

FACTORS AFFECTING COST AND TIME CONTROL IN CONSTRUCTION PROJECTS

¹Olajide FAREMI¹,¹Olabode OGUNSANMI¹, Iniobong JOHN²

¹Department of Building, University of Lagos, Akoka, Lagos, Nigeria
juliusfaremi@gmail.com

²Department of Building, University of Lagos, Akoka, Lagos, Nigeria

ABSTRACT

The quest of construction project stakeholders is effective control of cost and time. Accomplishing this quest however, remains a difficult task. This study examines factors affecting cost and time control of construction projects with a view to proposing recommendations that could assist stakeholders to achieve enhanced cost and time performance of construction projects. A survey of professionals managing construction projects in Lagos, Nigeria was conducted. Structured questionnaire was developed and administered to eighty (80) managers of construction projects who were randomly selected from a sample frame of One-hundred (100) construction project contractors. A total of fifty-two (52) questionnaires were retrieved representing 62% response rate. Using Statistical Package for Social Sciences, version 20.0, descriptive and inferential statistical tools including, bar chart, mean, minimum and maximum values, frequency tables, T-test and Analysis of Variance (ANOVA) were employed to analyse collected data. The results of the analysis revealed that the top three significant factors affecting cost and time control of construction projects are; design and documentation issues, poor labour productivity and financial resource management. This study recommends the avoidance of poor work quality in construction activities. Also, project and construction managers should focus on project tripod constraints of cost, quality and time while workers hired and deployed on construction projects should be adequately skilled in order to achieve desired cost and time performance.

Keywords: Factors, Cost, Time, Control, Construction project, Lagos-Nigeria.

INTRODUCTION

Cost and time control refers to the process of controlling costs and time associated with an activity. It involves the process of managing and controlling factors that change or affect the budget and time of a given activity or sets of activities (Owens & Krynovich, 2007). Construction projects represent a unique set of activities that must take place to produce a unique product. Construction projects comprise of new buildings and structures, additions, alterations, conversions, expansions, reconstruction, renovations, major replacements, mechanical and electrical installations among others. The need to control cost and time in construction industry is essential to ensure that projects are completed within budget and on time or as scheduled (Rahman, Memon, Nagapan, Latif, & Azis, 2012).

Globally, the success of a construction project is determined by the ability of the project to meet the criteria of cost, time, safety, resource allocation, and quality as determined by the client. Kagioglou, Cooper, and Aouad (2001) affirm that a successful project is the one which has accomplished its technical performance, maintained its schedule, and remained within budgetary costs. Rahman *et al.* (2012) buttress the position that time and cost performance is the fundamental criteria for success in any construction project.

Despite the establishment of these performance metrics, ever reoccurring is the challenge of completing construction projects within the scheduled time and budgeted cost. Olawale and Sun (2010) argued that the generality of construction industry has been regarded as industry facing poor performance leading to failure in achieving effective time and cost performance. Consequently, most construction projects face huge amount of time and cost overrun. Ameh, Soyingbe, and Odusami (2010) concur that the history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns. The authors recount that of 8,000 construction projects surveyed in 1994, only 16% could satisfy the three famous performance criteria of been completed within scheduled time, within the budgeted cost and maintaining a high standard of quality. The inability of construction project managers to keep cost and time of construction projects within scheduled limits often results in severe consequences. Azis, Memon, Rahman, & Karim, (2013) opine that construction project cost which is out of control adds to investment pressure, increases construction cost, and affects investment decision-making. Shanmugapriya and Subramanian (2013)

add that from the national economic perspective, time and cost overruns reduce the productivity of available economic resources, edge the development potential and diminish the effectiveness of the economy.

Studies existing in literature (Olawale & Sun, 2010; Ameh & Osegbo, 2011; Memon, Rahman, Asmi, & Azis, 2011; Ibrahim, 2012; Azis *et al.*, 2013; Hashim, 2013; Shanmugapriya & Subramanian, 2013; Muhwezi, Acai, & Otim, 2014; Ballhysa & Blloku, 2014; Idiake, Shittu, & Oke, 2015) are limited to the identification of the influencing factors, but did not progress onto finding ways of mitigating the identified challenges. These observations underlie the rationale for this study as it aims to identify the factors affecting cost and time control of construction projects with a view to assist construction project managers achieve improved control of cost and time on construction projects.

In order to achieve the aim of this study, the following objectives are defined: To assess the factors affecting cost and time control of construction projects in Lagos State, Nigeria and to examine measures for achieving improved cost and time control of construction projects in Lagos State. The study also seeks to test the null hypothesis that There is no significant difference in the perception of construction professionals on factors influencing cost and time control of construction projects in Lagos State.

LITERATURE REVIEW

Cost and time control is defined as a process by which construction cost and time of a project is managed through best methods and techniques (Otim, Nakacwa, & Kyakula, 2012) so that project stakeholder(s) do not suffer losses as the activities of the project are carried out. Koh (2005) concurs that project cost and time control refers to the process by which the cost of a project is kept within the agreed cost limits and the duration kept within agreed schedule limits respectively.

Furthermore, Raut, Pimplikar and Sawant (2013) opine that construction cost and time control consists of simply monitoring actual cost and time performance of a project against the cost and time estimates earlier designed or stipulated for the project and identifying variances. The authors explain that the aim of cost and time control process is to monitor actual cost and time performance of projects and identify improvement opportunities, which must be dealt with by corrective actions.

Idiake *et al.* (2015) buttress that time, cost and quality are three major variables that are of primary concern to the main parties involved in procurement of building projects. The management of these variables is usually a complex task for project managers in practice. Ameh and Osegbo (2011) opined that the challenge of controlling project schedule is of global concern. Ineffective controls of time in line with project schedule usually results in the extension of time beyond planned completion dates. Similarly, ineffective control of construction project cost would usually result in a difference between actual cost of a project and its cost limit (Ballhysa & Blloku, 2014). When this difference occurs, it is referred to as cost overrun. Cost overrun on projects occurs when the resultant cost target of a project exceed its cost limits. Cost limit of a project refers to the maximum expenditure that the client is prepared to incur on a completed building project while cost target refers to the recommended expenditure for each element of a project.

When construction cost is out of control, it adds to investment pressure, increases construction cost, affects investment decision making, wastes the national finance and might result in corruption or offence (Rahman *et al.*, 2012). Most construction project are being completed at costs much higher than initial estimate which indicate that initial cost estimates on construction projects can hardly be relied upon by clients (Olawale & Sun, 2010). The problem of poor cost and time management and its respective overruns in project cost and time are serious issues in both developed and developing countries. This needs serious attention for improving the construction cost and time performance as rarely projects are completed within budget and schedule. This study would survey opinions of its sample on the challenges of cost and time control of construction projects within the study area by adopting articulated challenges discussed in this section of the study.

Rahman *et al.* (2012) opine that time and cost performance of construction projects are affected by factors such as design and documentation issues, financial resource management, project management and contract administration, contractors' site management, information and communication technology, material and machinery resource, labour (human) resource and external factors.

Memon *et al.* (2010) presented twenty-four factors influencing the effective control of cost on construction projects. The authors opined that the factors include the practice of assigning contract to

lowest bidder, contractor's poor site management and supervision, cash flow and financial difficulties faced by contractors, incorrect planning and scheduling by contractors, inadequate contractor experience, shortage of site workers, and delay in Material procurement. Other factors identified include incompetent project team (designers and contractors), fluctuation in prices of materials, underestimate project duration resulting in schedule delay, shortages of materials, mistakes during construction, lack of communication among parties, labor productivity, low speed of decisions making, change in the scope of the project, poor technical performance, frequent design changes, and slow payment of completed works. Also, identified are unforeseen ground conditions, equipment availability and failure, necessary variations of works, owner interference and social and cultural impacts. All identified factors in literature cited in this study were adopted for use in the course of collecting data for this study.

RESEARCH METHODS

This study is geographically delimited to Lagos State, the economic nerve center of Nigeria. A total sample frame of 100 construction companies having operations in Lagos state was developed for this study. The sample frame comprises of eighty eight (88) construction companies that are registered with Lagos state tender board and twelve construction companies scooped from the list of construction companies on Vconnet data base. Adopting the Taro Yamane (1967) equation for determining sample size as explained by Israel (2013) that:

$$n = \frac{N}{1 + N(e)^2} \dots\dots\dots \text{equation 1}$$

Where:

n is the sample size

N is the population size

e is the level of precision

A sample size of eighty (80) was obtained. Consequently, eighty (80) data collection instrument was designed and administered. Out of the administered questionnaires, a total of fifty-two questionnaires were retrieved representing 65% response rate.

RESULTS AND DISCUSSION OF FINDINGS

Demographic Data of Respondents

The statistics of the characteristics of the respondents for this study was analysed and the results presented in figure 1 below:

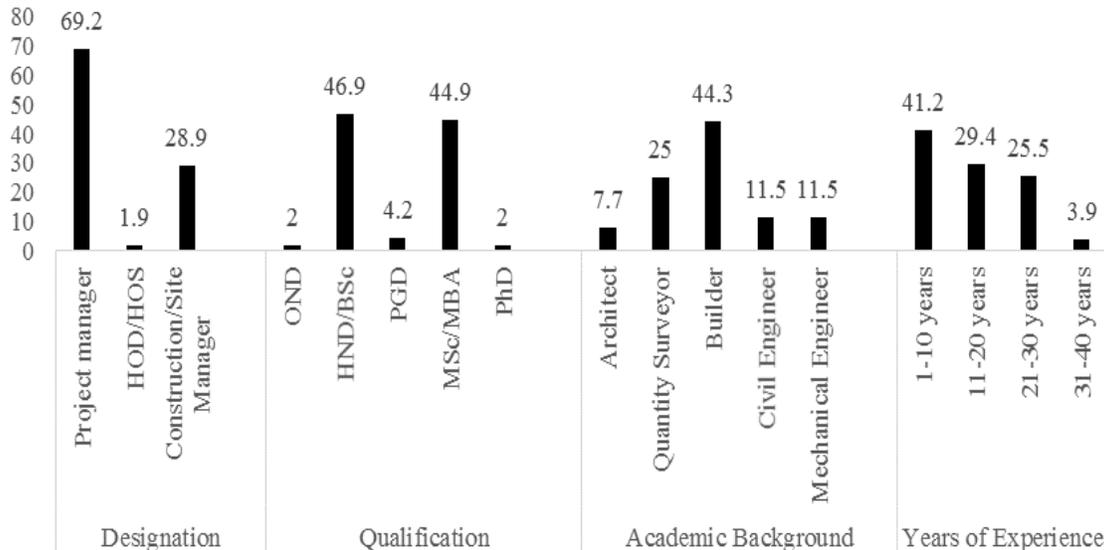


Figure 1: Respondents' demographic data

Figure 1 above shows the characteristics of respondents for this study across four areas of respondents' designation, academic qualification, academic background and the years of experience on construction projects of those that responded to the survey. The analysis revealed that the designations of majority of the respondents were project managers and construction managers account for about 70% and 29% of the responses respectively. This implies that the respondents are core professionals equipped to handle building construction projects, thus their responses would be of immense value to this study. Also about 47% of the respondents have Higher National Diploma (HND) certificates or Bachelor of Science Certificate (B.Sc) while about 51% possessed post graduate qualifications. It implies the generality of the respondents have acquired significant level of formal education and would therefore be able to provide appropriate responses to the various formulated research questions.

Factors Affecting Cost and Time Control of Construction Projects

Based on extensive review of literature as discussed in previous chapter of this study, prevailing factors affecting cost and time control of construction projects were presented to surveyed respondents and they were asked to assess the level of significance of each of the articulated factors on a 5 point Likert scale ranging from not significance to highly significance. A total of forty-nine (49) factors were assessed, the resulting analyses are shown in table 1 below:

Table 1: Factors affecting cost and time control of construction projects

Factors	N	Mean	Rank
Design and Documentation issues	47	4.57	1
Poor labor productivity	49	4.53	2
Financial Resources Management	51	4.51	3
Change in the scope of the project	48	4.48	4
The practice of assigning contract to lowest bidder	49	4.45	5
Poor technical performance	50	4.44	6
Shortage of site workers	51	4.43	7
Unforeseen ground conditions	48	4.42	8
Incompetent project team (designers and contractors)	51	4.41	9
Human Resources	49	4.41	10
Project Management and Contract Administration	50	4.40	11
Inadequate contractor experience	48	4.40	12
Delay in Material procurement	51	4.39	13
Frequent design changes	49	4.39	14
Owner interference and social and cultural impacts	49	4.39	15
Lack of communication among parties	48	4.38	16
Material and Machinery Resource	51	4.37	17
Necessary variations of works	49	4.37	18
Incorrect planning and scheduling by contractors	49	4.37	19
Shortages of materials	50	4.36	20
Low speed of decisions making	48	4.35	21
Inadequate fund for the project	50	4.34	22
Contractors Site Management Techniques	50	4.34	23
Obtaining building permits and approvals	49	4.33	24
Slow payment of completed works	50	4.32	25
Mistakes during construction	50	4.30	26
Contractor's poor site management and supervision	49	4.29	27
Fluctuation in prices of materials	51	4.27	28
Cash flow and financial difficulties faced by contractors	51	4.27	29
Equipment availability and failure	49	4.27	30
Design changes during project execution	50	4.26	31
Subcontractor incompetency	51	4.25	32
Information and Communication Technology	50	4.24	33

Factors	N	Mean	Rank
Delay in delivery of materials	51	4.24	34
Underestimate project duration resulting schedule delay	48	4.23	35
Incompleteness of technical documentation	51	4.16	36
Inadequate planning of project before commencement	51	4.16	37
Variations	50	4.14	38
External Factors	47	4.13	39
Unexpected subsoil/ground condition	48	4.10	40
Inadequate tools and equipment	51	4.08	41
Accidents	48	4.02	42
Political instability or change in government policies	48	4.02	43
Delay in response to decision taking	50	4.02	44
Labour dispute in form of strike or lock-out	48	3.98	45
Delay in inspection and testing of completed work	50	3.96	46
Temporary work stoppages due to adverse weather	46	3.96	47
Unclear or inadequate instructions to operators	48	3.90	48
Community issues	49	3.86	49

The results in table 1 reveal that design and documentation issues ranked first among factors affecting cost and time control of control projects. This is followed by the productivity level of labour resources on construction projects, financial resource management, change in the scope of projects and the practice of assigning contracts to lowest bidders respectively. This result implies that significant time is spent on resolving request for changes in design by key project stakeholders. Also, cost and time spent on obtaining required development permits for building construction projects from relevant government agencies within the study area are relatively difficult to estimate because in most cases such approval periods are prolonged due to the bureaucratic nature of obtaining such permits and approvals, this consequently alters project managers and construction managers cost and time schedule.

This result concurs with the findings of Memon, Rahman, and Azis (2012) that design and documentation issues are very dominant in construction, they opined that design and documentation issues have significant impact on cost and time performance of construction projects as frequent design changes are common practice on construction projects. Factors ranked to be least significance include; strike actions as a result of labour dispute, delay in inspection and testing of completed work, temporary work stoppages due to adverse weather, unclear or inadequate instructions to operators and community issues. Unlike this study that ranked labour productivity as the second most significant factor affecting cost and time control of construction projects, Memon *et al.* (2012) ranked financial resource management as the second most significant factor affecting cost and time control of construction projects. They explained that delay in payment to the contractor for completed works by the client results in cash flow challenges which usually slow down the pace of contractors. The differences in the findings of this study and that of Memon *et al.* (2012) on factors that influence the control of cost and time of construction projects may be as a result of differences in geographical location, culture and prevailing construction practices in the respective locations where the studies were conducted.

Measures for Achieving Improved Cost and Time Control of Construction Projects

This study seek to assess measures for achieving improved cost and time control of construction projects, hence, respondents were presented with hypothesized measures that could improve control of cost and time of construction projects as elicited from literature. The respondents were asked to rate their level of agreement or otherwise with each of the potential measures using a 5 point Likert scale ranging from strongly disagree to strongly agree. Table 2 below shows the resulting analysis:

Table 2: Measures for improved cost and time control of construction projects

Measures for improved cost and time control	N	Mean	Std. Deviation
Avoid poor quality of work	48	4.65	.526
Focus on the quality cost and delivery of the project	50	4.62	.490
Hire skilled workers to achieve good progress	49	4.59	.497
Committed leadership and management	48	4.56	.542
Proper work planning	48	4.56	.542
Training and development of all participant to support delivery process	50	4.54	.646
More rectification and double handling, close monitoring	50	4.54	.613
Adoption of tools and techniques i.e.: value management, lean thinking, total quality management, etc	50	4.52	.580
Effective site management and supervision	50	4.50	.580
Use new construction technologies (IBS-Industrialize Building System)	50	4.48	.677
Effective strategic planning	50	4.46	.542
Send a clear and complete message to worker to ensure effective communication	50	4.46	.579
Proper project planning and scheduling	50	4.44	.644
Fully utilize the construction team	49	4.43	.707
Use of appropriate construction methods	48	4.40	.765
Measure performance against other projects	48	4.35	.699
Provide knowledge/training to unskilled workers based on their scope of work	50	4.30	.839
Clear information and communication channels	47	4.30	.720
Frequent progress meeting	49	4.29	.764
Focus on client's need	50	4.28	.640
Use of experienced subcontractors and suppliers	52	4.27	.660
Frequent coordination between the parties	47	4.23	.729
Perform a preconstruction planning of project tasks and resources needs	48	4.23	.692
Systematic control mechanism	47	4.19	.680
Comprehensive contract administration	47	4.17	.732
Use up to date technology utilization	47	4.15	.908
Improving contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors	46	4.09	.812
Proper emphasis on past experience	50	4.08	.752
Developing human resources in the construction industry	46	4.04	.815

The analysis in table 2 shows that respondents strongly agree that avoidance of poor quality of work with a mean of 4.65 is the most significant measure for achieving improved cost and time control of construction work. The second most significant measure agreed by the respondents is that construction project managers should focus on project quality, project cost and project delivery as inseparable entity. The results infers that quality work orientation and avoidance of poor quality of work would reduce defective work and rework in the course of construction activities which would in turn impact cost and time performance of construction projects positively. This support the position of Abdullah *et al.* (2010) and Memon *et al.* (2011) that the success of a project is defined by the extent to which the project conforms to defined quality standards i.e., specification and performance. Also, low quality materials increase material waste on site which eventually results in higher construction cost than expected.

Research Hypothesis

Ho: There is no significant difference in the perception of construction professionals on factors affecting cost and time control of construction projects within the study area.

H₁: There is significant difference in the perception of construction professionals on factors affecting cost and time control of construction projects within the study area.

To test the hypothesis, Analysis of Variance (ANOVA) method was used. From the computation for the hypothesis, the overall average significance value for the Analysis of Variance test was found to

be **0.437** at a significant level of 0.05. Although a case by case significance test shows that there are significant differences in the perception of the respondents on four (4) of the factors, therefore, the individual null hypotheses for them were rejected. The affected factors include mistakes during construction ($p=0.033$, $p<0.05$), lack of communication among parties ($p=0.030$, $p<0.05$), low speed of decision making ($p=0.016$, $p<0.05$) and frequent design changes ($p=0.024$, $p<0.05$). The average statistics value ($p=0.437$, $p>0.05$) however supports the null hypothesis that there is no significant difference in the perception of construction professionals on factors affecting cost and time control of construction projects.

CONCLUSION

This research concludes that five of the forty-nine hypothesized factors examined in the course of this study are the predominant factors affecting cost and time control of construction projects in Lagos state, Nigeria. These are design and documentation issues, labour productivity, financial resources management, changes in the scope of the project and the practice of awarding contracts to the lowest bidder. These findings support the position of Rahman et al. (2012) that design and documentation as well as financial resource management are the two most important factors for improving cost performance of construction projects. Azis *et al.* (2013) further emphasize that design is the road map and systematic guide in leading to the objective of any project while documentation plays an important role in tracking and monitoring the progress of the project.

In addition, other top factors that project stakeholders should give attention in the quest for effective cost and time control in construction projects include labour productivity issues (i.e. poor productivity of workers on construction projects). Shanmugapriya and Subramanian (2013) affirm that poor labour productivity is one of the seven (7) most significant factors affecting cost performance of construction projects in Indonesia. Others factors affecting cost and time control of construction projects in Lagos state are incessant changes in the scope of construction projects and the practice of assigning the contracts of construction projects to lowest bidders. These set of factors complement design and documentation issues and financial resources management as most significant factors affecting cost and time control of construction projects.

This study recommends that construction project stakeholders especially project and construction managers should ensure that poor workmanship is avoided when carrying out construction activities. This would minimize the need for rework and consequently enhance the optimization of both financial and time resources. Also, project and construction managers should constantly and consistently focus on construction project tripod of cost, quality and time. Such focus should encompass the development of skills and competence that would enhance their ability to effectively discharge duties in this regard. Construction project stakeholders should make effort at hiring only workers that are adequately skilled as the project or work/activity demands. This would result in accelerated progress of work and consequently good construction project time performance.

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