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An Experimental Comparison of Multi-Criteria Decision AID (Mcda) For Contractors' Evaluation

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Abstract: *Several contracts are left at incompletion stage to become white elephant projects. This may be attributed to awarding contract to an incompetent contractor. Several tools have been used to evaluate the competencies of contractors based on certain criteria before selection of the contractor from a list of bidders. Among such tools are the Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP). The two techniques are based on multi criteria pairwise comparison. ANP goes further to incorporate a feedback mechanism and interactions among dimensions or cost factors as well as the hierarchical relationship of alternatives. Datasets of more than 200 contractors bidding for 20 contracts at different times were collected along with those that were awarded the contracts. With these datasets, the AHP and ANP techniques were employed independent of the other in evaluating the contractors. The execution of the design framework was implemented in super decision software in windows 8 operating system environment. Results obtained showed that only 8 out of the 20 contracts awarded could have been awarded to those awarded manually if AHP was used in the evaluation. If ANP were employed in the evaluation only 7 of those awarded manually would have benefitted. A further comparison of AHP and ANP were performed and was found to have covary to 0.65 meaning that 13 of the 20 contracts match head to head with AHP and ANP. A recommendation of any of the two methodologies is therefore made to any establishment wishing to evaluate its contractors before selection.*
Keywords: *AHP, ANP, Contractor, MCDA, Evaluation, Selection*

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I. Introduction

One of the very difficult decisions to take is in awarding contract to the most qualified contractor devoid of sentiments such as nepotism and favoritism. When a bid for a contract is advertised, hundreds of contractors applied for the award. Whereas there is a due process to follow in the award, but in an attempt to award it to a favoured contractor, corners are cut to realize such ambition. The evaluation of a contractor involves multiple criteria as stipulated in the Due Process Act in Nigeria. Multicriteria Decision Aid (MCDA) is a 7-tuple model depicted as M = {A, C, E, P, S, T,U} where;
A = a set of alternatives
C = a set of criteria
E= a set of evaluation attributes
P = a list of preferences
S = a set of scales associated with the attributes
T = type of evaluation
U = a set of corresponding measures

A multifactor information is fast becoming explosive in an information age such as ours and processing such information becomes a daunting task. Techniques such as MCDA are therefore meant to salvage these challenging situations. Basically, MCDA is categorized according to how the alternatives are considered in the decision making process. There is the discrete MCDA and the continuous MCDA. Discrete MCDA deals with a finite number of alternatives while continuous MCDA involves unrestricted number of alternatives.

Contractor selection procedures involve parameters that are finite, so a discrete MCDA is required for such evaluation. There are several techniques that are used to evaluate discrete MCDA among such include Decision Making Trial and Evaluation Laboratory (DEMATEL), Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP).

DEMATEL is based on graph theory. According to Jiang and Tzeng (2011), in using DEMATEL, multiple criteria could be divided into a cause-and-effect group to better understand causal relationship which helps to plot a network relationship map. In the AHP method, a hierarchical framework is constructed for decision making. In the hierarchy, the goal is on top while the alternatives for the criteria are at the bottom. Saaty (1994), based on the theory of Milner (1956), that a human mind can only remember 7±2 pieces of information developed a point scale of relative importance as shown in Table 1. With this framework, a matrix is formed for pairwise comparison to establish the relative importance of each criterion.

Table 1: Saaty's 9 point scale (Saaty, 1994)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderately more importance	First element is moderately more important than second one
5	Strongly more important	First element is strongly more importance than second one
7	Very strongly more important	First element is very strongly more important than second one.
9	Extreme more important	First element is extremely more important than second one

2,4,6,8 are intermediate value. Based on this Table a pair wise comparison of contract evaluation cost factors for AHP/ANP is computed as presented in Table 3.

Saaty (1994) describes ANP as a generalization of AHP where dependence within a criterion and among different criteria is handled. While AHP involves a top-down structure from overall goal to criteria through sub-criteria to alternatives, in ANP criteria, sub criteria and alternatives are treated equally as nodes in a network. Each node in ANP could be compared to any other node as long as there is a relationship between them. AHP deals with linear relationship while ANP deals with non-linear relationship. According to Baykasoglu and Durmusoglu (2014), ANP has the ability of capturing numerous decision making variables by incorporating a feedback mechanism and interactions among dimensions as well as the hierarchical relationship of alternatives. There are however some challenges of AHP as pointed out in Triantaphllou and Manu (1995). One of such challenges is the closeness of alternatives to one another which could lead to wrong decision making. They therefore suggested the use of additional tool to discriminate among alternatives.

On the strength of this assumption, this study undertakes an experimental comparison of the AHP model and the ANP model using data of contractors on some of the contracts awarded by the Akwa Ibom state, Nigeria government. Table 2 shows the list of contracts awarded from those bidding for 20 different contracts at different times in the state.

Table 2: Manually Selected Contractors from those Bidding for the Contracts

Contract. No	Alternative selected
1	B3
2	C2
3	D5
4	E1
5	F8
6	G1
7	H5
8	I5
9	J6
10	K8
11	L3
12	M2
13	N1
14	O5
15	P3
16	Q10
17	R4
18	S3
19	T3
20	U5

The objective is to find out which of the two MCDA tools could form a kernel in the evaluation of contractors given the multiple criteria as decision variables in the award of contracts. Parameters for the award of the contract are divided into 3 levels namely; the goal level; the criteria level; and the variable level. The remaining part of the study comprises Section 2, where the literature is presented, the models of AHP and ANP are presented in Section 3. In Section 4, the results of the experiment conducted on super decision software are presented and discussed while a conclusion drawn and recommendations made are presented in Section 5.

II. Literature Review

In Uzoka et al (2011) an experimental comparison of AHP and Fuzzy logic is carried out using the datasets gathered from some hospitals in Nigeria on malaria patients. The purpose of the study was to ascertain the levels of effectiveness and utility of each of the two tools in medical diagnosis so that medical decision system builders would know which of them should form the backbone when they are integrated. Results reported show that fuzzy logic diagnosis results covary a little bit stronger to the conventional diagnosis results than that of AHP. An integrated MCDM technique combined with DEMATEL for a novel cluster weighted with ANP method is discussed in Yang and Tzeng (2011). ANP is employed in the study to solve the problem of additivity and independency found in the traditional method of finding criteria importance. The integration of DEMATEL with ANP was necessitated by the need to establish interactions among sub-criteria and to visualize the causal relationship of the sub-system through a causal diagram. Data from a 3C component of a manufacturing company in Taiwan of vendors were used to demonstrate the functionality of the study. An impact direction map was created which shows the direction and degree of influence one criterion has on another. The direction map could be used to find the performance of an appropriate vendor.

Asuquo and Umoh (2015) employed AHP to evaluate the Quality of Service (QoS) of mobile data networks. Four criteria of Latency, Jitter, Data loss and Throughput were used as decision variables, while four 3G mobile networks in Uyo, a town in Nigeria were used as alternatives variables. Results of evaluation show that Etisalat mobile network offers the best QoS for web browsing application. Uzoka et al (2011) presented a clinical decision support system for malaria diagnosis using fuzzy logic and AHP with the fuzzy logic tool forming kernel to AHP. Results of the integration reveal a stronger correlation of the integrated system to the conventional diagnosis results than individual tool diagnostic results. An integrated multiple criteria decision making model to solve the problem of selection of a private primary school by parents to their wards is proposed in Baykasoghu and Durmusoglu (2014). The integration comprises ANP and Fuzzy Cognitive Map (FCM). Experts' knowledge were elicited and used on 300 parents who had at least one child in a private primary school. Six schools were used as alternative variables and evaluated with nine main criteria comprising 44 sub criteria. A super decision software was used to implement the model and results of implementation reveal that the 'teaching staff' main criterion had the highest priority of 12% while security factors were the least in consideration. The most favourable school had a cost/benefit ratio of 0.14. Case base reasoning and AHP are integrated to construct an intelligent tourism planning tool in Alptekin and Buyukozkan (2011). The strengths of individual tool are enhanced while their limitations are complemented. AHP is employed in measuring of preferences of region of visit, duration of visit and season among other criteria. The ranking based on the weight assisted in the adaptation stage of CBR is the most challenging stage in CBR.

In George et al (2016), a model for the evaluation of due process tenders in public procurement is designed. The model uses both the technical and financial components to evaluate contracts biddings of 30 contractors on the supply of computer systems. The technical component assigns weights to the evaluation criteria based on the advice of experts while the financial component computes the percentage differential cost between in-house cost estimates and the tendered quotation cost. A face validation of the model was carried out by 20 randomly selected contracting experts from the Due Process offices in Nigeria and 10 computational experts from two universities using a questionnaire method. The results of the method were used in awarding contracts.

AHP is used in Muhisn et al (2015) to demonstrate how decision makers can be assisted in selecting a team leader in software engineering education community. Four criteria of personality type, academic achievement, teamwork experience and previous programming grade were employed in the analysis. Results show that the most promising candidate in the team was selected as the most suitable alternative having scored the highest value of 0.46.

Financial capability, past performance, past experience, resources, current workload and safety performance of contractors were the criteria employed in Balubaid and Alamoudi (2015) in the application of AHP to multicriteria analysis for contractor selection. Questionnaires administered to subject matter experts in the fields of contract procurement and project management were used to determine the relative significance of each criterion. Pairwise comparison of the criteria was carried out by ranking the aggregate score of each alternative based on each criterion. The bidder with highest score was deemed to have won the contract. The study made use of hypothetical data in the analysis.

In Chua et al (2015) AHP is used in the implementation of a decision making framework for building maintenance procurement selection in nine public universities in Malaysia. Seven criteria of direct labour, outsourcing, out-tasking, public private partnership, total facility management, traditional and partnering were employed in the study. Each of these criteria has sub criteria. Structured interview with the nine selected public universities were conducted to validate the framework. The interview results show that in terms of capability, applicability and validity, 65% of those interviewed agreed the framework was good while 21% reported it was excellent. Zavadskas et al (2018) discussed contractor selection of construction in a competitive environment while Rasvand et al (2015) examined the limitations of the traditional prequalification evaluation for contractor selection. They identified incomprehensiveness of models and focus being paid to time and cost performance alone as resultant variables. In Lin and Yang (2016) six factors of influence were identified with Fuzzy Delphi method, based on these evaluation criteria were established among the objectives, the evaluation criteria and the candidates projects. The results of all these were used to develop a decision support model using the quantitative procedures of ANP. A case study carried out with a construction project show that evaluation criteria were weighted in the order of importance with the environment having the highest weight. In managing risk in construction projects Chatterjee et al (2018) employed the D numbers domain to extend the frontiers of ANP. With this extension, the ambiguity of information; completeness, uncertainty and incompleteness were handled and used to assess the weight of each risk criterion.

2.1 The Design

The design comprises the database, the AHP module, the ANP module and the user interface. Each of the components is discussed in the following sections.

2.2 The Database

The database consists of the following:

a. Contractor Table comprises the contractor Identity, name of contractor, address, phone number, email address.
b. Experience Table comprises the experience of technical staff, professional status of contractors, innovations, management capability, and length of time in business.
c. Finance Table comprises the financial capability, credit worthiness, banking report and bid price
d. Miscellaneous Table consist of equipment adequacy, cooperate social responsibility, community service history, environmental health impact and current work load.
e. Quality Table consists of evidence of successful of project, quality control measure and safety measure.

2.3 The AHP module.

The AHP breaks down the contractor selection into hierarchy that comprises the Goal, Criteria, Sub-criteria and the Alternatives, where pair wise comparison is done between Criteria on every data set with one another and Sub-criteria on every data set with one another. This is depicted in Figure 3.1. The pair wise comparison is carried out by AHP using Criteria namely: Experience, Finance, Quality and Miscellaneous. Also the pair wise comparison is done using Sub-criteria namely: Experience of Technical Staff, Professional status of contractor, Innovation, Management capability, Length of time in business, Financial capability, Credit worthiness, Banking report, Bid price, Evidence of successful completion of referenced projects, Quality control measures, Safety measure, Equipment adequacy, Cooperate social responsibility, Community service history, Environmental health impact and Current work load. The alternatives are A_1, $A_{2,}$ A_3,…, A_n where n is the number of contractors bidding for the contract. The sub criteria and their acronyms are as follows:

EXP = Experience of technical staff; PST = Professional status of contractor; INN =Innovation; MGT = Management capability; LTB = Length of time in business; CRT = Contractors; reputation; FCY = Financial capability; CWT = Credit worthiness; BRT = Banking report; BPC = Bid price; ESC = Evidence of successful completion of referenced projects; QCM = Quality control measure; SMS = Safety measures; EAY =Equipment adequacy; CSR = Corporate social responsibility; CSH = Community service history; EHI = Environmental heath impact; CWL= Current work load; $A_1 \ldots A_n$ = Alternative_1 …Alternative_n

The graphical representation of the model is shown in Figure1.

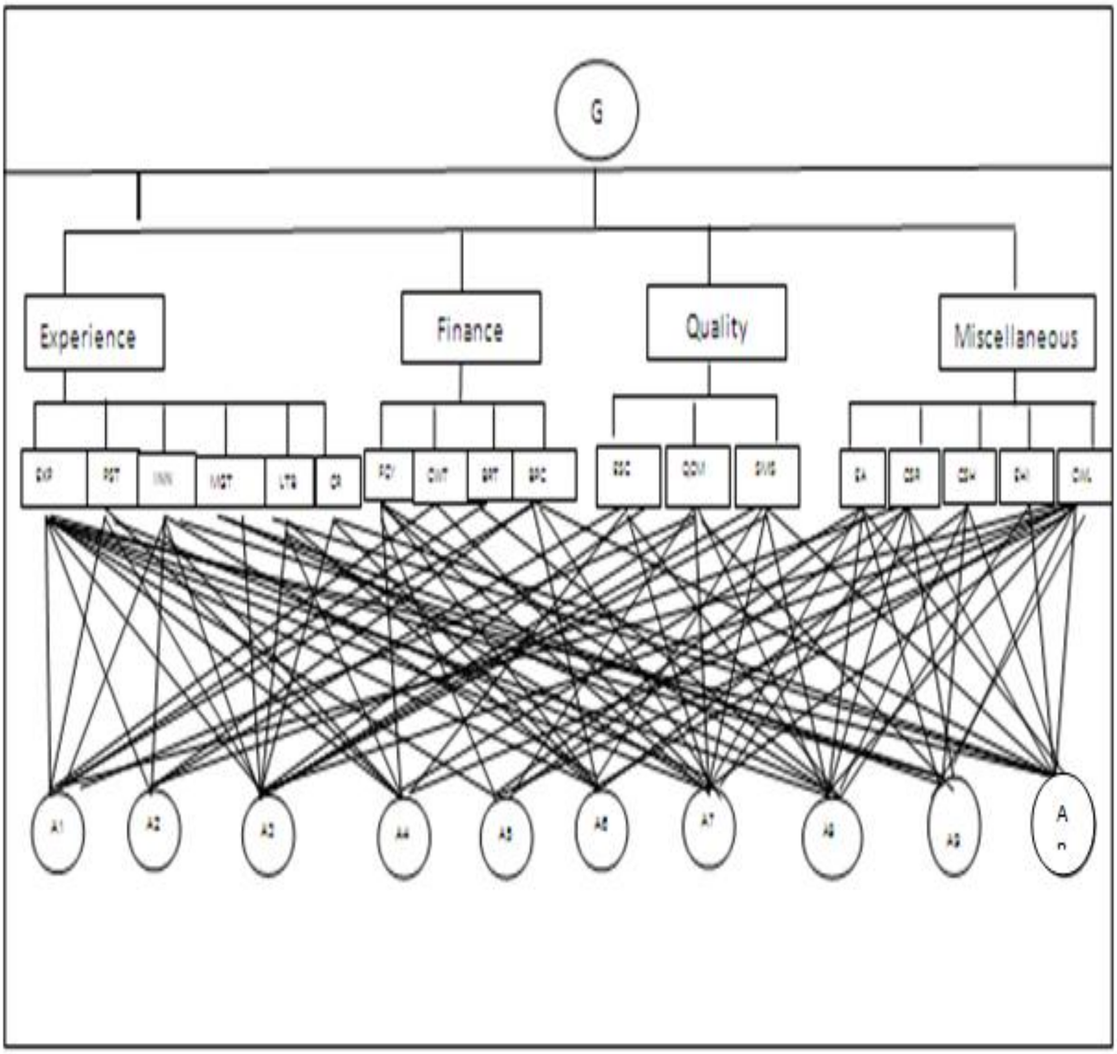

Figure 1: Model of the AHP for contractor selection.

3.3 The ANP Module

The ANP sub-system uses the hierarchy of the AHP sub system but shows interdependencies and feedback between clusters. It uses the same criteria and sub criteria as used by AHP. A model of the ANP is shown in Figure 2. In the ANP, the interdependencies are depicted in loops or feedbacks.

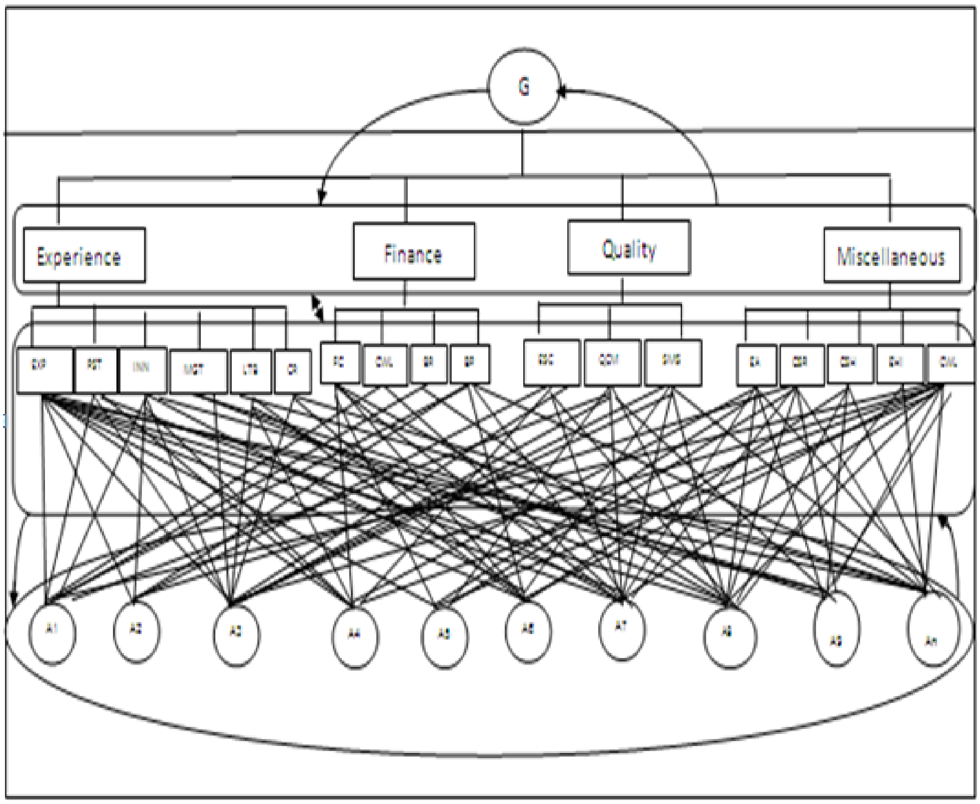

Figure 2: Model of the ANP sub-system for contractor selection.

The Goal, Criteria, Sub-criteria and Alternatives form clusters and there are dependencies as shown in the ANP model. The ANP supports modeling dependencies and feedback between elements in the network. For this reason, the ANP is one of the most appropriate methods for making decision in fields that are characterized by existing dependencies of higher-level elements on lower level elements. Here pair wise comparison is done both horizontally and vertically. The flow diagram for the two modules of AHP/ANP is depicted in Figure 3.

2.4. **Evaluation of the Criteria and Sub-criteria**

The local priorities or weights of the criteria as assigned by an expert (Director of works Civil Engineering Directorate in the ministry of works) are as follows: Experience = 40%; Finance = 10%; Quality = 45%; Miscellaneous = 5%; Total = 100%

The local priorities for the sub-criteria are as follows: EXP = 7%; PST = 6%; INN =8%; MGT =5%; LTB = 4%; CRT = 10%; FCY= 3%; CWT = 2%; BRT = 1%; BPC = 4%; ESC = 10%; QCM = 25%; SMS =10%; EAY= 2%; CSR = 1%; CSH = 0.5%; EHI =1% ;CWL = 0.5%; Total = 100%.

In ANP, once a network is created, some judgments need to be done so that computations can be carried out and results obtained. To do this judgment, carry out computations and obtain results, the following are computed in the following listed order:

- Unweighted super matrix.
- Weighted super matrix.
- Limit matrix.

The Unweighted super matrix consists of the normalized pair wise comparisons on a node level. This matrix is used to represent the flow of influence from each element of the network on all other elements in the same network. It is composed of principal eigenvectors of all the models elements. To compute the super matrix we use the same process to the one used for AHP. The only point that needs attention is the handling of blocks, a block, consists of the weight vectors of its child nodes. Elements that have zero value correspond to elements that have no influence on the element in question.

A weighted super matrix is obtained from the combination of unweighted super matrix and the control hierarchy. Whereas a limit matrix is a weighted matrix raised to an arbitrary large power so that it converges. The limit matrix contains the final results of the process as steady state priorities.

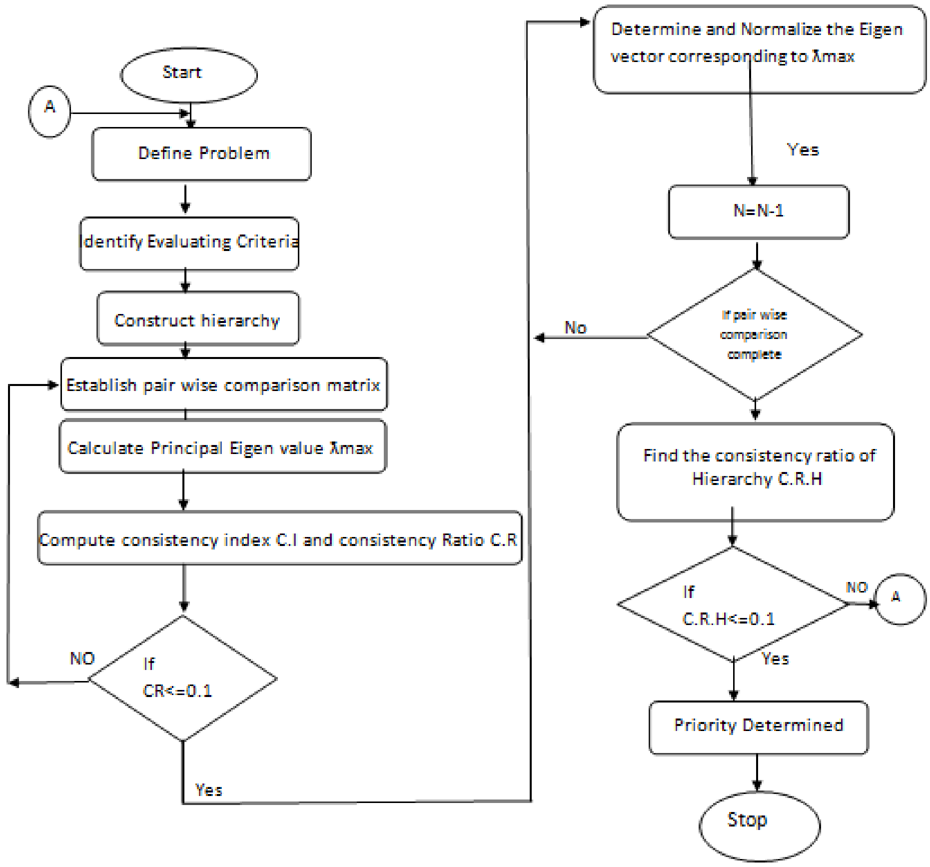

Figure 3: Flow diagram of AHP/ANP: Source: Uzoka et al (2011)

III. The Experiment and Results

The experiment was carried out with Super Decision software as the computation and analysis tool. Figure 4 and Figure 5 depict the data capturing environment in a GUI of super decision.

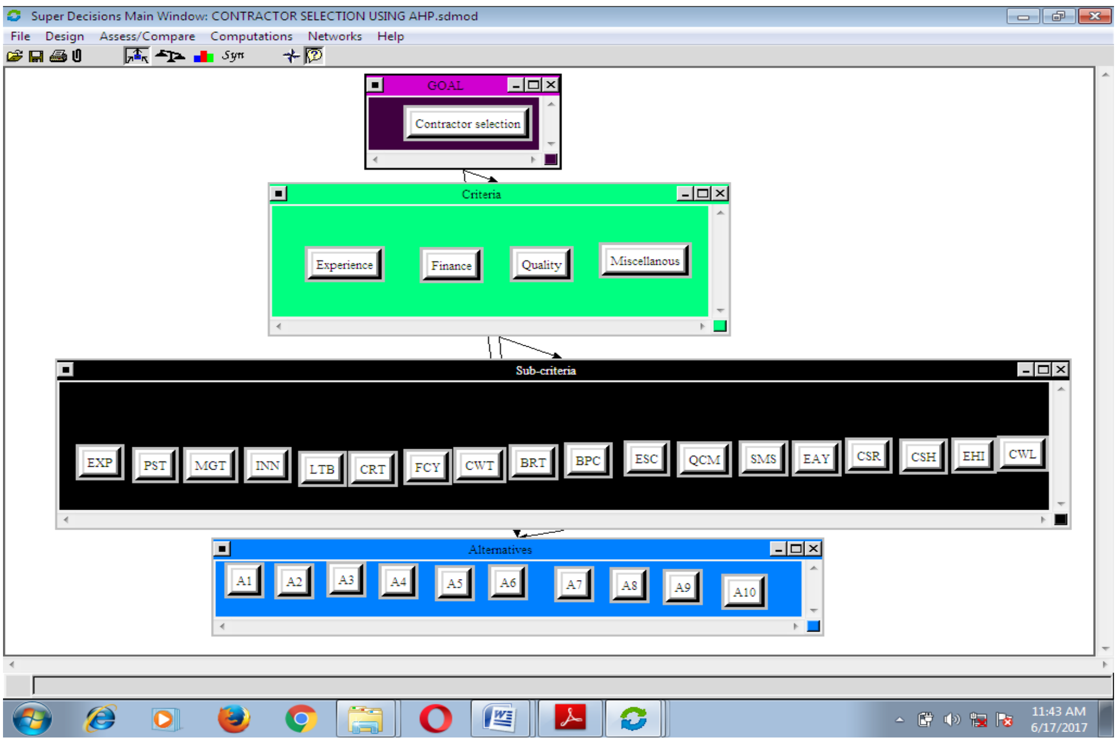

Figure 4: Super Decision GUI for AHP

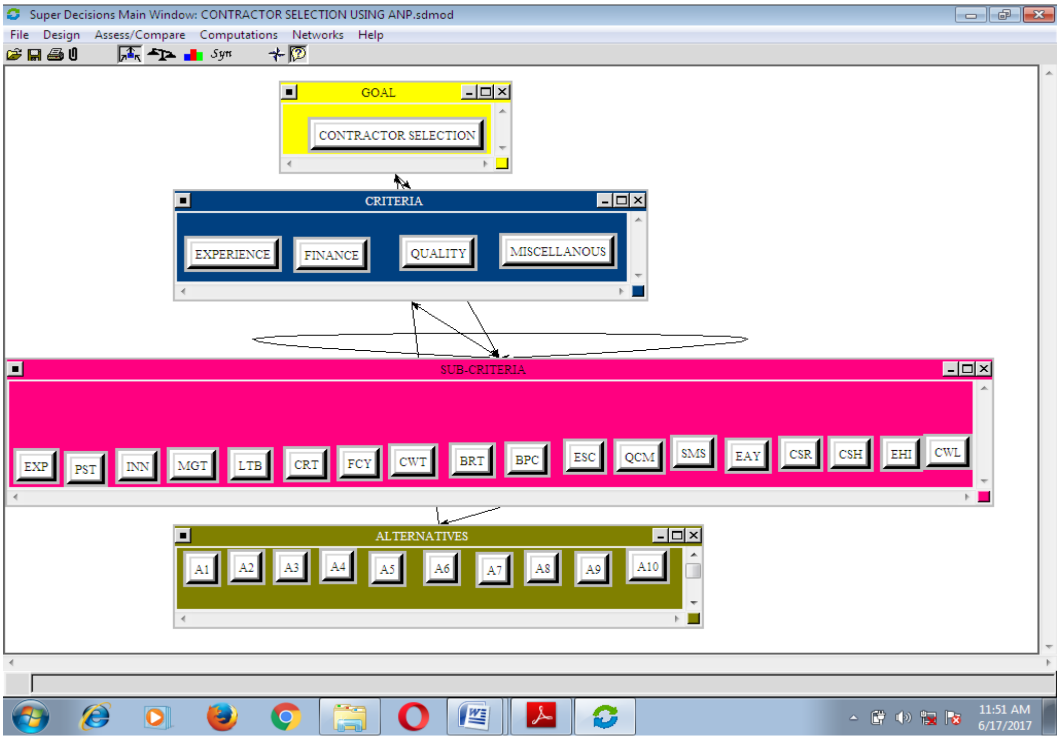

Figure 5: Super Decision GUI for ANP

3.1. Results

The pairwise comparison of the sub criteria for AHP and ANP using the super decision software is presented in Table 3.

Table 3: Pairwise comparison of sub criteria

	BP C	BR T	CR T	CS	CS R	C W	C W	EA Y	EH I	ES C	EX P	FC	IN N	LT	M G	PS T	Q C	SM
BP				0.1								0.5		1.0				6.0
C	1.0	0.2	5.0	4	0.2	0.1	0.3	0.3	0.2	5.0	3.0		3.0		2.0	3.0	9.	
		5			0	4	3	3	0			3.0		3.0			0	7.0
BR	4		7.0	8.0						7.0	6.0		7.0		4.0	5.0		
T		1.0			1.0	0.3	2.0	2.0	1.0			0.2		0.2			9.	1.0
	0.2		1.0	0.1		3				1.0	0.3	0	0.3	0	0.2	0.2	0	
CR	0	0.1		4	0.1		0.1	0.2	0.1		3		3			5		7.0
T		4	7		25	1.0	6	0	4	7.0		3.0		4.0	6.0		5.	
	7			1.0							4.0		5.0			5.0	0	5.0
CS		1.0	8		2.0	0.5	5.0	3.0	2.0	7.0		2.0		3.0	4.0			
H	5			0.5							5.0		5.0			5.0	9.	7.0
		3	8		1.0	1.0	2.0	2.0	1.0	7.0		3.0		3.0	4.0		0	
CS	7			1.0							5.0		5.0			5.0		7.0
R		0.5	6		2	0.3	3.0	3.0	2.0	0.5		2.0		3.0	4.0		9.	
	3			0.2		3					4.0		5.0			5.0	0	7.0
CW		0.5	5	0	0.5		1.0	3.0	0.5	5.0		2.0		3.0	3.0			
L	3					0.3					4.0		5.0			4.0	9.	7.0
		1.0	7	0.3	0.5	3	0.3	1.0	0.5	7.0		2.0		3.0	5.0		0	
CW	5			3			3				5.0		5.0			6.0		1.0
T		0.1	1.0		1.0	0.5		2	1.0	1.0		0.1		0.2	0.2		9.	
	0.2	4		0.5			2				0.3	6	0.3	0		0.2	0	3.0
EA	0		3		0.1	0.1		0.2	0.1	3	3		3		0.3	0		
Y		0.1		0.1	4	4	2	0	4			0.2		0.3	3		9.	5.0
	0.3	7	5	4						6	1.0	0	2.0	3		0.5	0	
EHI	3				0.2	0.2	0.2	0.2	0.2						3.0			2.0
		0.3	3	0.2	0	0	5	5	0	3	5	1.0	5.0	2.0		3.0	9.	
ES	2	3		5											0.3		0	5.0
C			5		0.5	0.3	0.5	0.5	0.5	5	0.5	0.2	1.0	3.0	3	0.3		
	0.3	0.1		0.3		3						0				3	5.	4.0
EX	3	4	5	3	0.2		0.2	0.2	0.2	5	3		0.3	1.0	2.0		0	
P					0	0.2	0	0	0			0.5	3			3.0		3.0
	1.0	0.3	4	0.2		0				5	3			0.5	1.0		7.	
FC		3		0	0.3		0.3	0.3	0.3			0.3	3			2.0	0	0.1
Y	0.5		0.2		3	0.3	3	3	3	0.2	2	3		0.3	0.5			4

INN LT B MG T PST QC M SM S	0.3 3 0.1 1 0.1 7	0.2 5 0.2 0 0.1 1 0.1 4 0.1 4	0 1.0	0.2 5 0.1 6 0.2 0 0.1 1 0.1 4	0.2 5 0.2 0 0.1 1 0.2 0	3 0.2 5 0.2 0 0.1 1 0.1 4 0.1 4	0.2 5 0.2 0 0.1 1 0.1 4	0.3 3 0.2 5 0.1 1 0.1 4	0.2 0 0.1 6 0.1 1 0.1 4	0 1.0	0.1 4 0.3 3	0.3 3 0.1 1 0.2 0	3 0.1 4 0.5	3 0.1 4 0.2 0	0.1 4 0.2 5	1.0 0.1 4 0.3 3	9. 0 7. 0 7. 0 7. 0 7. 0 1. 0 7	1.0

In Table 4, the results of overall priority vectors for contract Number 17 is presented. The same method is employed in computing the other 19 contracts.

Table 4: Results of Priority Vectors for Contract No. 17

EXP	PST	INN	MGT	LTB	CRT	FCY	CWT	BRT	BPC	ESC	QCM	SMS	EAY	CSR	CSH	EHI	CWL
0.10	0.06	0.09	0.04	0.06	0.11	0.04	0.03	0.02	0.04	0.10	0.12	0.10	0.03	0.02	0.01	0.02	0.01

The Priority vectors for various alternatives (R1-R5) for contract number 17 are presented in Table 5

Table 5: The Priority vectors for various alternatives for Contract No. 17

	EXP	PST	INN	MGT	LTB	CRT	FCY	CWT	BRT	BPC	ESC	QCM	SMS	EAY	CSR	CSH	EHI	CWL
R1	0.26	0.13	0.09	0.01	0.50	0.15	0.01	0.02	0.01	0.11	0.07	0.34	0.11	0.05	0.06	0.68	0.20	0.08
R2	0.04	0.01	0.01	0.14	0.07	0.15	0.04	0.01	0.01	0.01	0.71	0.34	0.01	0.01	0.01	0.68	0.61	0.01
R3	0.13	0.01	0.01	0.01	0.01	0.15	0.05	0.05	0.07	0.02	0.02	0.04	0.02	0.03	0.04	0.025	0.01	0.15
R4	0.1	0.25	0.08	0.01	0.45	0.12	0.01	0.02	0.01	0.10	0.07	0.32	0.09	0.03	0.04	0.68	0.19	0.08
R5	0.03	0.08	0.01	0.01	0.01	0.15	0.05	0.05	0.07	0.02	0.02	0.04	0.02	0.03	0.04	0.03	0.03	0.05

Let overall priority vector for individual sub criteria be equal to L_i, priority vector for each alternative be equal to P_i. Therefore final priority is equals to $\sum_{i=1}^{n} l_i P_i$. The values for this on Contract number 17 is presented in Table 6

Table 6: Final priority vectors

R1	0.23
R2	0.51
R3	0.09
R4	0.17
R5	0.002

The other contracts biddings are equally processed and the best alternatives with the corresponding priority value are shown in Table 7.

Table 7: AHP Results

Contract	Best Alternative	Priority value
1	B3	0.286
2	C3	0.270
3	D10	0.482
4	E1	0.511
5	F3	0.371
6	G1	0.288
7	H5	0.314
8	I6	0.301
9	J2	0.287
10	K3	0.297
11	L3	0.400
12	M5	0.234
13	N5	0.282
14	O5	0.313
15	P1	0.271
16	Q8	0.265
17	R2	0.5I2
18	S3	0.312
19	T4	0.422
20	U5	0.311

The unweighted matrix is filled with the results obtained from pairwise comparison of the nodes, this is used to obtain the weighted matrix by making the unweighted matrix column stochastic. The limit matrix is then obtained by raising the weighted matrix to an arbitrary high power such that the columns are identical. From the limit matrix as shown in Appendix 1 (for contract 1), the alternative with the highest priority is selected as the best alternative. This is depicted in Table 8.

Table 8: ANP Results

Contracts	Best Alternative	Priority value
1	B3	0.457
2	C3	0.482
3	D10	0.466
4	E1	0.322
5	F3	0.389
6	G7	0.462
7	H5	0.478
8	I6	0.419
9	J2	0.400
10	K8	0.399
11	L2	0.426
12	M2	0.427
13	N5	0.512
14	O5	0.521
15	P5	0.501
16	Q8	0.500
17	R2	0.499
18	S2	0.319
19	T4	0.387
20	U3	0.299

IV. Conclusion And Recommendation For Future Work

The paper presents the procedure used in selecting contractors from a list of contractors applying for contracts. Decision variables used in selecting contractors among more than 200 contractors bidding for 20 different contracts at different times were used in the analysis. Based on these variables and the datasets, two MCDA tools of AHP and ANP were employed.

From the manual selection presented in Table 2 a comparison of the selection done with AHP and ANP is undertaken respectively. The ratio of comparison of manual to AHP is 20: 8 while that of manual to ANP is 20:7. There were 13 exact matches between AHP and ANP. The weak matching between the manual and the computational tools is attributed to the lack of due process characterized in contract awards in public service. The manual method is not devoid of sentiments. AHP seems to perform a bit higher than its counterpart ANP in this arrangement. The closeness of AHP and ANP with a strong correlation of 0.65 buttress the effectiveness of the two tools in contract selection involving multicriteria selection. The use of any of the two tools could improve performance and curb to a large extent the challenge of failed contract and collapse buildings which has caused several lost of lives and properties.

The integration of the two tools is recommended for future work in order to streamline the limitations of the individual tool while enhancing their strengths. The challenge of acquiring more datasets if taken care of could be used to improve on the results obtained in this research.

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Appendix: **Limit Matrix for Contract 1**

	G	EXPTS	PST	INNOC	MGTC	LTB	CR	FC	CW	BR	BP	ESCRP	QCM	SM
G	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EXPTS	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PST	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
INNOC	0.017	0.02	0.02	0.02	0.02	0.017	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
MGTC	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
LTB	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
CR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
FC	0.061	0.06	0.06	0.06	0.06	0.061	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
CW	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
BR	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
BP	0.066	0.07	0.07	0.07	0.07	0.066	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
ESCRP	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
QCM	0.028	0.03	0.03	0.03	0.03	0.028	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
SM	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
EA	0.033	0.03	0.03	0.03	0.03	0.033	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CSR	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CSH	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
EHI	0.016	0.02	0.01	0.08	0.01	0.017	0.08	0.02	0.04	0.06	0.07	0.03	0.01	0.01
CWL	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B1	0.418	0.42	0.42	0.42	0.42	0.418	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
B2	0.018	0.02	0.02	0.02	0.02	0.018	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B3	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
B4	0.014	0.01	0.01	0.01	0.01	0.014	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B5	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
B6	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B7	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B8	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B9	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
B10	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18

	EA	CSR	CSH	EHI	CWL	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EXPTS	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PST	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
INNOC	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.017	0.02	0.02	0.02	0.02	0.02
MGTC	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
LTB	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
CR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
FC	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.061	0.06	0.06	0.06	0.06	0.06
CW	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
BR	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
BP	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.066	0.07	0.07	0.07	0.07	0.07
ESCRP	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
QCM	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.028	0.03	0.03	0.03	0.03	0.03
SM	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
EA	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.033	0.03	0.03	0.03	0.03	0.03
CSR	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CSH	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
EHI	0.09	0.06	0.11	0.14	0.07	0.19	0.29	0.55	0.15	0.25	0.13	0.13	0.96	0.67	0.12
CWL	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B1	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.418	0.42	0.42	0.42	0.42	0.42
B2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.018	0.02	0.02	0.02	0.02	0.02
B3	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
B4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.014	0.01	0.01	0.01	0.01	0.01
B5	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
B6	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
B7	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B8	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
B9	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
B10	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18