

A STUDY OF RELATIONSHIP BETWEEN THE APPLICATION OF PROJECT MANAGEMENT TECHNIQUES AND PROJECT UNCERTAINTY

Bldr T. I, Adogo and Engr. Aliyii Mohammed

Abstract

The essence of (his study is to relate the application of different types of project management techniques to projects characterized by uncertainty. The study was carried out by reviewing relevant literature on the subject matter. A structural questionnaire was administered to top executives of Building and Civil Engineering construction firms in Abuja, Jos, Yola, Ilorin and Kaduna. The responses form the basis of analysis which was based on 2 x 2 contingency tables and Chi-Square statistics tests. The result of the analysis revealed that the use of bar chart, network analysis, resource leveling/ allocation, progress curves, trend analysis and percentage completion were found to be statistically not significant in determining the level of degree of uncertainty in a project while the use of regular reports was significant. The study was concluded with recommendations aimed at improving the use of project management tools to enhance efficiency.

Key Words: Bar Chart, Network Analysis, Resource leveling/Allocation, Progress curves, trend analysis, Percentage completion, uncertainty.

Introduction

The concept of project management has grown in importance with increasing complexity of projects as a result of demand from clients most especially the corporate clients. Construction projects are no exception to these demands. The development of problem management techniques to take care of different situational uncertainty will go a long way in creating better understanding of projects. The necessity for this kind of study have earlier been highlighted by Webster (1982) when he wrote "there **is criticism** of project management literature in regard to the inability to find guidance as to which tool which variant to use under what circumstances".

The study of relationship between project management techniques and project uncertainties **which** characterize projects should therefore be viewed as an important aspect of managing projects. It has the potential of minimizing waste of resources, (labour, time and machinery).

Project management techniques comprises mainly of planning and controlling techniques, such that while planning techniques is associated more with the pre-contract stages, the control techniques is associated with the post-contract activities.

The need for this study is glaring in view of demands by clients for maximum value of their time at this period of rising cost of projects, increasing cost awareness and to successfully complete project on time, at minimal cost and for the project to meet functional requirements. To satisfy this demand the study was set with the objective of examining the different types of project management techniques, understand the different ways in which uncertainties can result in projects analyze the implication of various management techniques on the characteristics and highlight the importance of relating projects management techniques to project characteristics.

Project Uncertainty

Park (1966) described uncertainty as situations which are of relatively unique in nature and for which the probabilities cannot be calculated. Similarly, Roger and Miller (2001) stresses the fact that uncertainty applies to situations in which potential out-comes and casual forces are not fully understood. Project uncertainty has been defined as the predictability or likelihood that a particular event occurrence will happen (Pekar et-al, 1976).

Level of uncertainty in a given project results from a number of factors affecting the project. Some of these include:

1. The type of activities required for the project. The level of uncertainty increases with increasing number of activities.
2. The sequencing relationship among activities. This becomes more difficult with the increased complexity in the nature of job. Variations in job content are always accompanied by sequence

- alterations.
3. Activity duration and cost even where the activities needed are determined to a given degree of accuracy. Uncertainties in durations and cost still arises. Unexpected job conditions encountered result in the actual amount of work differing significantly from what was assumed when the job was estimated. For example works involving underground work particularly those involving quality and characteristics of rock and subsurface soil quite often create unexpected job conditions.
 4. Inadequate plans and specifications also constitute a source of uncertainty in a project. This may result in ordering of unsuitable materials and underestimation of adequate timing required for the project.

Study Methodology

The data for this study was randomly obtained from five towns within the North Central geographic region of Nigeria. These are Abuja, Jos, Yola, Ilorin and Kaduna. It was assumed that the conclusion drawn from the result of investigations carried out in these regions would be a fair representation of what obtained in Nigeria.

A total of 85 questionnaires were administered and a total of 65 responses were received as given in the detail in Table 1.

Table 1 Breakdown of Responses/State

S/No	Town	No. Sent Out	No Recieved	% Response
1	Abuja	40	30	75
2	Jos	20	19	95
3	Yola	10	10	100
4	Ilorin	10	04	40
5	Kaduna	05	02	04
	Total	85	65	-

The questionnaire was set to explore the level to which the top managers at the hierarchy of the firms utilize the various project management techniques to solve problems of uncertainty that often characterizes some operations. A Pilot survey was earlier carried out to clear doubtful questions. The techniques covered are Bar Chart, Network Analysis, Line of Balance, Resource Levelling/Allocation. Progress curves. Trend Analysis, Percentage completion and Regular reports.

Data Presentation and Analysis

Two levels of perceived relative uncertainty were defined: certain and uncertain. To determine the perceived level of uncertainty for a given project, each interviews was asked to rate the degree of uncertainty involved in his project with respect to each of the following two characteristics.

- Activity Duration
- Activity Costs

Each of these two characteristics was rated as certain, relatively certain, relatively uncertain or uncertain. If either of the two dimensions was rated as uncertain or if both of them were rated as relatively uncertain, the project was classified as uncertain; otherwise the project was classified as certain.

Since the data on project uncertainty was measured on an ordinal scale and the data on the application of specific project management techniques were dichotomous, non parametric statistical techniques were used in the data analysis. A series of 2 x 2 contingency tables were used to determine the association between project uncertainty and the use of project management techniques.

In a typical case of finding the relationship between the use of bar chart on project characterized by uncertainty or otherwise a hypothetical question that may be asked is illustrated using the data in Table 2 obtained for the bar chart. Do these data indicate that in general the use of

the bar chart are of less important to project characterized by uncertainty than by certainty (5% level)? Similarly illustrations also apply to other project management techniques.

1. Analysis for Bar Chart/Project Uncertainty

The analysis for the relationship between the use of bar chart and project uncertainty is presented below:

Table 2: Contingency Table for the Use of Bar Chart Versus Project Uncertainty

	No. of Companies that Use	No. of Companies that do not Use Bar Chart	Totals
Certain	29	31	60
Uncertain	3	2	5
	32	33	65

As in any contingency table, a hypothesis indicating that the two criteria of classification is independent is set up (in this case project uncertainty and the use of bar chart). In the hypothesis, it is expected that the ratio of number of companies that use bar chart with certainty to all companies that use and do not use bar chart with certainty to be same as the ratio of the number of companies that use bar chart to the total number of companies.

Denoting by X the expected number of cases that are supposed to use bar chart we have:

$$X : \frac{60}{65} \times 32 = 29.54$$

Therefore, the total number of companies that are uncertain in using bar chart = 60 - 29.54 = 30.46

From the Table 2, the expected ratio of number of companies that do not use bar chart with certainty to all companies that use and do not use bar chart with certainty to be the same as the ratio of companies that use bar chart to the total number of companies.

Denoting by Y the expected number of companies that do not use bar chart:

$$Y : \frac{5}{65} \times 32 = 2.77$$

2,23. Therefore, the total number of companies that are uncertain in not using bar chart = 5 - 2.77 =

Calculation of Chi-Square for the Data

Table 3: Chi-Square Table for the Use of Bar Chart Versus Project Uncertainty

o	e	o-e	(o-e) ²	$\frac{(o-e)^2}{e}$
29	29.54	-0.54	0.292	0.00988
31	30.46	0.54	0.292	0.00959
3	2.77	0.23	0.053	0.0191
2	2.23	-0.23	0.053	0.0238
65				0.0624

A 2 x 2 contingency table with one degree of freedom (V = 1) as shown above was used to obtain the above result. From the Chi-Square distribution table, the table value at the 5% level for V = 1 is $X^2_{.05} = 3.84$, a value far larger than the calculated value. It is therefore concluded that under the hypothesis of independence of use of bar chart and project uncertainty, a deviation from expectation larger than that which occurred in this test is found more than 5% of the time, therefore, this result is not significant. This means that the use of bar chart as a project management technique has not gotten any significant influence on factors that create uncertainty in a project.

Similar exercise was carried out for other project management techniques versus project uncertainty. The results obtained are tabulated in Table 4.

Table 4: Contingency Table Chi-Square Results for the Relationship Between the Application of Project Management Technique Versus Project Uncertainty

	Techniques	Certain/Uncertain	Relationship
i.	Bar chart	0.0624	Not Significant
ij	Network Analysis	0.2965	Not Significant
iii	Resource leveling/Allocation	1.492	Not Significant
iv	Progress curves	1.3541	Not Significant
v	Percentage completion	1.3267	Not Significant
vi	Regular report	3.8582	Significant
vii	Trend Analysis	0.7672	Not Significant

Discussion of Results Bar Chart

The results indicate that the use of bar chart is not significant in solving problems which creates uncertainties in a project. The bar chart is used in a project mainly to indicate time needed for the individual activities or phases of work.

Network Analysis

The results show that there is no significant relationship between network analysis and project uncertainty. This means that the use of network analysis in a construction project does not play any major role in minimizing the relative degree of uncertainty that often occurs in a project. This should be expected, as the network analysis is developed mainly to provide management with flexibility for purpose of resource management and decision affecting economies.

Line of Balance

The result indicates that there is no significant relationship between the use of line of balance technique and project uncertainty. This result should be expected as the technique is developed mainly to determine the rate of finishing for a repetitive work and therefore has no relevance to uncertainty.

Resource Leveling/Allocation (RLA)

The result indicates that the use of resource leveling/allocation technique is not significantly related to project uncertainty. This shows that the use of relative leveling/allocation technique does not affect the relative degree of labour/materials (resources) or their distribution for the project covered in this study.

Progress Curves

The result indicates that the use of progress curves is not significantly related to project uncertainty. Since project curves are developed to show the developmental stages in a project i.e. report on current status and predict future expectation, it then follows that if it had been properly used by the contractor, it would have reduced the level of uncertainty affecting the various projects,

Trend Analysis

The result indicates that the use of trend analysis is not significantly related to project uncertainty. If this technique had been properly used it was expected to have helped in solving problems of uncertainty since it was devised to help managers assess results of certain decisions earlier taken on a project.

Percentage Completion

The result indicates that the use of percentage completion as means of monitoring projects is not significantly related to the relative degree of uncertainty. Monitoring percentage completion of Projects are important in indicating the progress of work or cost expenditure relative to duration of the project. It is not expected to solve problems of uncertainty in a project.

Regular Reports

The result indicates that the use of regular reports is significantly related to the relative degree of uncertainty that occurs in a project. This means that the use of regular reports helps to reduce the level of uncertainty that may occur in a given project. This should be expected since these reports ensure that better understanding of current situations in a project and hence aid more reliable predictions.

Conclusion and Recommendations

This paper studies the relationship between the application of some selected project management techniques and project uncertainty. The finding reveals that only regular reports as a project management techniques was relevant in managing project uncertainty. There is the need to encourage the understanding of this kind of relationships to ensure better and more effective management of resources, to predict more precisely activity durations and project costs.

Assessment of situations likely to lead to uncertainty during the project life cycle need to be thoroughly examined prior to commencement of project and should be reviewed periodically as the project progresses.

Even though management techniques such as progress curves and trend analysis were found not to be significantly related to project uncertainty it is believed that if the techniques have been properly used by construction practitioners the result obtained will most likely be otherwise. It is further recommended that a study of relationships between project management techniques and other project characteristics such as project complexity, managerial complexity and technical complexity should be carried out.

References

Park, R. W. (1966). *The Strategy of Contracting for Profit*. Eaglewood Cliffs N. J.: Prentice Inc.

Pekar et al (1976). New Directives for Management Control of Project Plans. *Project Management Quarterly*. Vol. 7, September.

Roger, M; Donald, L. (2001). Understanding and Managing Risks in Large Engineering Projects. *International Journal of Project Management*. Vol. 19 No. 8 November.

Webster, F. M. (1982). Tools for Managing Projects. *Project Management Quarterly*. Vol. 13. June.