

The Role Of Monitoring And Control On Construction Project Management In Northern Nigeria

Ibrahim Sani Yar adua

Department of Quantity Surveying, Hassan Usman Katsina Polytechnic, Katsina.

e-mail: sani4hukpoly02@gmail.com

08033701386

Abstract—This paper analyzes project monitoring and control techniques and tools and how they impact on project management, performance and its success among construction companies in Northern Nigeria. Extensively exploring the current literature, it reviewed the Bodies of Knowledge (BOK) approach and evaluated the managers' perspective to satisfy the research requirements. Data relating to the outcomes of various projects undertaken by a set of construction managers in both the private and public sectors on the impact of the use of methodologies, techniques and tools was obtained by a set of questionnaire and structured interview and used for this study. Various views of the Bodies of Knowledge were reviewed and synthesized and the information was used to analyze the correlation between variables that determine the application of monitoring and control methodologies, techniques and/or tools and other variables that determine the success criteria in projects. Results obtained from the study have shown a positive influence of the use of Monitoring and Control techniques and tools as a success factor in project management and performance. The study aims to highlight an optimal and most appropriate approach on the use of techniques and tools in project monitoring and control processes in the Nigerian Construction Industry, thus promoting the implementation of both traditional and new tools. The adoption of newer techniques and tools is hereby recommended. This could generate a considerable improvement in project performance, thus promoting new strategies for the development of the discipline.

Keywords—Construction, Monitoring and control, Northern Nigeria, Project management, Role.

Introduction

Monitoring and control (M&C) in projects is designed to achieve the set objectives of the project, maintaining the set out conditions for the attainment of an optimal level of success. Based on observation, systematic measurement of performance, identifying variances, and adoption of corrective / preventive actions as well as changes in management styles,

monitoring provides a systematic methodology for the smooth and successful execution of construction works based on the stipulated conditions. Studies by many researchers have proved that the process of M&C contributes to the minimization of the deviations during execution and to the achievement of better results.

Project monitoring and control have been studied widely, largely motivated by the impact that the process has on project success. [23] emphasizes that many of the causes of project failures can be attributed to the lack of planning and monitoring, highlighting importance of control in the achievement of the aims and improvement in the project performance. Classifying them as one-dimensional and multidimensional control systems, he explained that the one dimensional systems are not integrated variables, this being their main disadvantage, and are used for specific issues due to their easy usability while the multidimensional systems on the other hand, included an integration of variables.

A number of other scholars have also made extensive studies on this subject matter. (Consider the works of [19]; [1]; [7]; [9], [5] [8]. These studies over the last few years have generated a wide range of methods, techniques, tools, or modifications of the existing traditional models. However, literature on this subject matter in particularly the developing countries including Nigeria is scanty and warrants a research commitment in this respect.

This research evaluated the traditional and current methods and techniques of M&C based on the existing bodies of knowledge and evaluated the project manager's perspective to analyze the impact of these methods and techniques on project performance. The study was carried out to understand the project managers' adoption of methods, techniques and tools of M&C and its impacts on the success of projects in Northern Nigeria.

ACRITICAL ANALYSIS OF THE METHODS AND TECHNIQUES FOR MONITORING AND CONTROL: THE BODIES OF KNOWLEDGE PERSPECTIVE

Several standards and methodologies for project management exist or are presented in the Bodies of knowledge (BOK). These are developed by organizations, public and private agencies,

management professionals and researchers. Popular among these organizations are Project Management Body of Knowledge (PMBOK), Association for Project Management Body of Knowledge (APMBOK), International Competence Baseline (ICB) [10], International Standard Organization 10006 (ISO 10006) [20] and Projects in Controlled Environments of the United Kingdom (PRINCE2) [15]. A large number of standards for project management have been issued by organizations, standardization companies and associations in the world with common content and principles. An analysis however of the monitoring and control variables in accordance with the guidelines of each of the known standards provided in the bodies of knowledge indicates that most of its proposals agree on the importance of applying monitoring process on the variables representing the axis of the management of a project (scope, time, cost or quality). Likewise, most applicable tools and techniques recommended focus their application on these variables.

Several methods and techniques for monitoring and control also exist both in literature and in practice. Most common of these methods include the Earned Value Management (EVM), the Balanced Scorecard (BSC), The Critical Chain methodology (CC); which applies the theory of constraints (TOC), Gantt Chart, Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM). In Nigeria, the Earned Value Management is the method most often used in measuring multidimensional systems. This is due to its ease of application, interpretation and implementation, and can be used for various types and classes of projects in public and private sectors as observed by [2]. Despite their disadvantages of excluding other aspects such as, among others, quality, technology and design, the EVM have widely been accepted by project managers [12].

The Balanced Scorecard (BSC) on the other hand, works by detecting changes in the market to give rise to organizational changes and its application in project management and allows the integration of three perspectives: customer, internal processes and learning, and growth. It is seen as a tool for improving the effectiveness of project management, and improving operational performance of project teams [14].

Organizations operating in multi-projects use the techniques and method of Critical Chain methodology (CC) which applies the theory of constraints (TOC) that recognizes the relationship between activities and resource constraints. This method works by planning, programming and controlling project processes. According to [6], it is applied for monitoring the progress of projects, the deviations, and the schedule and for assisting in correct decision-making. This method can be implemented with many other tools.

The Gantt chart, Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are other traditional techniques used by managers in

the Nigerian construction industry. Over the years, their adaptation to information technology tools has corrected the limitations observed by managers in their applications.

The basis for measurement of project performance has also been a topic for wider discussion with divergent views. Each, based on the manager's situation and the project type and condition, provides for a unique criteria and variables. According to [4] Performance assessment is based on the measurement and monitoring of the performance criteria of the projects, and which according to [16] and [22] has traditionally been associated with the variables of time, cost and quality.

Conceptual Clarifications

In order to analyze the impact of the adoption of methods, techniques and tools of M&C on performance in project management, the criteria normally used to assess such performance also has to be analyzed. For the purpose of this work, the concepts of a '*successful project*' and that of '*project management success*' are hereby clearly distinguished. Although there is divergence of views, project success, as measured by the achievement of objectives on the final product [16], and project management success, measured usually in terms of time, cost and quality [3] are adopted for this purpose.

Researchers like [13], argued that project performance is measured by metrics and that the process is about setting goals, about the choice of an improvement strategy through success factors, and measurement to establish the difference between what is planned and the end results [22]. But because according [11] and [13] projects vary from one from another, this is always difficult usually due to variations in the nature, type and condition of the projects. It is therefore impossible to generate a universal list of criteria. In general, most current methods are therefore based on the so-called iron triangle defined by cost, time and quality and other categories are added to this [22]

Data Gathering and Analytical Methods

In order to satisfy the requirements of this study, qualitative and quantitative data was generated by a set of questionnaires and structured interviews. This was intended to determine the use of monitoring and control techniques and tools, and to evaluate the relationships between their use and project success. The first part of data collection involved a review of available literature on the bodies of knowledge. A questionnaire survey administered on a purposively selected population was used to collect empirical data about the managers interviewed on their use of techniques and tools, and their relationship with performance measured by success criteria in projects. A population of sixty respondents was identified by a snow ball technique and selected for questionnaire administration. Fifty-nine of the questionnaires administered were recovered and summarized for

analysis. Data obtained from the questionnaire and information obtained from the structured interview was analyzed, and through a correlation analysis, the influence of the adoption of techniques and tools on project results and that of each of the variables were shown and results discussed.

Analysis and Discussion of Results

Questionnaire responses were summarized and classified by variables including gender, duration in practice and profession. These were subsequently analyzed in order to determine whether any of these had an impact on performance aspects. The other variables in this part of the questionnaire were used to characterize the elements that determined the type and nature of projects undertaken by the respondents.

The frequency of using the assessment variables for each technique and tool for project monitoring and control, gathered from the analysis of literature and standards were identified and the relationship between each tool or technique and the variables assigned to measure project performance were assessed. The most used tool, the project type, the measurement frequency and the final percentage of completion of each project were also assessed. The variables that determine the performance were related to the variables identified for techniques and tools, assessing whether there was relationship between them and project performance.

From the overview analysis it can be seen that all the managers interviewed were male, constituting 100%. More than half (79.65%) of the study population worked for between 5 to more than 10 years. This guaranteed, in principle, that the sampled managers had professional experience.

Table 1. Respondents Years of Experience in industrial practice

| S. no | Duration in the Industry | Frequency (N = 59) | Percentage (100) |
|-------|------------------------------------|--------------------|------------------|
| 01 | Less than 5 Years | 12 | 20.33 |
| 02 | More than 5 but less than 10 years | 26 | 44.06 |
| 03 | More than 10 Years | 21 | 35.59 |
| | Total | 59 | 100 |

The most prevalent Professions were mostly in the area of Construction Management, Architecture and Engineering; which confirms that these areas are the most applicable for project management.

In terms of the respondents' nature of business, 16.9% of the respondents work with contracting firms, 20.33% were consultants and the remaining 62.71% are involved in both contracting and consulting. All the 59 respondents representing 100% were involved in both public and private projects. In the study area,

3.38% of the respondents were involved in mainly civil engineering projects; 59.32% were involved in Building construction projects and 37.28% were involved in both building and civil engineering projects. None of the respondents from the population was involved in heavy engineering. This explains the nature of business of the region.

With regards to the adoption of M & C methodologies, in general there was a low use of methodologies among the respondents, but however, majority of them adopted the PMBOK. It had high acceptance and application with approximately 65% of the sample. This does not however coincide with results of studies described in the literature, where PMBOK and PRINCE are said to be the most used methods in some European countries. Approximately 35% of managers did not often use methodologies developed from the mentioned standards, in some cases because they did not use any procedures at all, and in others, because they used in-house methodologies or techniques developed by their organizations from existing traditional methods.

With respect to the use of monitoring and control techniques in projects, generally one can see a use of more traditional tools like the Gantt chart (91.5%); and in other cases, the use of newer techniques such as performance indicators (11%) and earned value (25%). It is also interesting to note that a considerable proportion of the sample (13.5%) do not normally use any technique for project monitoring and control. Table 1 below shows the most general and representative results of the use of techniques.

Table 2. Employment of Methods/Techniques by managers in their previous projects

| S/no. | Method | Frequency (n=59) | Percentage (100%) |
|-------|--|------------------|-------------------|
| a. | Earned value management (EVM) | 15 | 25.4 |
| b. | The balanced scorecard (BSC) | 26 | 44.0 |
| c. | The Critical Chain Methodology (CC) | 23 | 38.9 |
| d. | Gantt Chart | 54 | 91.5 |
| e. | Program Evaluation and Review Technique (PERT) | 57 | 96.6 |
| f. | Critical Path Method (CPM) | 57 | 96.6 |
| g. | None of the above | 08 | 13.5 |
| h. | Others, specify | 12 | 20.3 |

With respect to the use of tools, the considerable and widespread use of the spread-sheet as a monitoring and control tool was observed. The use of word processing and other tools like Microsoft Project probably due to the application of templates was also observed among some of the managers.

Table 3. Frequency of using methods in the management of projects by respondents

| S/No | Method | Never | Often | Very Often |
|------|--|-------|-------|------------|
| a. | Earned Value Management (EVM) | 00 | 43 | 16 |
| b. | The Balanced Scorecard (BSC) | 02 | 48 | 09 |
| c. | The Critical Chain Methodology (CC) | 00 | 52 | 07 |
| d. | Gantt Chart | 00 | 12 | 47 |
| e. | Program Evaluation and Review Technique (PERT) | 02 | 17 | 40 |
| f. | Critical Path Method (CPM) | 00 | 08 | 41 |
| g. | Others (Specify) | 46 | 13 | 00 |

Table 4. Measurement of performance criteria indicators in assessment of the success of projects by respondents.

| S/No | Performance Criteria | Frequency (N=59) | Percentage (100) |
|------|----------------------------|------------------|------------------|
| a. | Time | 59 | 100 |
| b. | Cost | 59 | 100 |
| c. | Quality | 59 | 100 |
| d. | Activities | 43 | 72.8 |
| e. | Scope | 47 | 79.6 |
| f. | Stakeholders' satisfaction | 52 | 88.1 |

Table 5. Factors that Influenced Managers Choice of Methods/Techniques (n =59)

| Item | Factors | Not Important at all | Not Important | Less Important | Important | Very Important |
|------|---|----------------------|---------------|----------------|-----------|----------------|
| a. | Ease of application | 00 | 00 | 00 | 38 | 21 |
| b. | Flexibility | 00 | 00 | 34 | 11 | 14 |
| c. | Could be used with other methods | 00 | 16 | 35 | 08 | 00 |
| d. | Facilitate creative and innovative approaches | 00 | 34 | 23 | 02 | 00 |
| e. | Efficiency | 00 | 09 | 11 | 26 | 13 |
| f. | Less Complicated | 00 | 00 | 28 | 17 | 14 |
| g. | Less Number of Elements | 00 | 00 | 04 | 08 | 47 |

Table 6. Respondents' Assessment of the Impacts of Methods and Techniques Employed in their Project Management (n=59)

| S/No | Method | None | Less (Low) | Much (High) | Very much (Very High) |
|------|--|------|------------|-------------|-----------------------|
| a | Earned Value Management (EVM) | 0 | 8 | 35 | 16 |
| b | The Balanced Scorecard (BSC) | 0 | 14 | 31 | 14 |
| c | The Critical Chain Methodology (CC) | 0 | 21 | 30 | 8 |
| d | Gantt Chart | 0 | 6 | 11 | 42 |
| e | Program Evaluation and Review Technique (PERT) | 0 | 4 | 7 | 48 |
| f | Critical Path Method (CPM) | 0 | 3 | 22 | 34 |
| g | Others (Specify) | 0 | 0 | 0 | 0 |

Discussions

Correlations between variables on the use of methodologies, techniques and tools and the projects performance criteria can be seen from the results of the descriptive statistical analysis. Regarding the use of methodologies, a positive correlation with performance was generally found. The strongest positive correlation occurred between the use of methodologies and the project scope, especially with the PMBOK standard. That is, the more methodologies are used the better the project scope results are. Another variable with strong positive

correlation was between the use of methodologies and project cost and time, that is, generally the use of methodologies improves key variables of project management results. Although the correlation with other performance variables (quality, activities and stakeholders' satisfaction) was not as representative as for the rest, one can see that the correlation remained positive. This indicates that managers who used project management methodologies found better results. Regarding the correlation between the use of techniques and tools with performance, the variables with the strongest positive correlation were cost, activities, time and scope of projects. In this case the activities were affected by the use of techniques and

tools, indicating that control on operational execution was improved. So were the results. The other variables (quality and stakeholders) showed positive correlation as well. Although not strong, some degree of influence on the results has been observed.

Conclusion

Monitoring and Control have always been intended to frequently check the progress of project implementation. Project management performance need to be properly evaluated and understood for us to understand the influence of the adoption of monitoring and control methodologies, techniques and on project management performance. Project results have shown positive relationship with the adoption of techniques and tools and the use of methodologies developed from representative Bodies of Knowledge. This is proved by the Review and analysis of literature and Bodies of Knowledge and the results of the Questionnaire and interview responses.

The results showed that project management literature and Bodies of Knowledge have treated the subject of monitoring and control techniques and tools adequately. However, there was a low rate of use, particularly on the modern methods and techniques. This may have been due to Managers' poor level of enlightenment. However, Bodies of Knowledge and standards were proved to be known, so probably the issue is about applying their guidelines.

It is considered that standards such as PMBOK and PRINCE2 [15] structure detailed application monitoring and control, in part, because they assume that this is a process in the distribution of process groups. PMBOK includes actions to monitor the status of the project, analyzing the impact on the management plan, performance report and relevant decision making. However, documentation systems have to be used as formats and / or templates to transform the totality of the standard and increase its usefulness in the effective implementation of projects. With regard to techniques and tools that are included in the bodies of knowledge and standards, traditional techniques are suggested but supported by computer tools or software management systems. This validates the usefulness of these techniques still in force and the need to include information technology as support for project managers. Similarly, the technique of earned value management is perhaps the most popular today, and suggested by all standards. However, their adoption affected project performance with greater or lesser impact. There was not general consensus about the most used technique or tool, since there were not significant differences in their use. It was found that there was more adoption of traditional management techniques applied in project management. The techniques most correlated with performance were related to the use of key performance indicators, such as earned value, or review systems.

Recommendations

Although satisfaction and adoption of more known and used traditional tools were high, the study has shown that they were not the ones that generated better results on project performance. The adoption of newer techniques and tools is hereby recommended. This could generate a considerable improvement in project performance, thus promoting new strategies for the development of the discipline. It is also considered that the methodology used to prepare the study is useful in project management contexts and provides a procedure that allows an adequate analysis, data processing and results presentation, both interpretively and graphically. It is suggested that the methodology could be used in similar studies to relate the success factors in a project to its performance and outcome.

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