DEVELOPMENT OF A FEEDBACK INTEGRATED MULTI-CRITERIA GROUP DECISION SUPPORT SYSTEM FOR CONTRACTOR SELECTION IN NIGERIA

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INTRODUCTION

The construction sector constitutes one of the most important sectors in the economy of any country. Over the years in Nigeria, the selection of contractor has been done manually from the process of inviting contractors to bid for projects to the selection of successful bidders. The traditional systems of procurement through manual modes suffer from various problems such as inordinate delays (approximately 4 to 6 months) in tender/order processing, heavy paper work, multi-level scrutiny that consumes a lot of time, physical threats to bidders (Adebiyi *et al*., 2010).The research proposed a web-based Multi-Criteria Decision Making model for contractor selection using the construction of No 1 Three-in-One Lecture Theatre for Centre for Entrepreneurship (CENT) at the Federal University of Technology, Akure as case study.

METHODS

The multi-criteria group decision making model with feedback mechanism consists of technical and financial evaluation modules. The functionality of the technical evaluation module is based on Fuzzy Analytic Hierarchy Process (FAHP). Each group member is required to fill up a pairwise comparison matrix of the relative importance of criteria, sub-criteria and alternatives using experts' judgments.

To aggregate the experts' judgments of criteria, sub-criteria and alternatives, Buckley model is applied as shown in equation (1).

$$\tilde{r}_i = \left(\prod_{i=1}^{7}(\tilde{a}_{ij})\right)^{1/7} \quad (1)$$

where $\tilde{r}_i$ is the geometric mean of fuzzy comparison values

The fuzzy weights is calculated using equation (2);

$$\tilde{w}_i = \tilde{r}_i \otimes (\tilde{r}_{i1} \oplus \tilde{r}_{i2} \oplus \dots \oplus \tilde{r}_{i7})^{-1} = l\tilde{w}_i, m\tilde{w}_i, u\tilde{w}_i \quad (2)$$

To defuzzify the fuzzy weights, Chou and Chang (2008) model is applied via equation (3);

$$M_i = \frac{l\tilde{w}_i \oplus m\tilde{w}_i \oplus u\tilde{w}_i}{3} \quad (3)$$

where M_i is the relative non-fuzzy weight

M_i is normalized via equation (4);

$$f_i = \frac{M_i}{\sum_{i=1}^{7} M_i} \quad (4)$$

where f_i is the normalized non-fuzzy weights.

The local weights of the elements under investigation is calculated via equation (5);

$$w_i = \frac{f_i}{7} \quad \forall\, i \in [1, \dots, 7] \quad (5)$$

In this research work, consistency module is introduced. In the case of high inconsistency, the decision makers are advised to reconsider their pairwise comparisons using feedback mechanism.

The last step of the Fuzzy AHP model aggregates all local weights from the decision table. The final global weights thus obtained are used for ranking the contractors. At the financial evaluation module, the differences between the project owner's cost estimate and the bid prices are calculated. The contractor having the lowest value of such difference is awarded the contract.

RESULTS

The final global weights are shown in Table 1.

Table 1: Final Alternatives Global Weights

Alternative Name	Final Alternative Global Weights
Alternatives 1	0.0009681379511372286
Alternatives 2	0.0003145523535312201
Alternatives 2	0.0009984848302776537
Alternatives 2	0.0012431277724388604
Alternatives 2	0.0009351835421238076
Alternatives 2	0.0013432232896320195
Alternatives 2	0.00029251691977694687
Alternatives 2	0.0013432076780150039
Alternatives 2	0.001003087331930214

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