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Appropriate Cost Reduction Strategy through Timely Delivery, Quality Improvement and Health/Safety Measures in Public Building Production

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ABSTRACT

Building industry is beset with some problems among which are the challenges of cost reduction through timely, delivery, quality control and health/safety measures. The problems of unavailability and unreadiness of materials and working implements at the correct time and place. They team up to hinder the operations from being carried out on schedule. Procurement of quality materials and implement vis-à-vis the deployment of health/safety measures go a long way to muddle up value chain and specification which in effect hampers effective public building delivery. To achieve the stated aim three core objectives are set out as follows: to examine the input of timely delivery; assess the effect of quality improvement and ascertain the impact of health/safety measures all as cost reduction strategies in public building project delivery in the South East Nigeria. The field survey research approach were adopted to collect relevant data, structured questionnaire on contemporary issues on material management was administered to over 760 respondent selected on the basis of randomized stratified samplings technique. Data collected from field survey were analyzed using appropriate statistical tools. Among the major findings of the study is the variation in cost reduction and significantly reduced cost of public building projects delivery. Diligent building construction management in the area of time economy, quality improvement and good health/safety measures correlate highly and positively with each other as relevant factors in effective public building projects delivery.

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Introduction

Construction industry provides a vast scope for cost and time reduction by improving performance and quality through knowledge gained in planning, scheduling and controlling construction process. This is made possible when man, materials, machine, money and management techniques are combined together as well as adopting latest construction practices.

Project time is the time frame between when the contractor got impress and commenced site works until the completion and hand over of the project to the client. Once the project delivery time is established in agreement with the client and the contractor; strict adherence to achievability and realization is key to the success of the project.

According to [1], actual progress should correspond with planned progress of construction work. All significant stages of the project should take place not later than their specified date. Late completion or delays of a public/institutional building project will disrupt the academic calendar of educational institutions. If the planned time-scale is exceeded, the original cost estimate and budgets are certainly to be exceeded.

Effective building construction management minimizes the total project and installation costs.

Quality improvement performance however is another key factor and strategy in cost reduction. Quality is defined as the totality of features required in order to satisfy prescribed needs or fitness for purposes.

The important criteria for measuring quality performance of a project is the extent of compliance with the use of specified construction materials and component to ensure all round quality and standardization to the level of client's satisfaction.

Achieving quality performance requires competence on site and building materials management. Good quality of materials and work tend to carry a higher initial cost than lower quality alternatives but in the long time benefit analysis quite superior and rewarding. Quality control should be exercised during all stages of a project and supervised regularly by a clerk of works which results in satisfying contract specifications.

Furtherance to cost reduction strategy Health and Safety at work is equally paramount. Health has been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infinity [2]. [3] in his contribution defined safety in construction site as the freedom from the danger of risk of injury due to accidents and danger to health resulting from occupational hazards. Site accident result in many human tragedies, discourage workers, disrupt site activities, delay project progress and affect overall project cost, productivity and regulation.

All these premise tend to support the assertion of [4] that cost, time, quality and safety are important characteristics of every project in the construction Industry in Nigeria.

There should be under normal circumstances a strong relationships between cost, time, quality and health/safety

measures variables in effective delivery of public building projects. However, the apparent conflict between these variables as evidence in public building project delivery in the South East, Nigeria; gives cause to worry necessitated this study. Any change in one objective is bound to affect others. If the planned time scale is exceeded, the original cost estimate and budgets will likely increase. Again if the quality specified is downgraded, there will be substantial apparent save in cost but in the long-run counterproductive.

Also, adequate, clean and smart ordering, purchasing and storage of building materials are keys to effective implementation and success of public building delivery.

Lack of requisite manpower and managerial acumen in scheduling and planning were great obstacles to healthy building project delivery. Haphazard storage and littering of materials, poor adherence to Health/safety measures and unclean construction site environment lead to lost of uncounted man hour and fatalities. All these irregularities increase cost and delay in the scheduled time for delivery.

These are the captured and visualized problems this study through its aim and objectives will seek to address.

It is focused on a strategy to develop a correlation that will demonstrate and confirm the effectiveness of public building production in the area of cost reduction through the appropriate deployment of quality improvement and good health/safety measures.

The objectives will be to:

- examine the input of timely delivery as a cost reduction strategy in existing public, building project delivery in southeast Nigeria.
- assess the effect of quality improvement as a cost reduction strategy in appropriate public building project delivery and
- ascertain the impact of health/safety measure as a cost reduction strategy in appropriate public building project delivery in Southeast Nigeria.

Concept of Effective Project Delivery

In building production management, the goal is to achieve project delivery within the contract cost, time and to ensure that specified scope and quality is met without compromising the health and safety of the operatives. Thus, effective project delivery refers to realizing the building project within the scheduled time at the scheduled cost which equally meets the client's need.

Construction cost is the total cost necessary to procure a project and cost performance is measured by the extent of completion of a project within estimated budget and time. [5], opined that there is a direct and very important relationship between time and cost (money). If the planned time scale is exceeded, the original cost estimates and budgets are almost certain to be exceeded too. A project cost money during every day of its existence. The cost could be categorized as direct cost, indirect (over head) costs, costs of financing, cost of penalties. All these time/cost considerations mean that delays on a large project can easily cause additional cost [6].

For effective project delivery, time, cost, quality health and safety at work are very important factors that need to be properly managed to achieve cost reduction in successful delivery of public building project.

Data Presentation

Respondents in the study were drawn from the built environment operatives/personnel's involved in building industry and consultant, who assess the quality and the application of appropriate techniques in public building construction.

The public buildings include tertiary institutions, banks, churches, shopping malls, federal and state secretariats in the South – East States of Nigeria. Nine hundred (900) copies of the questionnaire were distributed and seven hundred and six one (761) responded to the questionnaire representing 84.6 percent of the respondent.

To what Extent does Cost Reductions in Materials Management Affect Effective Public Building Projects Delivery?

The result in table 1.0 represents the summary analysis of respondents' opinion on the extent to which cost reduction, timely delivery, project quality and health/safety have on effective public building projects delivery. The result shows that cost, time and quality are rated so high compared to the factor health/safety. For instance 37.6 percent being the majority of the respondent rated the contribution of cost performance in effective public project delivery as 61 – 80 percent. Whereas, 31.7 percent of the respondents rated the contribution of cost performance in effective public project delivery as 41 – 60 percent. Few of the respondents, being 12.2 percent of the respondents, rated the contribution of cost performance in effective public building project delivery as 21 – 40 percent while 11.7 percent of the respondents rated the contribution of cost performance in effective public project delivery as 81 percent and above. Only 6.8 percent being the least of the respondents rated the contribution of cost performance in effective public project delivery as less than 20 percent.

Table 2. Cost Performance in Public Building Projects Delivery.

| Cost | F | X | Fx |
|------------------|-----|------|---------|
| 0 – 20 percent | 52 | 10 | 520.0 |
| 21 – 40 percent | 93 | 30.5 | 2836.5 |
| 41 – 60 percent | 241 | 50.5 | 12170.5 |
| 61 – 80 percent | 286 | 70.5 | 20163.0 |
| 81 – 100 percent | 89 | 90.5 | 8054.5 |
| Total | 761 | | 43744.5 |

$$\text{Arithmetic Mean } \bar{X} = \frac{\sum fx}{\sum f}$$

$$\text{Average performance of cost} = \frac{43744.5}{761} = 57.5\%$$

Table 3 contains the descriptive statistics section of the output which gives the mean, standard deviation, and sample size for each condition in the study and the marginal means. The data show a mean score of 2.58 for "Quality" being the highest mean score reported in the study followed by a mean

Table 1. Summary Analysis of Respondents Opinion on the extent to which cost reduction, time reduction (timely delivery), project quality improvement and good health/safety measures has on effective public building project delivery.

| S/N | Response | Cost | % | Time | % | Quality | % | Health & Safety | % |
|-------|----------------------|------|---------|------|---------|---------|---------|-----------------|---------|
| a. | Less than 20 percent | 52 | (6.8) | 55 | (7.2) | 48 | (6.3) | 301 | (39.6) |
| b. | 21 – 40 percent | 93 | (12.2) | 125 | (16.4) | 116 | (15.2) | 222 | (59.2) |
| c. | 41 – 60 percent | 241 | (31.7) | 145 | (19.1) | 121 | (15.9) | 109 | (14.3) |
| d. | 61 – 80 percent | 286 | (37.6) | 333 | (43.8) | 298 | (39.2) | 73 | (9.6) |
| e. | 81 percent and above | 89 | (11.7) | 103 | (13.5) | 178 | (23.4) | 56 | (7.4) |
| Total | | 761 | (100.0) | 761 | (100.0) | 761 | (100.0) | 761 | (100.0) |

Source of Data: Author's Fieldwork, August 2014 through January 2015.

score of 3.40 for “Timely delivery”, a mean score of 3.35 for “Cost reduction” and finally a mean score of 2.16 for “good Health/Safety measures”.

Table 3. Descriptive Statistics.

| Descriptive Statistics | Mean | Std. Deviation | Analysis N |
|------------------------|------|----------------|------------|
| Cost | 3.35 | 1.057 | 761 |
| Time | 3.40 | 1.129 | 761 |
| Quality | 3.58 | 1.182 | 761 |
| Health & Safety | 2.16 | 1.249 | 761 |

Source of Data: SPSS output of fieldwork data

To test the fourth hypothesis, Multiple Regression Analysis technique is used. Table 4.4 gives the correlation matrix of the variables used.

Table 4. Correlation Matrix.

| Correlation Matrix | Cost | Time | Quality | Health & Safety |
|--------------------|-------|-------|---------|-----------------|
| Correlation Cost | 1.000 | .915 | .808 | .808 |
| Time | .941 | .945 | .813 | .813 |
| Quality | .915 | 1.000 | .812 | .812 |
| Health & Safety | .808 | .812 | .812 | 1.000 |

Source of Data: SPSS output of fieldwork data

Table 4 contains the correlation matrix indicating the level of relationship existing between the variables (cost reduction, time reduction, project quality improvement, and good health/safety measures). The statistics that there is positive and high level of relationship existing among the variables as the result shows that there is a correlation of 0.941 between cost and time reduction. 0.915 is the correlation coefficient between cost and quality performance and finally 0.808 is the coefficient between cost and health/safety. The analysis further shows that cost and time correlate higher than the other factors. This result implies that a multi-collinearity problem exists between the variables (cost reduction; time reduction, quality improvement, and good health/safety measures) rendering the statistics not sufficient to determine or report which variable contributes more to effective public building projects delivery in the South – Eastern Nigeria. In order to resolve this problem, the principal component model of factor analysis tool which employs multiple-stated iterative simulation to extract community coefficients of multiple explanatory variables (cost reduction; time reduction, quality improvement, and good health/safety measures) is introduced. The extracted coefficients are used to generate decision factors which are a function of principal components' weighting of the original variables.

Table 5. Extraction of Factor Analysis.

| Communalities | Initial | Extraction |
|-----------------|---------|------------|
| Cost | 1.000 | .930 |
| Time | 1.000 | .948 |
| Quality | 1.000 | .934 |
| Health & Safety | 1.000 | .808 |

Extraction Method: Principal Component Analysis.

Source of Data: SPSS output of fieldwork data

Table 5 shows the communalities which is the proportion of each variable's variance that is explained by the factors. The indication that the variable time reduction (timely delivery) has a higher proportion than the others as it reports 0.948 which is 94.8 percent followed by quality with 93.4 percent. Cost reduction accounts for 93 percent and finally good health/safety measures are the least with 80.8 percent of the weighting.

Findings

-That a fair degree of positive relationship exist in cost reduction through timely delivery, quality and health/safety at work and that;

-The application of appropriate management techniques with a correlation coefficient of 0.453;

-The coefficient of determination of 0.205 indicates that application of appropriate management in the area of quality control good health/safe working environment and economy in time account for 20.5 percent of time reduction.

-In cost reduction; time reduction, quality improvement and good health/safety measures are important and relevant factors in public building projects delivery and they correlate highly and positively with each other.

Conclusion

In building production project, the goal often times has been to achieve project delivery within an agreed contract cost and time without ensuring that the specified scope and quality is met. Specifications are muddle up by using unqualified operatives and often times in an unclean and unkempt working environment. The short time benefits may be rewarding but in the long run will be counterproductive. Hence, the need to professionally adopt the use of requisite, manpower, quality materials/equipment in an articulate clean environment. In addition, safety and accident free principles and policy to achieve cost reduction, timely delivery for a long time analysis cost benefit should be appropriately employed.

Recommendation

-Stakeholders and operatives in the building industry should take responsibility to deliver the project within the specified time schedule with quality materials and workmanship.

-There should be proper coordination and communication among various parties working on the projects in order to control inventory management, nip problems in the bud and reduce any avoidable delay.

-Proper estimating and ordering of building project materials through cross checking of estimates based on updated price information in order to avoid any wrong estimation should be a priority for all builders.

-Proper evaluation of quality and quantity of materials is necessary in order to reduce or eliminate the incidence of failed building projects.

- In addition, green, clean and safe environment and safety measures equipment and facilities should be ensured and provided for an accident free working environment.

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