Advances in Science and Technology, Vol. 1, No. 2 / 3, April - September 2007, pp99-107.

Success Measurement in Construction Projects: Understanding the Quantitative Criteria Used by Stakeholders in Nigeria

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(Submitted: August 13, 2006; Accepted: April 18, 2007)

Abstract

The implementation of construction projects usually involves persons or groups whose different interests in the project make them project stakeholders. Visibly littering the Nigerian landscape are several construction projects (some completed) which can be deemed to have failed because the projects exceeded their initial cost, time, and quality content as specified and may also have been undertaken under very poor inter-stakeholder relations. Meeting the initial values of the above three parameters constitutes the criterion by which project success is generally and classically measured quantitatively. The single criterion of meeting the initial numerical value of the three objective parameters rarely, if ever, hold true in real life in Nigeria. Three major groups of corporate construction stakeholders (clients, consultants, and contractors) have been used to provide the data for this study. It was found that the final values of the three objective parameters of success (cost, time, quality) can vary within certain ranges and still produce a success verdict. Knowing, before hand, the tolerances for the different stakeholders can aid the proper measurement of, and even the planning for, project success.

Keywords: Success, success measurement, construction, project stakeholder, criteria.

1.0 Introduction

A project can be seen as a series of activities or tasks having specific objectives to be achieved within specified resources constraints of time, cost, quality, and of course good customer relations (Kerzner, 1989). The execution of such activities which taken together constitute the client's/sponsor's project idea naturally involves many stakeholders such as the contractor, consultants, public authorities and many others who most times remain unannounced (Lambert, 1994). Project activities are usually guided by time, cost, and quality content which the client has directly or indirectly caused to be specified for the project. The above stated variables are also generally seen as the major 'objective' parameters for measuring success (as different from success factors). Where the initial/contract numerical values of these specifications are met, the project is deemed a success, otherwise failure is pronounced.

This paper addresses the problem of determining the basis for the success verdict that is usually passed (directly/indirectly) on projects, especially construction, in Nigeria in the print and electronic media, oral discussions, and even in formal reports for the monitoring and evaluation of construction projects especially where governments or their agencies are major stakeholders and more so when they act as clients. The problem of a basis actually derives from two roots. The first is that of parameters, as indicative factors or reference labels. Our experience confirms the use of the classical 'objective' parameters of cost, time and quality as the main factors considered and these were used for this paper. The second relates to the criterion or decision rule that is employed to reach a verdict on a project.

A study of construction projects undertaken in Nigeria in the recent past will indicate that only a small proportion of the total number could be said to have been successful even though some of these have been completed. For instance, of 21 construction projects used for the preliminary study by the author, only one (4.76%) met the initial specification of the parameter of time only. Representing the general trend, time and

cost over-runs of between 50 - 420% and 8 -133%, respectively, have been reported with 80% of the projects recording between 100 – 400% time over-run. This position has been further supported by the idea that client's risks and objectives for a particular project should inform the execution content and process (Herbert, 1991) and by extension, the basis for measuring success and which basis must specify relevant parameters and the criteria or decision rules. When the risks and objectives as above are identified, quantified and met, this goes a long way in satisfying such a client and to such a client this will mean success (Seeley, 1997; Walker, 2002).

Billons of Naira have no doubt been tied down in the numerous delayed and/or abandoned projects littering the Nigerian landscape with some of the completed projects failing for not having met the classical criterion. Nwachukwu (2002) had shown that classical success is a rare occurrence in the Nigerian construction experiences. It can however be said that project failure is only a symptom of more fundamental variables/features associated with the perception of stakeholders in the industry. One such perception relates to the use of the parameters of cost, time, and quality only for measuring success.

This limitation may be explained in part as the only parameters explicitly specified in most construction contract documents, especially those within the Joint Contracts Tribunal (1980) family. The other perception, derived from the classical success paradigm, is the single criterion of acceptance of meeting the initial specifications of the 'objective' parameters of success.

The above classical model of success presents at least one obvious problem: the problem of exactitude. Given the lack of absolute control and the individual differences exhibited by humans who carry out projects, and the ever present variability in nature itself, we attempt to determine the factors (parameters) and criteria to which construction project stakeholders in Nigeria reference their measurement of project success. The increasing demand for one-stop-shopping for professional services by construction clients (Garner, 1999), their corresponding interest in value engineering (Smith, 1999), accuracy of objective success parameters (Baber, 1999), and 'balance' of the parameters (Griffiths and Stubbs, 1998) are further highlights of the stated problem.

Although different construction procurement options exist, this paper is restricted to projects undertaken using the lump-sum version of the Joint Contracts Tribunal (JCT, 1980) form (with quantities), which is the most commonly used form in Nigeria. This choice is further informed by the requirement of this form that cost, and time especially, be explicitly made part of the contract.

2.0 Theoretical Background

There are many types of projects. However, most projects can generally be grouped into research and development, maintenance, administrative, and construction (Bubshait, 1990). The need for construction projects may arise for own use, investment or speculation (Litchfield, 1956) or even social service but generally to advance organizational goals. To be precise, construction is seen here as including the group of interrelated production activities involving the erection, maintenance and repair of physical structures, including highways, housing, commercial construction, industrial plants, dams, ports and other heavy construction (Fapohunda, 1987). Given the above wide coverage, the focus on construction in this write-up is therefore justified for its importance to the development of nations as implicated by its continuing use as an economic regulator (Woodward, 1998; RICS, 2001).

Basically, construction has to do with building, fitting or putting together (Hornby, 1995; National Association of Women in Construction, 1996) of materials and components to provide for man's convenience and improve his physical and social environment. Construction therefore involves activities which can collectively

be termed a project for which several definitions abound. This paper, in particular, shares the view of a project as a one-time-only configuration of activities, resources, people, tools, management, and expectations (Kerzner, 2003). Hence a project can be defined as any non-repetitive goal-oriented finite-set of related activities undertaken within specified quantitative and qualitative constraints or performance conditions. When the set of activities are undertaken within the specified constraints and the performance criteria met, the project is, classically, said to be a success. Put another way the classical definition of success has no provision for over-runs or under-runs for the three 'objective' parameters of cost, time and quality.

The occurrence of quantitative deviations as entailed above and stated earlier, means failure, a phenomenon that seems to pervade different economies abroad and in Nigeria (Schwalbe, 2001; Igwe, 1987).

Whereas time and cost deviations are normally overruns, that of quality will usually be an under-run (Kerzner, 1989). What then is success? It is that the project comes in on schedule (time parameter/criterion), achieves basically all the goals originally set for it (effectiveness parameter/criterion), comes in on budget (monetary parameter/criterion), and is accepted and used by the client for whom the project is intended (client satisfaction criterion) (Pinto and Slevin, 1988).

In relation to the time and monetary criteria, there have been calls for the prescription of limits as yardsticks for measuring cost and time, the ability to control both of which tends to diminish rapidly over the life of the project (Seeley, 1976).

Beyond cost, time and quality, the other criteria (effectiveness and acceptance) show a preponderance of mixed usages. Even the parameter of quality presents considerable difficulty in definition arising from the fact that many people are responsible for its determination (Amirine *et al.*, 1975). The result is that most contributors simply discuss the importance of managing quality (Locke, 1992). A strong case has therefore been made in favour of the need for workable and measurable quality criteria (Ridout, 1994), as efforts toward achieving total quality (Kliem and Ludwin, 1992).

Similarly, the concept of project success can, and in fact should, be stretched like that of quality above, such that construction project stakeholders can talk of total or overall success.

In this regard, further studies (Baker *et al.*, 1988) have shown that success should be seen as that situation in which the project not only meets the technical performance specifications and/or mission to be performed but also provides a high level of satisfaction with the project outcome among key people on the project team, users and clientele. It has also been shown by the same study above that overruns of the objective parameters of cost and time (in particular), are not strongly or significantly related to the perception of success. It is in this vein that we are of the opinion that the perception of major stakeholders will help model a more realistic basis for the measurement of project success in Nigeria.

3.0 Research Design

To achieve the objective above, it is reasoned that construction stakeholders in Nigeria significantly represent their counterparts in the global arena and therefore provide a reasonable basis for this study.

Similarly, it was reasoned that the three major, often visibly active and usually announced stakeholder-groups (client, contractor, consultant) are in a good stead to provide realistic representative data for this study.

The choice of these groups as 'major' is supported by literature (Wahab, 1990; Murdoch and Hughes, 1996).

A questionnaire was used to collect data from the stakeholders chosen nationwide using random numbers. The questionnaires were transmitted and returned by industrial trainees from the author's former employer's list of students placed on mandatory industrial attachment nationwide. The questionnaires were required to be filled and endorsed by the most senior personnel in the organization in which the industrial attache served.

The respondents, in the main, provided data on the level of variation (%) above or below the initial/ contract value of the objective parameters of success (cost, time, quality) within which the stakeholders are willing to maintain a verdict of success.

In this way, the concept of success has been treated as a variable (not an attribute) in line with the current trend in quality control studies (Haley, 1994).

The classical/theoretical model of success does not permit over-runs or under-runs in the values of the three 'objective' parameters. Gosset's t-test was therefore used to determine the significance of the results obtained from the field. Gosset's t is defined as

$$t = \frac{x - \mu}{S}\sqrt{N-1} = \frac{x - \mu}{S\sqrt{N}}$$

where N = sample size, x = sample mean; μ = population mean, s = sample standard deviation. In this paper x = mean tolerance / variation on the parameter values, μ = initial/contract value of the parameter, $S\sqrt{N}$ = standard error (S.E.). The decision rule is to accept H_o if $t_c > t_T$ and reject H_o and accept H_i if $t_c < t_T$.

The mean tolerance/variation reported by the respondents have been used in the test of the Null hypothesis (H_o) of no significant variation is allowed by stakeholders on the initial/contract values of the objective parameters of success.

4.0 Analysis and Discussion

Out of a total sample size of 300, 144 questionnaires were completed and returned giving a return rate of 48%. The spread of respondents is shown in Table 1. Unuseable responses were however found to be 3, 17 and 21 in number for consultants, contractors and clients, respectively. Incomplete and inconsistent entries were mainly responsible for the responses being unreliable and therefore unusable for data analysis. A common sample size of 30 was then randomly chosen and used for each stakeholder-group (to achieve numerical uniformity/equality for the analysis). The mean values of the responses are presented in Tables 2, 3, and 4 for consultants, contractors and clients, respectively.

Using Gosset's t-model, the mean, standard deviation and standard errors are computed for each parameter and stakeholder-group as presented in Table 5. With N = 30, percent error computations yielded Table 6.

The findings show that the three parameters of cost, time and quality are commonly accepted, and mainly used for measuring construction project success in Nigeria. The indication is also that the definition of success in very exact quantitative terms is erroneous and that construction stakeholders in Nigeria use, instead, a range of values for measuring project success. The findings specifically show that on cost, the range for consultants, contractors, and clients (other things being equal) lies about 20%, 17% and 39%, respectively. On project time/period, it was found to lie about 22% for both consultants and clients, and 19% for contractors. In terms of quality specification, it was 12%, 3% and 2% for consultants, contractors and clients, respectively.

Table 1: Spread of Respondents

Respondent Group	Number	%
Consultants	33	22.9
Contractors	52	36.1
Clients	59	41.0
Total	144	100

Source: Field Data

Table 2: Mean Variation (%) Allowable by Consultants

Respondents' S/N	Success Parameter		
	Cost	Time	Quality
1	10.20	14.80	5.00
2	10.20	14.80	5.00
3	10.10	15.00	5.00
4	9.80	14.60	5.00
5	9.50	17.80	5.00
6	9.51	15.00	3.75
7	9.50	15.00	5.00
8	10.00	14.50	5.00
9	10.00	14.70	5.00
10	10.00	15.00	5.00
11	10.00	14.80	5.00
12	10.00	14.90	6.50
13	10.00	15.00	5.00
14	10.00	13.90	5.00
15	10.00	14.60	5.00
16	10.00	15.00	5.50
17	10.00	15.01	5.00
18	10.00	15.00	5.00
19	10.00	15.00	5.00
20	10.00	14.71	5.00
21	10.00	14.61	5.00
22	10.00	14.90	5.00
23	10.00	15.00	5.00
24	10.00	15.00	5.00
25	10.00	14.90	5.00
26	10.00	14.70	5.00
27	10.00	14.80	5.00
28	8.50	14.90	5.00
29	8.00	14.60	5.00
30	8.00	15.00	5.00
$\sum$	293.8	444.10	150.50
$\bar{X}$	9.79	14.80	5.02

Table 3: Mean Variation (%) Allowable by Contractors

Respondents' S/N	Success Parameter		
	Cost	Time	Quality
1	12.41	9.05	5.00
2	12.29	9.10	5.25
3	12.33	8.00	5.00
4	12.50	8.20	5.00
5	12.40	8.50	5.00
6	12.25	9.08	5.03
7	12.30	8.30	5.00
8	12.20	9.20	5.00
9	12.31	8.00	5.00
10	11.93	9.30	5.00

11	12.70	9.61	5.00
12	12.50	9.80	5.00
13	12.61	10.10	5.25
14	12.38	10.11	5.00
15	12.50	9.60	5.00
16	13.30	8.70	5.25
17	14.10	8.90	5.00
18	13.60	9.31	5.00
19	12.00	9.70	5.00
20	12.11	9.00	5.00
21	12.30	8.80	5.00
22	12.40	8.90	5.03
23	12.50	9.15	5.03
24	12.50	9.00	5.00
25	12.40	8.85	5.00
26	12.36	8.78	5.03
27	13.00	9.21	5.03
28	12.00	9.31	5.00
29	12.50	8.89	5.00
30	12.40	9.20	5.00
$\sum$	375.08	271.65	150.87
X	12.50	9.054	5.03

Table 4: Mean Variation (%) Allowable Bv Clients

Respondents' S/No.	Success Parameter		
	Cost	Time	Quality
1.	16.54	22.00	5.00
2.	16.52	22.20	5.03
3.	16.52	21.70	5.00
4.	16.48	21.65	5.00
5.	16.47	21.81	5.00
6.	14.20	21.79	5.00
7.	20.00	22.10	5.00
8.	15.58	21.83	5.00
9.	20.00	20.00	5.00
10.	16.38	24.20	5.00
11.	14.59	22.10	5.00
12.	17.01	21.75	5.00
13.	17.10	22.80	5.25
14.	16.48	21.80	5.00
15.	16.51	21.69	5.00
16.	16.52	21.82	5.00
17.	16.47	21.90	5.00
18.	16.50	22.15	5.01
19.	16.51	22.00	5.00
20.	16.50	21.91	5.00
21.	16.50	21.97	5.00
22.	16.35	22.30	5.00
23.	16.40	21.96	5.00
24.	16.43	21.89	5.01
25.	16.53	20.90	5.00
26.	16.51	22.20	5.00
27.	16.51	21.95	5.00
28.	16.35	22.30	5.00
29.	16.28	21.94	5.00
$\sum$	497.11	658.69	150.30
X	16.57	21.96	5.01

Table 5: Sums, Means, Standard Deviations and Standard Errors

Stakeholder	Parameter	ΣX	X	S	S.E
Consultants	Cost	293.800	9.793	0.5564	0.103
	Time	444.100	14.800	0.595	0.110
	Quality	150.500	5.017	0.341	0.062
Contractors	Cost	375.080	12.503	0.459	0.084
	Time	271.650	9.054	0.534	0.097
	Quality	150.300	5.010	0.076	0.014
Clients	Cost	497.110	16.570	1.097	0.200
	Time	658.690	21.956	0.609	0.111
	Quality	150.300	5.010	0.046	0.008

At 95% level of confidence, the errors yield the following value in table 6 below.

Table 6: Error Values at 95% Confidence Level

Parameter	Consultants	Contractors	Clients
Cost	±0.202 or 20.2%	±0.165 or 16.5%	±0.392 or 39.2%
Time	±0.216 or 21.6%	±0.190 or 19.0%	±0.218 or 21.8%
Quality	±0.122 or 12.2%	±0.027 or 2.7%	±0.016 or 1.6%

Although the cost tolerance appears to show the greatest disparity among the groups studied, the magnitudes corroborate the literature (Seeley, 1997; Fayek, 1998; Knowles, 2004) and can be interpreted as indicating the relative dispositions of the groups to project expenditure. Here again, the profit bias of the contractor is clearly implicated.

The results on the parameter of time provide the closest overall agreement among the groups studied and particularly so between consultants and clients. It can therefore be said that the participants have a more common perception of project time/period and this is not expected to far exceed the 20% mark. We consider this finding reasonable given the varying weather conditions under which construction activities go on in Nigeria. Similarly, the seemingly ever changing and sometimes inconsistent economic polices of governments in Nigeria, coupled with over-dependence of the local construction industry on imports (especially equipment and materials) often find expression in delays and elongation of project durations.

To therefore say that the above factors have negatively affected the psyche of the stakeholders in terms of 'due diligence' assumed in the standard construction contract as reflected in the finding on time may not, after all, amount to an overstatement.

In terms of quality, the agreement appears to be between contractors (3%) and clients (2%). The implication is that whereas the contractor is conscious of the effect of revising work specifications (especially upwards) on his profit margin, the client wants to acquire a product that meets his original expectations which the consultant has translated into the design specifications. The allowable variance of 12% on quality indicated by this study, for consultants, may be explained as added safety margins or compensating for real or perceived under-performance by contractors, etcetera. However, this figure appears high considering that such variables are usually built into the design standards/guides. It also implicates the fact that discrepancies sometimes exist between consultants' design and construction practice (Mosaku, 1989), a situation that is not uncommon in real life in Nigeria especially where 'green' project types and consultants, and 'patronage' are involved.

In addition, and notwithstanding that the value derived for quality above does not appear to enjoy contractors' and clients' expectations (as earlier reported), such high tolerances tend to inadvertently and negatively affect the final values of other parameters thereby further making the likelihood of a better

success outcome more remote.

5.0 Conclusion

We have looked at the concept of project success and what informs the verdict (formal/informal) often passed by stakeholders on construction projects in different forms and fora in Nigeria. This was achieved by making reference to the three major stakeholders namely, the client, contractor and consultant, as well as the three classical parameters of project success of time, cost and quality.

There is no doubt that what is usually accepted as the initial or contract values of the objective parameters of success and against which success is measured in very exact terms, are actually estimates or 'professional guesses' having different margins of error. Having looked at the perception of success by the three main characters in a typical construction scene, this paper concludes that construction project stakeholders in Nigeria use mainly cost, time and quality, as parameters for measuring success. In the same vein, it is concluded that stakeholders accept/ tolerate variations in the initial or contract values of the objective parameters of success and that such variations do not invalidate their verdicts of success when they occur within certain ranges.

It is further concluded that knowing the permissible ranges for each project scenario is important for measuring project success and returning an informed verdict.

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