Antecedents of Effective Supreme Audit Institutions in Developing Countries: A Fuzzy Analytical Hierarchical Process Perspective.

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Abstract
In most developing countries, effective autonomous supreme audit institutions (SAIs) have become critical colonnades for attaining United Nations sustainable development goals especially those that are concomitant to eradicating poverty, hunger as well as achieving positive social, health and education outcomes. The main purpose of this study was prioritising the critical factors that can enhance the effectiveness of SAIs. The fuzzy analytical hierarchical process (FAHP), a multi-criteria decision making technique was applied to analyse qualitative factors drawn from empirical literature and ranked by 50 participants selected using purposive sampling technique. Our findings demonstrate that auditor independence (0.2188), public value (0.1567), stakeholder management (0.1536) and audit sanctions (0.1534) are the main factors that enhance the effectiveness of supreme audit institutions. Policy makers are urged to take necessary steps that ensure legal, factual and functional independence of SAIs. The contribution of this paper is demonstrating that the fuzzy analytical hierarchical processes are capable of efficiently handling the fuzziness of the data in the field of public finance.
Keywords: Supreme Audit Institution, Multi-Criteria Decision Making, Fuzzy logic, Analytical Hierarchical Process, Zimbabwe

1.0 Introduction and Background

Numerous reports on systemic corruption, financial malfeasances, and corporate misgovernance in the public sector have brought the effectiveness of supreme audit institutions (SAIs) under intensive scrutiny from the central government, law enforcement and anti-corruption agencies. SAIs are also known as court of audit in European countries and office of the auditor general in Anglosphere are independent national-level institutions that conduct audits for all government activities including government agencies and local government entities. Many studies argue that the key pilaster that has a multiplier effect on economic growth and national development is the effectiveness of a country's supreme audit institution. This is because effective SAIs play a fundamental role by advancing principles of sound public finance management especially those that are related to credibility, transparency, ethical leadership, financial accountability and good stakeholder management. Most developing countries have established independent SAIs to ensure transparency, financial probity, and accountability in the management of public funds [1, 2]. In Zimbabwe, The Office of the Auditor General of Zimbabwe (OAGZ) is the (SAI) whose core mandates include auditing the accounts, financial systems and financial management all departments, institutions, agencies of government and local municipalities. Whilst the OAGZ has exposed numerous financial lassitude linked to abuse of office, systemic corruption and theft of public resources, it has no power to enforce its recommendations, thus elevating uncertainties on the prospects of a public sector-led national development [2].

In many developing countries SAIs have also been criticised for shortcomings related to lack of credibility due to absence of factual and functional independence [3]. Most of them have become fecund sources for weak public finance management systems bedevilling the public sector in most developing countries. The nexus among effective SAIs, sound public finance management, economic growth and national development have strong empirical support in many prior studies [4] [5] [6]. This is because most public entities provide public goods like education, health, water and sanitation, sewerage reticulations services, electricity and public infrastructure that have strong linkages with national development. The primary objective of this paper was evaluating and identifying critical success factors that enhance the effectiveness of SAIs in developing economies using fuzzy analytical hierarchical process, a multi-criteria decision making approach. The provision of public goods such as infrastructure, communication systems, and financial, insurance, education, social and health services is a critical antecedent for stimulating economic growth and achieving rapid sustainable national development. Despite Zimbabwe having a SAI, financial malfeasances and public sector corruption are on the increase in the public sector. The public sector used to contribute at least 40% to the country's gross domestic product, but now

contributing 12%. Ensuring that SAIs in developing countries are effective could be colonnade for eradicating poverty and hunger as well as ensuring the provision of quality education, health and social outcomes. More importantly, many recent studies have argued that the lethargic national development being witnessed in many developing countries is to a larger extent caused by enfeebled SAIs [7] [8]. Enfeebled SAIs are detrimental to the government's capacity to extract and mobilise sufficient taxation revenues needed to fund public-sector driven growth. In addition, such institutions may affect the government's competence to contrive and implement cogent, coherent and balanced economic and socio-developmental policies. The rest of the paper is organised as follows; section two and three cover theoretical and empirical literature, section four presents the research methodology, section five covers key findings whilst the last section presents recommendations.

2.0 Theoretical literature Review

One of the well-known theory that explains ineffective SAIs is the principal-agent theory [9]. According to this theory, public sector officials are employed to protect the interests of the principal who in most cases is the government and/or its representatives. In real practice however, the interests of the public officials often deviate from those of the principal due to many asymmetric. In the principal-agent relationship, the principal can prescribe the pay-off rules through instituting legislative frameworks, procedures, rules and processes [10], and coming up with independent external monitoring institutions [8]. In most instances, there is often an informational asymmetry between the agent and the principal that usually favours the public official rather than the principal. In the public sector, the government is often the main principal whilst public officials are agents that are responsible for managing and controlling the entity on behalf of the principal. If both the principal and the agent maximise their personal utility from this relationship, there is a high likelihood that the agent will choose to act in his/her interest whilst neglecting the interest of the principal. The conflict of interest becomes assured when it becomes difficult for the absent principal to monitor the agent's actions. The principal-agent problem is also caused by risk sharing where the principal and the agent have different risk tolerance levels for given payoffs. To resolve the principal-agent conflict, the principal is forced to come up with positive incentives for the agent such as high remuneration and other non-monetary benefits [11] .

3.0 Empirical literature

A report by the World Bank (2021) on 118 SAIs in both developed and developing countries reveal that constitutional and legal framework, transparency in the process for appointing the head of SAI, financial autonomy, staffing autonomy, operational autonomy, audit mandate, audit scope autonomy, right and obligation on auditing reporting and access to information and records are some of the factors that enhance sound PFMs. Bostan et al (2021) using a panel data of European Countries for the period 2002 to 2019 show that effective SAI are characterised by transparency and accountability, and contribute to the reduction of public deficit and gross public debt. the lack of independence in the hiring of the Auditor General (AG), financing accountability, inadequate skilled staff, lack of political will, lack of transparency are major factors that constrain public sector accountability in Zimbabwe [12, 13]. [14] established financing accountability, independence, ethics, bureaucratic systems, administrative accountability, lack of transparency, inadequate working tools, statutes and legislation, lack of motivation, poor staff remuneration and poor funding of auditing operations as some of the major factors reducing the effectiveness of SAIs. Effective and autonomous SAIs reduce deadweight losses in the economy [16]. Various stakeholders expect SAIs to produce audit reports that help the public sector to effectively and efficiently deliver positive social outcomes and to ensure fairness and equitable distribution of national resources [18]. Public value is measured by how many SAI recommendations auditees accept and act upon. External audit findings are useful only when they are made public to the citizens [19]. .

3.0 Theoretical Framework Development

The FAHP is a powerful-decision making tool that helps to evaluate and determine the priorities among different criteria, compare alternatives for each criterion and also to establish an overall ranking of the alternatives. The FAHP assists in eliminating the complexity of meanings created by using other methods especially the DEMATEL and PROMETHEE. In addition, the FAHP is useful when dealing with ambiguities associated with human language including the thought process during decision making. We also argue that FAHP is to a larger extent intuitive, consistent, user-friendly and not difficult to manage particularly when dealing with multiple-criteria factors that are both quantitative and qualitative. Following [20] , the initial step was to decompose the decision problem into a two-level hierarchy. The first level of the hierarchy represented the overall goal of the decision problem that is evaluating and identifying factors that influence the effectiveness of SAIs. The second hierarchy was the intermediate level representing the criterial affecting the decision whilst the last hierarchy depicts the bottom level and represents the possible alternatives. The second step was using pair-wise comparisons to compute the relative important weights of decision criteria in each level. In this stage, the decision maker was allowed to employ the fundamental scale or weights. The weights ranged from 1 depicting equal importance, and 9 indicating extreme importance as was proposed by Saaty (1994). This allowed the researchers to come with a pair-wise comparison matrix where elements a^{ij} inside the matrix is interpreted as the degree of the precedence of the *ith* criterion over the *jth* criterion. The last step involves evaluating the decision alternatives by taking into account the weights of decision alternative (Saaty, 1980). The alternative scores were combined with criterion

weights to come up with the overall score for each alternative. To convert linguistic judgements into triangular fuzzy numbers we adopted the following procedures. Let $S \in F(Z)$ be a fuzzy number if it exists $y_0 \in Z$ such that $\theta_S(y_0) = 1. B_\alpha = \langle y. \emptyset_{B\alpha}(y) \geq a \rangle$ is a closed interval for any $a \in \{0.1\}. F(Z)$ is representing all fuzzy number sets. S is the set of real numbers. A triangular fuzzy number is then represented as $Z = (l, c, u)$ if its membership function $\emptyset_S(y): Z \to [0.1]$ is equal to;

$$\emptyset_S y = \begin{cases} \frac{y}{c-1} - \frac{l}{c-1}, y \in [l, c] \\ \frac{y}{c-u} - \frac{u}{c-u}, y \in [c, u] \\ 0 \qquad\qquad \text{Otherwise} \end{cases} \qquad (1)$$

Where $l \leq s \leq y, l, y$ and s are lower, upper and middle-values of the support of S respectively. The support of S is the set of all elements $\{y \in Zll < \emptyset < y\}$

Let triangular fuzzy numbers $Z_1, Z_3, Z_{5,} Z_7 \; and \; Z_9$ represent the assessment from equally to extremely important and $Z_2, Z_4, Z_{6,} \; and \; Z_8$ are the middle values. From priori studies we adopted the following triangular fuzzy score conversion.

Table 1: Triangular Fuzzy Score Conversion

Linguistic scale	**TFNs**	**Reciprocal TFNs**
Equally important	(1, 1, 1)	(1, 1, 1)
Weakly more important	(2/3, 1, 3/2)	(2/3. 1, 3/2)
Strong more important	(3/2, 2, 5/2)	(2/5, 1/2, 2/3)
Very strong more important	(5/2, 3, 7/2)	(2/7, 1/3, 2/5)
Absolutely more important	(7/2, 4, 9/2)	(2/9, ¼, 2/7)

Let Y=$\{y_1, y_2, y_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots y_n\}$ be an object set and Y=$\{u_1, u_2, u_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots u_n\}$ be an objective set. Each of the object is taken to execute extent analysis for each goal respectively. Then the s extent analysis values for each object can be discovered with the following signs.

$$S_{g_i}^1, S_{g_i}^2, \ldots\ldots\ldots\ldots, S_{g_i}^s \; , where \; i = 1,2,3 \ldots\ldots n;$$

Where $s_{g_i}^j = \{l_{g_i}^j, n_{g_i}^j, u_{g_i}^j\}, j = 1,2, \ldots\ldots\ldots\ldots\ldots s$ are a set of triangular fuzzy numbers. The value of the fuzzy synthetic extend with respect to the i[th] object is expressed as;

$R_i = \sum_{j=1}^n S_{g_i}^j \times \{\sum_{i=1}^n \sum_{j=1}^n S_{g_i}^j\}^{-1}$

$$\tilde{A} = \begin{array}{c} \\ 1 \\ \dot{\alpha}_{21} \\ \\ \end{array} \begin{bmatrix} \dot{\alpha}_{1\,2} \ldots\ldots & & \dot{\alpha}_{1n} \\ 1 \ldots\ldots & & \dot{\alpha}_{2n} \\ \dot{\alpha}_{n1} & \dot{\alpha}_{n2} \ldots\ldots & 1 \end{bmatrix}$$

Where$\dot{\alpha}_{ij}$ is a fuzzy triangular number (FTN) and $\dot{\alpha}_{ij} = (l_{ij}, m_{ij}, u_{ij}$ ãij) and that, $\dot{\alpha}_{ij} = \frac{1}{\dot{\alpha}_{ij}}$. For every TFN $\dot{\alpha}_{ij}$ or M=(1,m,u), its membership function µâ 9x or µ M9X) is a continuous mapping from real numbers -∞ ≤ x ≤r ∞ to the closed interval (1.0) and can is defined by equation

$$\mu 0\,(x) = \begin{cases} (x\text{-}l)(m\text{-}l), & l \leq x \leq m \\ (u\text{-}x) / (u\text{-}m), & m \leq x \leq u \\ 0, & \text{otherwise} \end{cases}$$

The operations on TFNs can be multiplication, addition and inverse. For example if M_1 and M_2 are TFNs where M1= (M1=(l_1, m_1, u_1) and M_2=(l_2, m_2, u_2), then

Multiplication $m_1 x m_2 = (l_1 x l_2, m_1 x m_2, u_1 x u_2)$

Addition $m_1 + m_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2)$

Inverse $m_1^{-1} = (l_1 x m_1 x u_1)^{-1} = (\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1})$

The third stage was aggregating the group decisions where after collecting matrices from all decision makers there are the aggregated using fuzzy geometric method proposed by Buckley (1985). In a certain case $\hat{u}_{ij} = (l_{ij}, m_{ij}, u_{ij})$, the aggregated TFN of *n* judgements made by decision makers is given by

$\hat{u}_{ij} = (\prod_{i=1}^{n} \hat{a}_{ijk})^{1/n}$

$\hat{a}_{ijk}$ Represents the relative importance in the form of TFN of the kth decision maker's perception and, n is the total number of decision makers. On the basis of the aggregated pair wise comparison matrix, $\tilde{U}=(\tilde{u}_{ij})$, the value of fuzzy synthetic extent S_i with respect to the ith criterion can be computed by making use of the algebraic operations on TFNs described above.

$S_i = \sum_{j=1}^{n} \tilde{u}_{ij}\, x(\sum_{i=j}^{n} \sum_{j=1}^{m} \tilde{u}_g)^{-1}$

Where $\sum_{j=1}^{m} \tilde{u}_{ij} = (\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j \sum_{j=1}^{m} u_j \; and$

$\sum_{i=1}^{n} \sum_{j=1}^{m} \tilde{u}_{ij} = \sum_{l=1}^{n} \tilde{u}_{ij} \sum_{l=1}^{n} m_j \sum_{l=1}^{n} u_i$

Relying on the fuzzy synthetic extent values, the non-fuzzy values that represent the relative weight or preference of one criterion over others are required. Adopting Chang (1996) to find the degree of possibility that $S_b > S_a$ is given as follows.

$$V(S_b > S_a) \quad \begin{bmatrix} 1 & , \text{if } M_b \geq M_a \\ 0 & , \text{if } L_a \geq U_b \\ L_a\text{-}U_b / (m_b\text{-}u_b)\text{-}(m_a\text{-}l_a) & , \text{otherwise} \end{bmatrix}$$

Where *b* is the ordinate of the highest intersection between u S_a and uS_b for the degree of possibility for a TFN Si to be greater than the number of n TFNs Kk can be shown by the operation min as proposed by Dubois and Prade (1980). The degree of possibility of $S_1 \geq S_2$ is expressed as in equation below

$V\{S_1 \geq S_2\} = (sup|min)\{u_{S_1(x)}\}, u_{S_2}(y))$, Where $y \geq p$

When a pair (x, y) exists such that $x \geq y$ and $u_{M_1}(x) = u_{M_2}(y) = 1$, then $V(R_1 \geq R) = 1, iff\ c_1 \geq c_2$ If $c_1 \geq c_2, V(S_1 \geq S_2) = hgt\{S_1 \cap S_2\}$, then $V(S_1 \geq S_2) = \left\{\frac{l_2 - u_1}{(c_1 - u_2)=(c_2 - l_2)}\right\}^{\prime l_2} \leq u_2, otherwise$

The degree of possibility for a triangular fuzzy number that is greater than K triangular fuzzy number $S_1 (i = 1,2,3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots k)$ can be expressed as $V(S \geq S_1, S_2, \ldots\ldots S_k) = min\, V(S \geq S_1$ Assume that $d'(A_t) = minV(S_t \geq S_k)$ where d' is the abscissa of the highest intersection point between B_1 and B_2 and At is the i[th] element of the k[th] level for$k = 1,2, \ldots . n; k \neq i$. The weight vector of the k[th] level is $W' = (d'(B_1), d'(B_2), d'(B_n))^T$. The normalised weight vector is then obtained by normalization as;

$W = (d(B_1), d(B_2), \ldots . d(B_n))^T$. Where *W* is not a fuzzy number. After evaluating the weights of the criterial, the scores of the alternatives with regards to each criterion were computed and later also calculated the composite weights of the decision alternatives by aggregating the weights through a hierarchy.

3.0.1 Data collection, Analysis and Validity

A structured questionnaire was administered to a purposively chosen ten experts knowledgeable about external audits done by supreme audit institutions. The questionnaire consisted of two sections, the first allowed the ten experts to rate the effectiveness of Zimbabwe's SAI using rating scales: highest, high, medium, low and lowest. The second section provided a list of factors that have been used in literature such as audit value, independence, trust, transparency, professionalism, ethical leadership, stakeholder value and financial accountability. The experts were requested to evaluate these factors and each factor was considered as criteria of the hierarchy respectively. To ensure the reliability of FAHP it is important to do some diagnostic tests. The reliability obtained from pairwise comparison is determined as a measure for the consistency index. To ensure a certain quality level of a decision or the value of consistency we computed consistency rate defined as the ratio between the consistency of a consistency index (CI) and the consistency of a random consistency index (RI). A reasonable evaluation is less than 0.1 whilst an acceptable evaluation is less than 0.2. Once the weights of criteria are assessed it is required to compute the scores of the alternatives with respect to each criterion and then establish the composite weights of the decision alternatives by aggregating weights through hierarchy. The threshold for this ratio is 0.1 for a matrix larger than four by four.

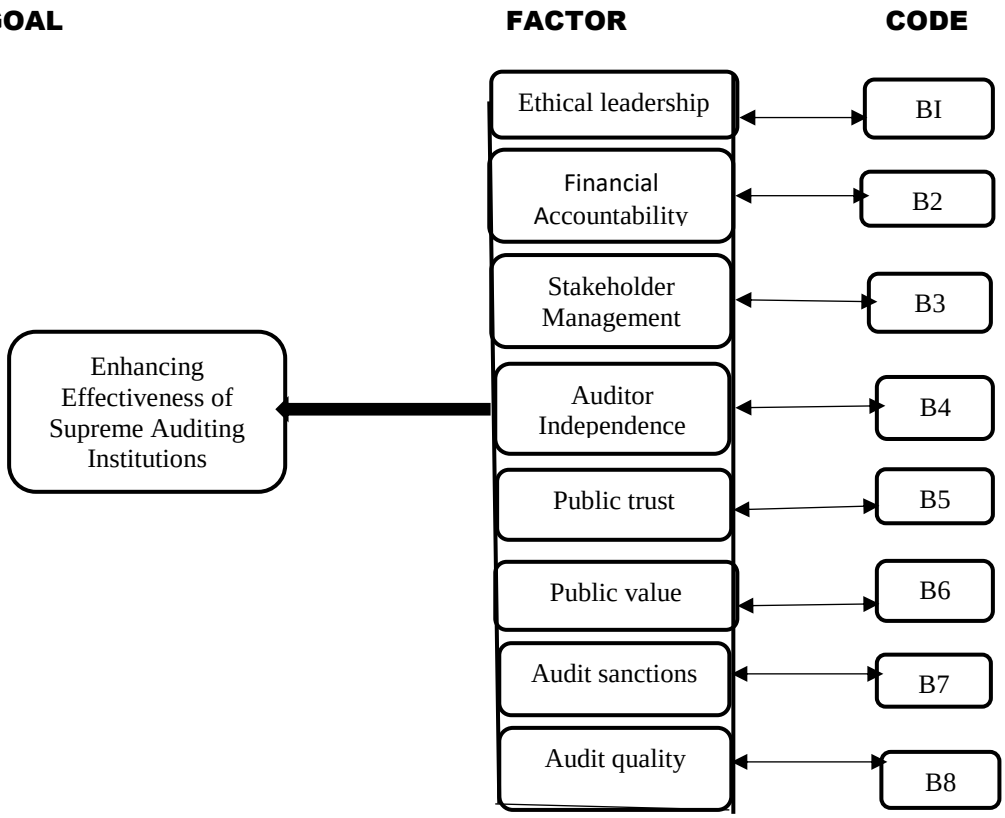

Figure 1: Hierarchy Structure of Selecting factors influencing effectiveness of SAI (Own Source)

The final stage after getting responses from ten experts was establishing the fuzzy pair-wise comparison matrices using three steps. First we compared the findings from different experts regarding the factors, followed by the transformation the scales to triangular fuzzy numbers. The distance values were transformed into the linguistic scale and pair-wise comparison matrices.

4.0 Findings and Discussions

As outlined by [21] , the following sections discuss findings related to the selection problem, aggregated fuzzy pair-wise matrix, the computed fuzzy synthetic extent values, the approximated fuzzy priorities for criteria and the approximated fuzzy priorities for alternatives are presented in tables 1 to 7.

4.0.1 The Experts Fuzzy Pair-Wise Matrices

Table 1 shows the ten fuzzy pair-wise comparison that was constructed using views of ten experts' evaluations as shown in equations 1, 2 and 3, and findings are shown in Table 1.

Table 1: Experts Fuzzy Pair-Wise Matrices

	B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**
B1	(1 1, (1,	(0.60, 1, 1.41)	(0.60, 1, 1.45)	(0.60, 1, 1.41)	(1 1, (1,	(0.60, 1, 1.41)	(0.60, 1, 1.41)	(0.60, 1, 1.41)
B2	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.60, 1, 1.41	(1, 1, 1)	(1, 1, 1)	(1.55 2, 2.55)
B3	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B4	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B5	(1, 1,	(0.60, 1,	(0.40, 0.75,	(0.40, 0.75,	(1, 1,	(0.60, 1,	(0.60, 1,	(0.60, 1,

	1)	1.41)	1.50)	1.50)	1)	1.41)	1.41)	1.41)
B6	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.70, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B7	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.60, 1, 1.41)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B8	(0.60, 1, 1.41)	(0.40, 0.50, 0.70)	(0.40, 0.50, 0.70)	(0.40, 0.50, 0.70)	(0.60, 1, 1.40)	(0.40, 0.50, 0.70)	(0.40, 0.50, 0.70)	(1, 1, 1)

4.0.2 The Aggregated Fuzzy Pair-wise Matrix

From the Table 1, an aggregated fuzzy pair-wise comparison matrix was constructed as shown below. The aggregate fuzzy pair-wise comparison matrix was found using equations 5, 6 and 7, and the results are shown in Table 3. The sum of row or column sums was used to calculate the fuzzy synthetic extent values as shown in Table 3.

Table 2 Aggregated Fuzzy Pair-Wise Matrix

	B1	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**
B1	(1 1, (1,	(0.62 0.90, 1.15)	(0.60, 0.72, 1)	(0.76 1, 1.25)	(1.10, 1.20, 1.40)	(0.95, 1.18 1.41)	(0.77 0.90 1.08)	(0.77, 1, 1.20)
B2	(0.62, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(0.62, 1, 1.50)	(1, 1, 1)	(0.62, 1, 1.50)	(0.62, 1, 1.50)	(0.62, 1, 1.50)
B3	(0.62, 1. 11 1.50)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.62, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B4	(0.62, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.62, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 2.25)
B5	(1, 1. 13 1)	(0.62, 1, 1.50)	(0.41, 0.75, 1.50)	(0.41, 0.75, 1.50)	(1, 1, 1)	(0.62, 1, 1.50)	(0.62, 1, 1.50)	(0.62, 1, 1.50)
B6	(0.62, 0.90 1.50)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.66, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50
B7	(0.62, 1.16 1.50)	(1, 1, 1)	(1, 1, 1)	(1, 1, 1)	(0.62, 1, 1.50)	(1, 1, 1)	(1, 1, 1)	(1.50, 2, 1.50)
B8	(0.62, 1, 1.50)	(0.40, 0.50, 0.62)	(0.40, 0.50, 0.62)	(0.40, 0.50, 0.62)	(0.62, 1, 1.50)	(0.40, 0.50, 0.62)	(0.40, 0.50, 0.62)	(1, 1, 1)

The Sum of Horizontal and Vertical Directions

The sum of horizontal and vertical directions were obtained using the multiplicative procedure as in equation 6a and the findings are depicted in Table 3.

Table 3: The Sum of Horizontal and Vertical Directions

Criteria	**Row sums**	**Horizontal Sums**
B1	(6.45, 7.71, 9.65)	(8.25, 11.80, 10.45)
B2	(6.40, 9.50,10.35)	(8.15, 10.90, 9. 25)
B3	(7.05, 9.08, 9.35)	(6.60, 9.56, 8.45)
B4	(7.70, 8.88, 11.50)	(6.25, 8.40, 9.71)
B5	(5.60, 7.74, 9.99)	(5.45, 9.70, 7.66)
B6	(7.79, 8.81, 8.97)	(5.10, 7.29, 6.34)
B7	(6.70, 9.46, 4.66)	(4.62, 5.35, 3.88)

B8	(5.73, 4.15,7.65)	(3.70, 2.45, 2.25)
Sum of rows or columns		(54.52, 65.43, 62.67)

Own source

The Computed Fuzzy Synthetic Extent Values

Table 4 shows the fuzzy synthetic extent value S_i that were calculated by applying equations 10 and 11. Table 4 provides a synthetic evaluation of object relative to an objective in a fuzzy decision environment with multiple criteria.

Table 4: The Fuzzy Synthetic Extent of each Criteria

B1	(0.1033, 0.1206, 0.1772)*
B2	(0.1024, 0.1447, 0.1917)
B3	(0.0901, 01354, 01867)
B4	(0.1127, 0.1392, 0.1737)
B5	(0.1258, 0.1376, 0.1922)
B6	(0.0880, 0.1166, 0.1823)
B7	(0.1255, 0.1357, 0.1739)
B8	(0.1257, 0.1397, 0.0791)

Source Own *($6.48, 7.89, 966) * (54.52, 65.43, 62.67)^{-1}$

The Normalised Weight Values of Each Criterion

The relative weights in Table 5 were normalised to permit them to be similar to weights defined in the FHAP method. The normalised weights are shown in table 5 below. Table 5 shows the non-fuzzy values that depict the relative weights or preferences of one criteria other criteria. Each of these is the degree of possibility found using equation 11. The relative weights in Table 5 were normalised using equation 12 to permit them to be similar to weights defined in the FHAP method.

Table 5: Normalised Weight Values of Each Criterion

Criteria	relative weight	Normalised Weight	factor	Ranking
	(w/(S1)	w(Si)		
B1	1.279	0.1408	Ethical leadership	5
B2	1.1130	0.1520	Financial accountability	6
B3	1.3766	0.1536	Stakeholder Management	3
B4	1	**0.2188**	Auditor independence	1
B5	2.4555	0.1143	transparency	7
B6	0.8543	0.1567	Public value	2
B7	0.9656	0.1534	Auditor sanctions	4
B8	0.6507	0.0816	Audit quality	8

Table 5 shows that auditor independence has the highest rating suggesting that it is a key determinant of effective supreme institutions. With full autonomy the supreme audit institution is able to resist pressure from third parties. This finding has confirmation in literature [22] [23] [24] Public value of audits has the second highest rating suggesting that people are likely to consider a supreme audit institution is effective if the audits bring value to them**.** Public value of audits is reflected in reduction of wastages, creation of savings, efficiency improvements and sound public finance management. Ethical leadership in SAIs is likely to engender the legitimacy, credibility, trust and reliability of audit findings as observed in prior studies [25].

5.0 Policy Implications/ Recommendations

The findings have significant implications on ensuring the effectiveness of supreme audit institutions in developing countries and if they are to contribute to robust public management systems, economic growth and development. First policy makers should broaden the remit of supreme audit institutions to make them truly independent from the executive. This is likely to enhance public value of audit findings and in turn, enabling the audit reports to have a greater societal impact in terms of promoting financial accountability, ethical leadership, and stakeholder management in the public sector. It is important that supreme audit institutions are legally, factually and functionally independent from the executive and other influential third parties as this is likely to increase audit quality, transparency and credibility.

6.0 Conclusions

Since 2017 audit findings on Zimbabwe's public sector indicates that financial malfeasances such as systemic corruption, fraud, corporate misgovernance and abuse of office among others are rising phenomenally. This cast considerable doubt on the effectiveness of the reports being produced by the Office of the Auditor General of Zimbabwe. The study employed the fuzzy analytical hierarchical process rank critical factors that may determine the effectiveness of these reports. Using group-based fuzzy analytical process was used to generate criteria weights of eight factors after establishing the pair-wise comparison of criteria. The contribution of the study is on employing FAHP to rank qualitative factors that influence the effectiveness of the OAGZ.

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