should be noted that the findings of the study are based on the viewpoints of the experts of construction organizations engaged in building projects only. However, the perception of the construction organizations involved in other sectors might be

different in the determination of the performance of the construction organizations. For a construction organization involved in other areas, different sets of performance attributes/factors would have to be identified based on their organizational needs. Hence, the study in future may further be replicated by including a diversified group of construction organizations. Consequently, a comparative study can be performed on the performance measurement factors of the construction organization engaged in building projects with that of the construction organization involved in other sectors operating in India as well as other similar countries, which might be a valuable research.

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