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Functional parameter based building maintenance procurement method selection decision making matrix: A case study of tetfunds buildings in Bauchi state

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Abstract
Buildings are highly resourceful in the effective operation of tertiary institutions. It is necessary that these assets should be given good maintenance attention for effective performance. In Nigeria greater part of infrastructural facilities in higher education institutions are provided by TETfund. Currently the building projects are facing ineffective maintenance due to bureaucratic constrains and lack of provision of formidable and outstanding building Maintenance Management Practice within the Policy of TETfund. TETfunds buildings projects in HEIs only receive top management's attention when there is a problem. The choice and implementation of appropriate building maintenance procurement on TETfund building projects is a key decision that has to be made by the maintenance authorities within the HEIs early in the project lifecycle. it is indeed very vital to establish a systematic approach that can assist the maintenance departments in decision making on selecting the most appropriate building maintenance procurement method on the existing TETfund building projects. This study aimed at establishing decision making matrix for selecting the most appropriate building maintenance procurement method on TETfund building projects. The study used literature review, experts interview and the case study to develop, demonstrate and validate the decision matrix, From detailed literature review, a total of 26 factors influencing the selection of maintenance procurement method were shortlisted and considered as selection criteria and the criteria are further caterogised into 4 major groups. A questionnaire survey has been carried out to determine the most important factors by using relative important index (RII) method. Target population of the study are the maintenance personnel, constructional professionals within the academic staff and TETfunds desk officers. Convenience sampling technique was used to select seventy (70) respondents within HEIs that are beneficiaries of TETfund physical projects intervention within Bauchi State. After data analysis, price / costs certainty quality level, speed, experience contractor availability existing building condition and dissatisfaction with previous method used are found to be most significant factors. In the final phase weighted – matrix has been used to establish the deicson making matrix. This matrix is proposed to be very easy for maintenance personnel and the management of HEIs to use, while at the same time, providing tool that can be used in making a decision for selection of a suitable maintenance procurement method.

Keywords: Parameter, TETfund, Building maintenance, Bauchi State

Introduction

Generally, physical facilities in the tertiary institutions of learning are very important. It has been observed that, provision of adequate physical facilities in HEIs is essential towards improving academic performance of students (Ajayi and Ayodele, 2001 [3]; Musa and Ahmad, 2012 [17]; Akomolafe and Adesua, 2016) [4]. Currently, in Nigeria the TETfund Act 2011 mandated the fund to operate as an intervention agency to provide funding for educational facilities and infrastructural development in public HEIs, and specifically for the provision of maintenance of essential infrastructure for teaching and learning among others (TETfund, 2020).

Despite efforts by TETfund to discharging its responsibilities, previous studies (Gambo et. al., 2017 [11], and Aghimien and Aigbarbo, 2018) [2] have reported that there are weak and poor maintenance attention on TETfund Building projects by the institutions and TETfund authorities. Muktar et. al., (2021) opined that despite the importance of physical facilities in improving academic performance of the students, HEIs and the TETfund are facing challenges with regard to maintenance of the existing developed infrastructural facilities. Hashim et. al., (2006) [12], Alhazim and McGaffer (2000) observed that successful building maintenance management practice is often associated with the selection and implementation of appropriate building maintenance procurement method.

The aim of this study is to establish a building maintenance procurement method selection decision making matrix, with a view to improving the TETfund building maintenance management practicing of HEIs in Bauchi State.

Objectives of the study

1. To identify the available procurement method for building maintenance
2. To identify the criteria to be considered when selecting the procurement method.
3. To establish a decision making matrix for selecting the most appropriate building maintenance procurement method

The finding of this study will act as a tool to guide the Institutions and TETfunds authorities to select the most suitable and appropriate building maintenance procurement method which will improve the Building Maintenance Management practices in Nigerian tertiary institutions.

Building maintenance procurement method

Woodsworth (2001) defined building maintenance maintenance procurement as the process of how

maintenance works are carried. The types of procurement method identified through literature review for building maintenance were listed as below Worthswoth, 2001; Skeng, 2012; RICS, 2009; Hui and Tsang, 2004); Atking and Brooks, 2005):

1. Direct Labour or In-house
2. Outsourcing
3. Out – tasking
4. Public private partnership (PPP)
5. Total Facilities Management (TFM
6. Traditional
7. Partnering

Building maintenance procurement method selection criteria

There are various factors that are essential in making right decisions while selecting building maintenance procurement method. Through literature review, there are 26 criteria identified which are divided into four main categories that were client requirements, decision maker characteristics, project characteristics and external factors. The criteria identified from the literature review can be referred to table 1 (Chen *et al*., 2003; Ng *et al*., 2002 [18]; Hibberal and Djebarni, 1996; Al Khalil, 2002 [5]; Alhazmi and McCaffter, 2000' Love *et al*., 1998 [15]; Cheung *et al*., 2001)

Table 1: Building Maintenance Procurement Method Selection Criteria

Criteria			
C1	**Client Requirement**		
C1.1	Speed	C1.6	Responsibility
C1.2	Time Certainty	C1.7	Risk allocation / avoidance
C1.3	Price / Cost Certainty	C1.8	Quality level
C1.4	Degree of complexity	C1.9	Working relationship
C1.5	Degree of Flexibility	C1.10	Clarity of scope
C2	**Decision Maker Characteristics**		
C2.1	Intuition and past experience	C2.3	Knowledge of procurement method
C2.2	Dissatisfaction with previous method used	C2.4	Involvement of owner in the project
C3	**Project Characteristics**		
C3.1	Existing building condtion	C3.3	Client's in – house technical capability
C3.2	Project size	C3.4	Client's financial capability
C4	**External Factors**		
C4.1	Price competition	C4.5	Objective or policy of Institution
C4.2	Public accountability	C4.6	TETfund Policy
C4.3	Political issues / constraint	CE.7	Dispute & Arbitration
C4.4	Culture	C4.8	Experience contractor availability

Research methodology

The study was conducted in Bauchi State, Nigeria, through quantitative research technique. Bauchi State was selected because of the accessibility of data on TETFund buildings projects. Literature and Questionnaire surveys were used as a means of data collection approach. The building maintenance procurement methods available and the criteria for procurement method selection in building maintenance management were identified and shortlisted by reviewing the journal articles and other reliable references sources.

The target population of this study were maintenance personnels, constructional professionals within the academic staff and the TETfund desk officers of the Institutions under studies. Seventy (70) questionnaires were administered. Convenience sampling technique was use to access the respondents. Data collected from the survey were analyzed by means of Relative Important Index (RII) method in order to determine the most important criteria.

Lastly, a decision-making matrix was established on the basis of weighted – matrix procurement method decision approach, for the purpose of identifying the most crucial building maintenance procurement method on TETfunds building projects base on the generated criteria Index.

Data analysis and results

The primary data collected from the first part of the questionnaire was analyzed from the perspective of total of 70 respondents comprises of maintenance personnels, TETfund desk officers and some selected construction professionals within the academic staffs of the institutions under investigation. The responses were analyzed using Relative Important Index (RII) method. The top ten factors derived from results are shown below in table

Table 2: Top 10 Factors (RII) Methods

Rank	Factors Influencing Selection BMPM	RII
1.	Price / Cost certainty	0.950
2.	Quality level	0.895
3.	Speed	0.888
4.	Experience contractor availability	0.882
5.	Existing Building condition	0.870
6.	Dissatisfaction with previous method used	0.850
7.	Price competition	0.845
8.	Client's in – house Technical capability	0.840
9.	Project size	0.830
10.	Knowledge of procurement method	0.830

In this study, ranking of factors by the various group of respondent was checked using Spearman's rank correlation coefficient. For the purpose of testing the relative agreement between the responses from different groups of respondents, the ranks and the computed RII weights corresponding to the factors of building maintenance procurement method skeleton were analyzed using Spearman's rank correlation method. The values of Spearkman's rank correlation coefficient between various groups were between 0.690 to 0.822. this shows that there is very marginal difference in opinion of respondents for ranking of criteria and they all exhibit strongly positive correlation.

Establishing building maintenance procurement method decision matrix

This proposed matrix is based on weighted – matrix maintenance procurement decision Approach. It provides a means for building maintenance personnels to further examine and document a building maintenance procurement method decision for TETfund Building project.

- Each parameter / influencing factor under consideration is assigned a weight (wi)
- Relative weight (wi) is computed from the following equation:

$$Wi = \frac{Wi}{\sum_{i=1}^{n} Wi}$$

- A decision making scale (di) for each factor is assigned by dividing the selected weightage of respondent in questionnaire by its respective derived / decided value: the result multiplied by 100

$$ai = \frac{cj}{si} \times 100$$

$$Sij = Wi \times di$$

$$BMPMM = \sum Sij$$

Table 4: Tabular format of Establishing Building Maintenance Procurement Method Decision Making Matrix (Desai, et. al., 2016)

	Wi	Wi	Ci	Si	Di	Sij
Factor 1 Factor 2 Factor 3 Factor 4 Factor 5 Factor 6 Factor 7 Factor 8 Factor 9 Factor 10	Weight of each parameter (varied between (1 – 5)	Relative weight (Depends upon Wi)	Filled by the Respondents (varied between 0 to 10)	Ideal / optimal value of given governing factor ((10 +10)/2) = 5	Quality rating	Sub Index of i^{th} parameter
Building Maintenance Procurement Method Decision matrix $\sum Sij$						

Conclusion and recommendations

Building maintenance procurement method becomes the most crucial strategic decision for the client since from the early stage of the project. Effective analysis of appropriateness of any building maintenance procurement method requires the clients or stakeholder's understanding of the pros and cons of various BMPM, BMPM selection methods (BMPSM) and other related factors that affect the decision making process. This study indicates that the listed factors affecting building maintenance procurement method selection must be given adequate consideration while taking decision on adopting sustainable (BMPM) price / cost.

Certainly, quality level, speed, experience, contactor availability, existing building condition, dissatisfaction with previous method used, price competition and clients' in – house technical capability are the most significant factors for maintenance procurement method. So these factors must be taken into consideration. The proposed decision matrix is validated using case study and with the help of focus group interview. The validation results is satisfactory. The developed model is proposed to be user friendly for the client, while at the same time providing meaningful tool that can be used in making a selection of a suitable budding maintenance procurement method on TETfund building projects

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