AN ASSESSMENT OF PERFORMANCE OF CONSTRUCTION PROJECTS IN SOUTH AFRICA

(Please anonymize author information for double-blind review)

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Abstract

The South African construction industry, like most construction industries worldwide, is facing several problems and challenges that directly affect the performance of construction projects undertaken in the country. Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time cost, quality, client satisfaction, client changes, business performance, health and safety. However the abovementioned factors are not the only factors that affect the performance of construction projects; therefore this paper aims to establish the most critical factors affecting the performance of construction projects in South Africa, a case study of the Gauteng Province. The data for this paper was collected from both primary and secondary sources. The primary data was acquired through the administration of structured questionnaires. The questionnaire was distributed to construction professionals. The questionnaire was designed based on information emanating from an extant review of literature. Out of the 160 distributed questionnaires, 131 were received back which represented 82% response rate. Findings from the questionnaire analysis revealed that the key factors affecting the performance of construction projects in Gauteng are: cash flow, dispute management (Client and professionals), leadership skills of project manager, speedy and reliability of service to client, dispute management (labour and supervisor), learning from best practice and experience of others, review of failures and solving them and Availability of personnel with high experience and qualification. The study contributes to the body of knowledge on the subject of factors affecting the performance of construction projects in Gauteng, South Africa.

Keywords: construction projects, Gauteng, performance, performance of construction.

Introduction

The construction industry is vital for the development of any nation. In many ways, the pace of the economic growth of any nation can be measured by the development of physical infrastructures (Takin and Akintoye, 2002). The construction industry in South Africa is diverse and is involved in projects ranging from the development of civil infrastructure such as roads, bridges, ports and dams, the development of residential and non-residential buildings such as houses, retail facilities and offices as well as small private projects for individual home owners (SAC, 2012). Takin and Akintoye (2002) highlight that the development of construction projects involves numerous parties, various processes, different phases and stages of work and a great deal of input from both the public and private sectors, with the major aim being to bring the project to a successful conclusion.

However, Banaitiene & Banaitis (2012) inform that the construction industry is heterogeneous and enormously complex and projects are exposed to uncertain environment

because of such factors as planning, design and construction complexity, presence of various interest groups (owner, consultants, contractors, suppliers, etc.), resources (manpower, materials, equipment, and funds) availability, environmental factors, the economic and political environment and statutory regulations. As a result, the South African construction industry is facing several problems and challenges such as poor performance of construction projects. The South African construction industry, like most construction industries worldwide, faces several problems and challenges that directly affect the performance of their construction projects.

Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time cost, quality, client satisfaction, client changes, business performance, health and safety (DETR 2000; Cheung et al. 2004; Enshassi et al, 2009: 270). However the abovementioned factors are not the only factors that affect the performance of construction projects; therefore this paper aims to establish the most critical factors affecting the performance of construction projects in South Africa, a case study of the Gauteng Province.

Project Performance

The word performance is widely used in all areas of management. According to Neely (2002) and Pinhheiro (2011), performance is: i) measured by a number or an expression that allows communication (in management, performance is a concept multi-person); ii) to accomplish something with a specific intent (to create value), iii) the result of an action (the value created, the content measured); iv) the ability to achieve or enhance the creation of an outcome (customer satisfaction seen as a measure of the organization potential for future sales); v) comparing a result, internally or externally, with some reference standard; vi) a surprising result; vii) a demonstration that includes both actions and operations results, as well as the observation of the performers by strangers. The business dictionary (2014), further defines performance as the accomplishment of a given task measured against pre-set known standards of accuracy, completeness, cost and speed. In a contract, the performance is deemed to be the fulfilment of an obligation, in a manner that releases the performer from all liabilities under the contact.

Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time cost, quality, client satisfaction, client changes, business performance, health and safety (DETR 2000; Cheung et al. 2004; Enshassi et al, 2009: 270). Time, cost and quality are, however, the three predominant performance evaluation dimensions in the construction industry, also known as the “iron triangle”. Another interesting way of evaluating project performance is through two common sets of indicators (Pheng and Chuan 2006; Enshassi et al, 2009: 270). The first set is related to the owner, users, stakeholders, and the general public; the groups of people, who will look at project performance from the macro viewpoint. The second set comprises the developer and the contractor; the groups of people who will look at project performance from the micro viewpoint (Enshassi et al, 2009: 270). For construction projects, there have been different measurement indicators. The generally perceived factors that influence quality performance can be grouped under the headings of client, project, project environment, project team leaders, project procedures and project management procedures (Chan and Tam, 2000; Basheka & Tumutegyereize,2011:3766).

An assumption is made that if a project is completed on time, within the agreed budget and set quality, also referred to as the ‘golden/ iron triangle’, then the project is deemed

successful. Evidence suggests that this is far from the truth. Hence, the construction industry needs to pay attention to all factors affecting project performance, besides the golden/iron triangle (Toor & Ogunlana, 2005: 154; Garbharran et al, 2013: 91).

Methodology

The data for this paper was collected from both primary and secondary sources. The primary data gathered for the study was acquired through the administration of structured questionnaires, which is commonly used for formal quantitative research, according to McDaniel and Gates (2012). The questionnaire was designed based on information emanating from reviewed literature. Data collection was through self-administered questionnaires, which were distributed by hand and by Email in the research environment, the Gauteng province. Secondary Sources was gained from books, specialized International Journals, Publications, the internet and literature from similar fields. This study examined factors affecting the performance of construction project in Gauteng, South Africa. Using a five point Likert scale, the respondents were asked to rate the levels of agreement on each of the possible factors that may affect the performance of construction projects in Gauteng. The studied factors were ranked based on the mean item score. A higher mean item score represents a higher ranking. A total of eighty two factors were identified to be included in the questionnaire, these factors were further grouped into the following categories; 1) Cost factors, 2) Time factors, 3) Quality factors, 4) Productive factors, 5) Client satisfaction factors, 6) Regulatory factors, 7) Human resource factors, 8) Health and safety factors, 9) Innovation and learning factors, 10) Environmental factors. Out of the 160 distributed questionnaires, 131 were received back which represents 82% of the return rate, these formed the basis of this study. Frequencies statistical procedures were used to analyse the data from the returned questionnaires.

Mean item score

The five-point scale was transformed to mean item score (MIS) for each of the factors of causes and effects as assessed by the respondents. The indices were then used to determine the rank of each item. The ranking made it possible to cross compare the relative importance of the items as perceived by the respondents. This is the method used to analyse the collected data from the issued questionnaires in this study. Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement (Sukamolson, nd: 20). After the questionnaire is completed, each item may be analysed separately or item responses may be summed to create a score for a group of items. Hence, Likert scales are often called summative scales.

The computation of the relative mean item score (MIS) was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. This was based on the principle that respondents' scores on all the selected criteria, considered together, are the empirically determined indices of relative importance. The index of MIS of a particular factor is the sum of the respondents' actual scores (on the 5-point scale) given by all the respondents' as a proportion of the sum of all maximum possible scores on the 5-point scale that all the respondents could give to that criterion (Pilot & Hungler, 1995:33). Weighting were assigned to each responses ranging from one to five for the responses of 'strongly disagree' to 'strongly agree' and 'Extremely unlikely' to 'Extremely likely'. This is expressed mathematically below. The mean item score (MIS) was calculated for each item as follows;

$$MIS = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{\Sigma N} \quad \text{.....Equation 1.0}$$

Where;

n1 = Number of respondents for extremely unlikely or strongly disagree;

n2 = Number of respondents for unlikely of disagree;

n3 = Number of respondents for neutral;

n4 = Number of respondents for likely or agree;

n5 = Number of respondents for extremely likely or strongly agree;

N = Total number of respondents

After mathematical computations, the criteria are then ranked in descending order of their mean item score (from the highest to the lowest).

Findings and Discussions

From the 131 usable questionnaires, the following information was gathered; of all the respondents 61% were male and 39% were female. Relating to their qualifications, findings revealed that 1.5% of the respondents had no qualification, 6.1 % had only completed matric (grade 12), 40.5 % had diplomas, while 7.6% of the respondents had B-Degrees, 7.6% had an M-Degree and lastly, only 0.8% of the respondents had a Doctorate qualification. Findings also revealed that 34.6% of the respondents were Quantity surveyors, 21.5% were project managers, 11.5% were civil engineers, 7.7 % were construction project managers, 6.9% were construction managers, 5.4 % were electrical engineers, 1.5% of the respondents were both structural engineers and architects and finally 4.6% were mechanical engineers and the other 4.6% had job a titles that were not identified in the study and therefore their titles fell under the heading “other”. When asked about their work experience, findings showed that 54.4% of the respondents had between 2 and 5 years of work experience, 28.3 % had 6-10 years’ experience, 7.2 % had 11-15 years’ experience, 7.1 % had 16-20 years’ experience and 0,8 % of the respondents had 26-30 and 31-35 working experience in the construction industry.

According to the rankings (R), using the calculated standard deviation (SD) and mean score ($\bar{x}$), the most important factors that affect the performance of construction projects are as follows (Table 1): Cash flow (SD=0.789; $\bar{x}$=4.23; R1), dispute management (Client and professionals) (SD= 0.682; $\bar{x}$=4.22; R=2), leadership skills for project manager (SD= 0.754; $\bar{x}$=4.20; R=3), speed and reliability of service to Client (SD= 0.785; $\bar{x}$=4.20; R=3), dispute management (labour and supervisor) (SD=0.748; $\bar{x}$=4.19, R=4), learning from best practice and experience of others (SD=0.773 ; $\bar{x}$=4.19;R=4), review of failures and solving them (SD=0.765; $\bar{x}$=4.16, R=5); availability of personnel with high experience and qualification (SD=0.837; $\bar{x}$=4.16; R=5), profit rate of project (SD=0.77; $\bar{x}$=4.12;R=6), Planned time for project construction (SD=0.854; $\bar{x}$=4.12; R=6),professionals attitude towards project (SD=8.13; $\bar{x}$=4.12; R=6); percentage of orders delivered late (SD=0.806; $\bar{x}$=4.10;R=7), number of disputes between owner and project parties (SD=0.785; $\bar{x}$=4.09;R=8), Employees (labourers) motivation (SD=0.808; $\bar{x}$=4.09;R=8).

Table 1. Critical factors affecting the performance of construction projects in South Africa

Factors	$\bar{x}$	σX	R
Cash flow of project	4.23	0.789	1
Dispute management (Client and professionals)	4.22	0.682	2
Leadership skills for project manager	4.20	0.754	3
Speed and reliability of service to Client	4.20	0.785	3
Dispute management (labour and supervisor)	4.19	0.748	4
Learning from best practice and experience of others	4.19	0.773	4
Review of failures and solve them	4.16	0.765	5
Availability of personel with high experience and qualification	4.16	0.837	5
Profit rate of project	4.12	0.77	6
Planned time for project construction	4.12	0.854	6
Professionals attitude towards project	4.12	8.13	6
Percentage of orders delivered late	4.10	0.806	7
Number of disputes between owner and project parties	4.09	0.785	8
Employees (labourers) motivation	4.09	0.808	8
Average delay in payment from owner to contractor	4.08	0.941	9
Project overrun cost	4.08	0.857	9
Number of reworks	4.06	0.882	10
Risk assessment	4.06	0.864	10
Sequencing of work according to schedule	4.05	0.872	11
Information coordination between owner and project parties	4.05	0.809	11
Availability of resources (Labour, material & equipment) as planned through project duration	4.05	0.869	11
Time needed to implement variation orders	4.05	0.794	11
Time needed to rectify defects	4.04	0.918	12
Training the human resources in the skills demanded by the project	4.04	0.738	12
Labour attitudes towards project	4.03	0.98	13
Training and education of managers	4.02	0.789	14
Competitive salary packages	4.02	0.827	14
Learning from own experience and past history	4.01	0.770	15
Project complexity	4.01	0.98	15

Cost control system	4.01	0.918	15
Participation of managerial levels with decision making	3.98	0.843	16
Approvals of inspection authority	3.97	0.787	17
Quality of equipment and raw materials in project	3.97	1.019	17
Waste rate of materials	3.97	0.951	17
Quality auditing	3.96	0.901	18
Material and equipment cost	3.94	0.873	19
Cost of rework	3.93	0.965	20
Average delay because of closures and materials shortage	3.93	0.915	20
Conformance to specification	3.92	0.893	21
Cost of variation orders	3.91	1.072	22
Escalation of material prices	3.91	0.926	22
Quality assessment system in organization	3.91	0.972	22
Quality training/meeting	3.90	0.856	23
Career opportunities	3.88	0.889	24
Regular project budget update	3.88	0.947	24
Overhead percentage of project	3.87	0.934	25
Management-labour relationship	3.86	0.888	26
Project design cost	3.85	1.001	27
Project labour cost	3.85	0.911	27
Absenteeism rate through project	3.85	0.961	27
Access to medical care and facilities	3.82	0.957	28
Application for construction work permit	3.82	0.992	28
Average delay in claim approval	3.82	0.944	28
Cost of compliance to regulators requirements	3.81	0.994	29
Number of non-compliance to regulation	3.81	0.855	29
Working conditions	3.81	0.720	29
Health and safety specifications	3.79	1.023	30
Employee relations	3.79	0.887	30
Offences and penalties	3.79	0.992	30
Quality and availability of regulator documentation	3.78	0.857	31
Neighbours' and site conditions problems	3.78	0.946	31
Application of Health and safety factors in organization	3.77	1.049	32
Site preparation time	3.76	1.021	33

Human health	3.75	0.912	34
Job security	3.69	0.979	35
Reportable accidents rate in project	3.68	1.065	36
Number of new projects / year	3.67	0.93	37
Liquidity of organization	3.65	0.885	38
Occupant Control	3.65	0.907	38
Provision of sub regulations	3.64	0.967	39
Easy access to site (location of project)	3.61	1.012	40
Frequently changing jobs	3.58	1.037	41
Exchange rate	3.57	0.996	42
Notification of construction work	3.56	0.976	43
Housekeeping of site	3.53	0.897	44
Occupant comfort	3.49	0.936	45
Wastes around the site	3.44	1.082	46
Integrated pest management	3.32	0.934	47
Market share of organisation	3.30	0.908	48
Climate condition in the site	3.26	1.052	49
Air quality	3.06	1.112	50
Noise level	2.92	1.107	51

σX = Standard deviation; $\bar{x}$ = Mean item score; R = Rank

The findings from the survey support the work of Shaban (2008) and Omran (2012), in these studies average delay because of closures and material shortage, availability of resources as planned through project duration, leadership skills for project managers, project team leader experience, planning effort, adequacy of design and specification, cost progress monitoring and leadership skill of leader were all identified as major factors affecting the performance of construction project. Saqib et al (2008:392) attempted to identify factors influencing the success of project implementation, this study found the following to be the most important factors that influence project performance/successful project implementation:(1) Decision making effectiveness, (2)Project Manager's experience, (3) Contractor's cash flow, (4) Contractor experience, (5) Timely decision by owner/ owner's representative, (6) Site management, (7) Supervision, (8) Planning effort, (9) Prior project management experience, (10) Client's ability to make decision, these factors were also in agreement with the findings of the survey conducted in this study.

Factors that were ranked the least important factors affecting the performance of construction projects are as follows; Occupant comfort (SD=0.936; $\bar{x}$= 3.49; R45), wastes around the site (SD=1.082; $\bar{x}$=3.44; R=46), integrated pest management (SD=0.934; $\bar{x}$=3.32; R=47), market share of organisation (SD=0.908; $\bar{x}$= 3.30;R=48), climate condition in the site (SD=1.052; $\bar{x}$=3.29; R=49), air quality (SD=1.112 $\bar{x}$=3.06; R=50); and lastly according to all respondents the factor that least affects the performance of construction projects is noise level (SD=1.107; $\bar{x}$=2.29; R=51). Findings by Shaban (2008:56) were in

agreement that noise levels were the least important factor that can affect performance. However, findings by Omran et al (2012:61) revealed that, size and complexity of the project, tendering method, type of project and project duration were the least important factors that can affect the performance of construction projects.

Conclusion

The objective of this paper was to establish factors affecting the performance of construction projects in Gauteng, South Africa. Literature revealed that the most important factors affecting the performance of construction projects include: average delay because of closures and material shortage, availability of resources as planned through project duration, leadership skills for project managers, team leader experience, planning effort, adequacy of design and specification, cost progress monitoring, decision making effectiveness, project manager's experience, contractor's cash flow, contractor experience, timely decision by owner/ owner's representative, site management, supervision, planning effort, prior project management experience, client's ability to make decisions.

Results from the questionnaire survey, obtained from the randomly selected respondents, revealed that: Cash flow of project, dispute management (Client and professionals), leadership skills for project manager, speed and reliability of service to client, dispute management (labour and supervisor), learning from best practice and experience of others, review of failures and solve them, availability of personnel with high experience and qualification, profit rate of project, planned time for project construction, professionals attitude towards project percentage of orders delivered late, number of disputes between owner and project parties, employees (labourers) motivation, average delay in payment from owner to contractor, project overrun cost, number of reworks, risk assessment, sequencing of work according to schedule were rated as the ten most important factors affecting the performance of construction projects in Gauteng, South Africa. Findings from this paper supported work conducted by other Scholars, that there plenty of factors affecting the performance of construction projects in Gauteng ant the rest of the South Africa.

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