FACTORS INFLUENCING THE ADOPTION OF E-PROCUREMENT AMONG SMALL AND MEDIUM ENTERPRISES IN THE REPUBLIC OF SOUTH SUDAN

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ABSTRACT

Although e-procurement uptake is slow amongst SMEs in developing countries, the introduction of web-based technologies in the 1990s and the creation of social media platforms and other e-commerce sites have currently revolutionized the way small and medium-sized enterprises operate businesses. Therefore, the purpose of this quantitative cross-sectional survey research was to examine the factors that drive the effective implementation of e-procurement systems among SMEs in the Republic of South Sudan. The study systematically sampled and surveyed 300 SMEs out of a total of 1215 and collected data using a survey questionnaire in Google Form format with a valid response rate of 71% (213). The background data were analysed using descriptive statistics such as frequency and percentage; and the variables were analysed using inferential statistics such as principal component analysis (PCA), relatively important index (RII), and analytical hierarchical process (AHP). Resultantly, the availability of experienced and skilled personnel; and the availability of government directives were ranked the highest drivers among the political and legal factors, followed by an increase in quality through benchmarking (market intelligence) and an increase in quality through improved communication due to competitive factors, cost reductions in terms of staffing, processing, transaction, and administrations for management factors. Future studies should evaluate the main factors that motivate SMEs to adopt procurement practices in emerging and developed countries, with the aim of promoting the adoption of e-procurement. Meanwhile, stakeholders could invest in skilled personnel, advocate for government directives and policies, improve communication channels, utilize market intelligence tools, focus on cost reduction strategies, promote training and awareness programs, collaborate with industry partners, and ensure legal compliance. This study proposed employing qualitative techniques to examine the drivers of e-procurement adoption by SMEs.

Key Words: *Drivers, Factors, SMEs, E-procurement, Adoption, South Sudan*

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INTRODUCTION

The introduction of web-based technologies in the 1990s and the creation of social media platforms such as Facebook, X(Twitter), Pinterest, YouTube, Threads, Instagram, Snapchat, TikTok, and other electronic commerce (e-commerce) websites have currently revolutionized the way SMEs (small and medium sized enterprises) operate businesses. Electronic procurement (e-procurement), also known as e-commerce or online shopping occurs when purchasing processes are conducted electronically, usually via the Internet, to reduce procurement cycle time and transaction costs (United Nations High-Level Committee on Management Procurement Network or HLCM-PN, 2017). Companies have repeatedly recognized that the use of information technology in their procurement processes results in gaining a competitive advantage (Snchez-Rodrguez et al., 2019). E-procurement strengthens the local market for local suppliers by supporting long-term growth as it contributes to job creation for SMEs and increases the value of public funds by reducing foreign dependence (Ribeiro et al., 2018). E-procurement is used to increase efficiency, save costs, improve transparency, and reduce corruption in the procurement process (Nawi et al., 2016). Similarly, Bahaddad et al. (2018) found that e-procurement can help reduce the time and cost of processing and managing orders and payments to suppliers, reduce transaction errors, and improve data accuracy and information quality.

In addition, e-procurement also generates revenues: global e-commerce retail sales hit an estimate of US$5.8 trillion in 2023, with this number expected to grow by 39 percent in the coming years and is expected to reach US$8 trillion by 2027 (Chevalier, 2024). Statista (2024) projects that from 2024 to 2028, the US will lead the world's 20 nations in the growth of retail e-commerce sales, with an average annual growth rate of 11.8 percent. Africa's e-commerce market is predicted to see steady growth from 2024 to 2029, amounting to US$19.6 billion (+60.91 percent). According to Galal (2024), the indicator is predicted to reach US$51.82 billion in 2029, marking a new peak after rising for six years in a row. According to Cowling (2024), Egypt is expected to be the leading e-commerce market in Africa with 48.37 million users. Kenya is ranked second with 7.57 million users, according to Cowling (2024), which is 40.8 million users less than Egypt.

With an estimated monthly sale of US$5.70 million, South Sudan currently has 123 online stores run by e-commerce platforms like WooCommerce (61 stores), Customer Cart (39 stores), Wix (9 stores), Shopify (5 stores), Odoo (4 stores), Ecwid (1 store), Magento (1 store), OpenCart (1 store), and Wuilt (1 store) (Aftership, 2023).

Innovations in technology, especially in the digital sphere, have been seen to affect every facet of the retail industry, claims Gelder (2024). By engaging in e-commerce and procurement, SMEs who fully adopt and use these technologies possible may see a rise in revenue. 99 percent of businesses globally are SMEs, and they are essential to innovation, economic growth, and social development, according to a 2017 report from the Organization for Economic Co-operation and Development (OECD). SMEs, which make up approximately 93% of all registered businesses in South Sudan, are the backbone of the country's economy because they have the capacity to reduce poverty, create jobs, and spur economic growth (International Trade Center-ITC, 2022). ITC (2022) asserts that increased use of IT in marketing and business operations has significant potential to increase the productivity of South Sudanese SMEs, expand their reach into domestic and international markets, enable e-government and digital support service delivery, and enhance their access to financing.

Problem Statement

Although digitizing purchases and sales typically results in greater efficiency, productivity, lower operating costs through automation, and an improved customer experience (Harvard Business Review, 2023; Wengler et al., 2021; Lemon & Verhoef, 2016), achieving successful implementation of information systems like e-

procurement remains a major challenge, especially for SMEs. This challenge is attributed to regulatory requirements, competition in software, and the complexity of the adoption process (Quach et al., 2022; Azanlerigu & Akay, 2015). The literature shows that limited research has been conducted on the adoption of e-procurement in developing countries and post-conflict regions, particularly those with unique geographical and demographic characteristics such as South Sudan. Pitso et al. (2018) observed that although e-procurement systems offer significant benefits, their adoption continues to pose challenges for many organizations in developing countries, with Africa being a notable example. Similar observations were made by Fernandes and Vieira (2015), who noted that acceptance of e-procurement, which is still in its infancy, has not been extensively studied.

Research objective:

Therefore, to address that gap, this research examines the factors that drive or are critical to the effective implementation of e-procurement systems among small and medium enterprises in the Republic of South Sudan.

Research question:

The research question that guided the study is:

RQ. What are the main reasons why e-procurement systems are being adopted by small and medium-sized businesses in the Republic of South Sudan?

The drivers (critical success factors) of e-procurement adoption were the sole focus of this study; other study factors that are related to e-procurement adoption include strategies, benefits, barriers, and ways to get around those barriers.

LITERATUTRE REVIEW

Overview of e-procurement

The concept of electronic procurement, initially known as electronic data interchange (EDI), emerged in the 1960s and gained traction in the 1990s when Berners-Lee redesigned the World Wide Web (CERN, 2019). Around 1999, e-procurement platforms started to take off, and companies like IMB, Pizza Hut, eBay, Amazon, and Rakuten were among the first to actively participate in this game-changing industry (Jama et al. in 2024). The term "e-procurement" is defined differently by different scholars. Alvarez-Rodríguez (2014), for instance, defines it as the use of electronic communications to handle business processes between buyers and sellers. E-procurement, according to Opoku-Fofie (2022), is a platform that connects suppliers and the government online. The term "e-procurement" describes the use of web-based tools to automate an organization's procurement processes (Nawi et al. 2016). According to Jama et al (2024) e-procurement refers to the electronic methods of searching, advertising, tendering, evaluating, purchasing, and receiving goods, works and services, as well as making online payments.

Small and medium-sized firms that have implemented e-procurement systems experience advantages such as reduced costs, improved efficiency, enhanced transparency, and expedited procurement procedures (Nawi et al., 2016; Pitso et al., 2018; Boafo et al., 2020). Bahaddad et al. (2018) also found that e-procurement implementation reduces order processing time, minimizes transaction errors, and enhances the quality and accuracy of information contained in transactions.

Conceptual Framework

A conceptual framework explains the significance of the selected research question and assesses the appropriateness and precision of the suggested research methodologies (Crawford, 2020). According to Grant and Osanloo (2014), one advantage of a conceptual framework is that it aids in the definition and framing of the researcher's perspective on the phenomenon being studied. The commonly used model for e-procurement adoption is technological-organizational-environmental (TOE) framework developed by Tornatzky and Fleischer (1990). The TOE framework, according to Hoti (2015), is used to analyse the variables influencing SMEs' adoption of new information systems. PESTEL (‘Political’, ‘Economic’, ‘Social’, ‘Technological’,

'Environmental', and 'Legal') tools were integrated into the framework for the purposes of this study. Aguilar (1967) developed the framework as ETPS (PEST) was later extended to analyse and monitor the external or macro-environmental factors impacting an organization. The TOE and PESTEL frameworks were altered to take into account the following factors: i) Political and Legal Factors; ii) Competitive Factors (Environmental Factors); and iii) Management Factors (Social Factors) in the context of this study drivers to e-procurement adoption. Building on this foundation, the modified framework shown in Figure 1 below provides a broader angle for examining the intricate relationships between the various elements affecting the introduction of e-procurement.

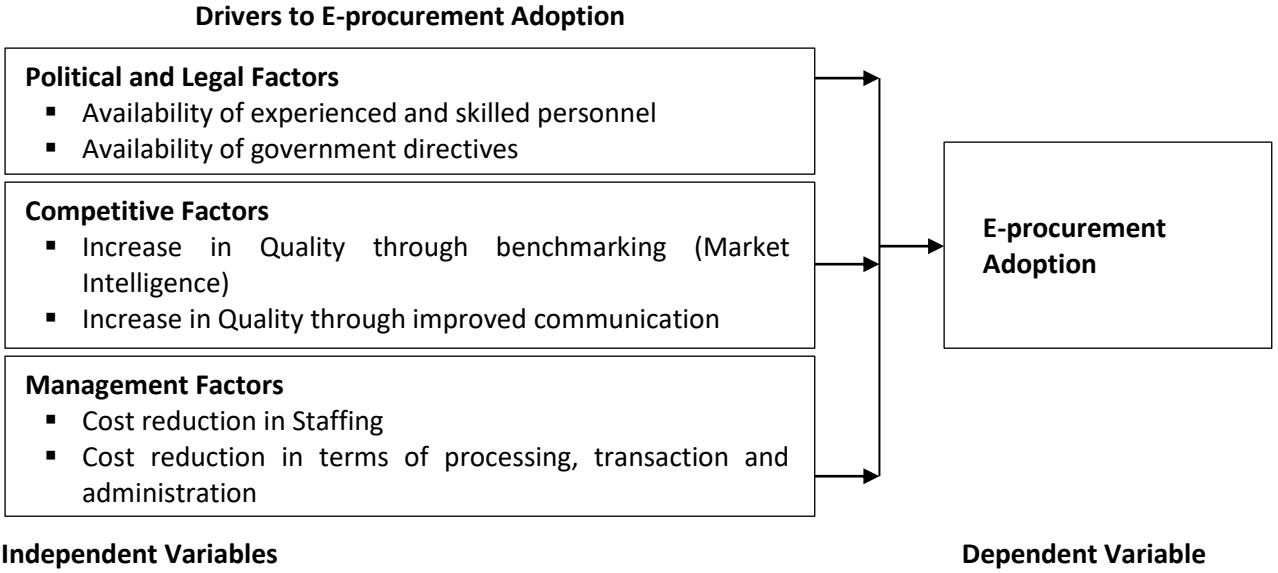

Figure 1. Conceptual Framework

Drivers to E-procurement Adoption

Govender and Pretorius (2015) viewed drivers as fundamental elements of processes, resources, or conditions—that are critical for the sustainable growth and prosperity of an organization. Yevu and Yu (2019) described drivers as compelling forces that propel, inspire, and promote the integration of e-procurement into project procurement. Political and legal concerns, competitive dynamics, and management influences (PCM) are the three main determinants of the successful introduction of e-procurement platforms.

Political and Legal Factors

According to Peterdy (2022), political factors are those that are impacted by laws and policies, whereas legal factors are modifications to the regulatory environment that have an impact on the economy as a whole, on particular industries, or even on particular businesses operating within particular sectors. Conversely, Matovic (2020) stated that political factors encompass country stability, local regulations, business ethics, tax regimes, fees, and tariffs, while legal factors pertain to laws, regulatory bodies, requirements, standards, labor codes, and capital movement regulations. Multiple studies have highlighted various political and legal factors propelling the adoption of e-procurement among SMEs. Yevu and Yu (2019) claim that the availability of laws and regulations from the government encourages SMEs to use e-procurement. According to Jacobson et al. (2017), SMEs are motivated to look for the best e-procurement strategies when they are competing to achieve value or quality. Furthermore, SMEs are adopting e-procurement due to the need for inventory management, archival systems, and procurement audit trails, as noted by Karthik and Kumar (2013). Jacobsson et al (2017) accepted that rules governing technology use and government

regulations help SMEs embrace e-procurement. Moreover, Asare and Prempeh (2017) highlighted the significance of skilled personnel in e-procurement implementation within public procurement offices. According to Muguro (2014), the existence of legal frameworks encourages SMEs to use e-procurement. Similarly, Azanlerigu and Akay (2015) found that the role of legal frameworks in defining responsibilities and duties, fostering trust in business transactions is the cause for e-procurement acceptance. Yevu and Yu (2019) underscored the enhancement of efficiency and effectiveness as a key benefit driving e-procurement adoption. Previously, Li et al. (2015) noted the inefficiencies of traditional paper-based procurement processes, making e-procurement appealing to SMEs. Eadie et al. (2010) observed that SMEs adopt e-procurement as a means of pursuing higher profit margins.

Competitive Factors

Competitive factors represent a mix of elements that give an organization superiority within a competitive environment and cannot be easily reproduced by competitors (Soltani et al., 2014). Roman et al. (2012) postulated that competitive factors embody real concerns and reasons for a company's existence. A detailed examination of the specialist literature reveals numerous competitive factors that drive the introduction of e-procurement among SMEs. For this reason, Wimalasena and Gunatilake (2018) advocated for e-procurement adoption to streamline overall procurement processing time and costs. Santoso and Bourpanus (2018) identified the reduction of communication delays and enhancement of information sharing among project stakeholders as additional competitive drivers for SMEs to embrace e-procurement. According to Isikdag (2019), the adoption of e-procurement is primarily driven by organizations' efforts to enhance the quality of their traditional paper-based procurement processes. Moreover, Hassan et al. (2017) discovered that leveraging marketing intelligence tools in procurement to enhance quality via benchmarking motivates SMEs to adopt e-procurement. Doloi (2014) perceived the imperative of augmenting quality through error minimization as a key driver for SMEs to implement e-procurement. Improvement in quality through enhanced communication and information exchange among project participants serves as another catalyst for e-procurement adoption (Khan et al., 2016; Kim et al., 2015). Additionally, Eadie et al (2010) observed that the drive to reduce order fulfilment, contract completion, and delivery times encourages SMEs to adopt e-procurement. Similarly, Ibem and Laryea (2015) underscored the advantages of e-procurement technologies over paper-based methods in terms of transaction speed, reduced transaction costs, and user-friendliness as reasons driving companies towards their adoption.

Management factors

Management factors arise from decisions or plans made by management as a social factor. Yevu and Yu (2019) emphasized that senior management plays a critical role in promoting technology adoption, which is necessary for the uptake and application of said technology. Eadie et al. (2010) noted that one of the main factors influencing SMEs' adoption of e-procurement was the top management's support in the form of financial resources and ICT equipment. Al-Yahya et al. (2018) noted that SMEs' aspiration to reduce processing, transactional, and administrative costs has led them to embrace e-procurement. Hassan et al. (2017) found that organizational technology-related policies and strategies also motivate SMEs to implement e-procurement. According to Afolabi et al. (2019) stakeholders in businesses regarded the availability of affordable, reliable, and fast internet services as significant contributors to e-procurement adoption. Additionally, top management support through training or enhancing employee knowledge, skills, and abilities is another factor driving companies to implement e-procurement (Eadie et al., 2011). Yevu and Yu (2019) mentioned that the costs associated with managing project-related documents motivate

project managers to adopt e-procurement. Similarly, Abu-Elsamen et al (2010) reported that cost savings in document management are among the factors that motivate project managers and organizations to adopt e-procurement. Svidronova and Mikus (2015) also emphasized cost savings in products, services, labor, and materials as reasons to implement e-procurement. Singh and Chan (2022) claim that the advantages of e-procurement include enhanced workflow integration, quicker transaction times, and better supplier collaboration.

METHODOLOGY

Study Design

The study examined the variables influencing the adoption of e-procurement among small and medium-sized businesses in the Republic of South Sudan using cross-sectional quantitative methods. According to Creswell and Creswell (2018), quantitative research focuses on principles such as deductive theory testing, ensuring protection against bias, managing alternative explanations, and enabling generalization and replication of results.

Study Population and Sampling Strategy

Using Yamane's (1967) formula n=[N/1+N(e)2], where 'n' stands for the samples size, 'N' for the populations size, and "e" for the precision level, 300 SMEs were chosen as a sample out of a total of 1215. Considering P = (5/100) 0.05 and a 95% confidence level. In order to select the sample from the sampling frame at regular intervals, the study used quantitative-systematic sampling techniques (Saunders et al. ,2016). This approach was suitable since it was a convenient way to sample large populations at a lower cost and easier to use, particularly if the sampling frame was in the form of a list (Kothari, 2012). As stated by Saunders et al. (2016), the procedures listed below were used to create a sample using this technique:

a) Every case in the sampling frame was assigned a unique number. For instance, the number for the first case was 0.

b) Using the eye closed pointing method, a random number was applied to select the first case. The sampling fraction was computed using the following formula:

$$\text{Sampling fraction}, = \frac{\text{actual sample}}{\text{total population}}$$

Equation (1)

Sampling fraction, $= \frac{300}{1215}$ $divide\ each\ by$ 300= $\frac{1}{4}$ round down to the nearest 10

c) To determine the frequency of selection, the ensuing cases were systematically assigned using the sampling fraction ¼. As a result, in this instance, one was chosen for every four sampling frames.

According to Saunders et al. (2016), if the sampling fraction is one-third or one-fourth, then one must be chosen from each of the three(third) or four (fourth) cases within the sampling frame. Saunders et al. (2016) state that some calculations may yield a more complex fraction, in this instance rounding the population to the nearest 10 (or 100) is acceptable. Until a more straightforward sampling fraction can be computed, increasing the minimum sample size is also acceptable.

Data Collection Procedures

Before collecting data, ethical clearance was secured under reference No. NASREC:2021-May-005 from the University of Zambia's Humanity and Social Sciences Research Ethics Committee (HSSREC), and consent was obtained from all participants in the research. The confidentiality of their information was rigorously upheld throughout the duration of the study.

The survey questionnaire consisted of two sections: Section A, which focuses on personal data, and Section B, which focuses on collecting data on drivers for e-procurement adoption. Section B was developed according to previous literature with a Cronbach's alpha value of 0.933 and the survey questionnaire in Google Form was distributed via email as a hyperlink for primary data collection. As noted by Stockemer (2019), the affordability of digital surveys has led to an increase in their use in empirical research during the past 20 years. Secondary data were gathered from several sources, such as books, blogs, journal articles, and

internet data from research institutions.

SMEs in the Republic of South Sudan were represented among the respondents, which included non-managers, middle managers, top managers, and first-level supervisors. A 5-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, was used to rate each of the 300 questionnaires that were distributed to respondents. A total of 213 valid answers were obtained, translating to a 71 percent response rate. One answer (0.47 percent) was deemed to be incomplete or inaccurate. According to Neuman (2014) a questionnaire survey response rates of 10 to 50 percent is excellent. The remaining 86 questionnaires (28.66 percent) were either not answered or were not received.

Data Analysis

The research data were analysed using both IBM Statistical Package for Social Sciences (SPSS) version 25 and Microsoft Excel software. First, the demographic characteristics of the participants were examined using descriptive statistics and presented using frequency and percentage distributions (see Table 1). The study then calculated the frequency and percentage distribution of 26 factors that drive e-procurement adoption among SMEs in South Sudan. Exploratory factor analysis was then conducted using principal component analysis (PCA) and varimax rotation techniques. The RII (Relative Importance Index) was then examined to drive the AHP (Analytic Hierarchy Process), which was subsequently used to facilitate decision-making at multiple levels and assess the key drivers for e-procurement adoption. Detailed explanations of the PCA, RII and AHP methods can be found in the following sections.

Principal Component Analysis-PCA

PCA is a mathematical method invented by Karl in 1901 that uses a limited set of factors to describe the variance in a data set (Palit et al., 2022). According to Rajput and Singh (2018), principal component analysis was designed to extract information from datasets and express it as a series of new orthogonal variables. Palit et al. (2022) state that PCA aids in the following tasks: identifying the most crucial information from the data table; condensing the dataset into its essential components; streamlining the dataset description; and analysing the arrangement of the variables and observations. In this study, the principal component analysis aided in the recognition and grouping of criteria and sub-criteria as well as the dimension reduction of independent variables that support the creation of the AHP hierarchical structure. The steps involved in principal component analysis include:

i) After data processing, the data variables were normalised by min-max methods, adjusting all variables to a scale between 0, and 1 (Abdrabo et al., 2023). This normalisation process of each variable involves a linear transformation that preserves the ranking and correlation structure of the original data, thus facilitating the aggregation of variables with different scales (Tran et al., 2010). The formula for the Min-Max technique is shown in Equation 2.

$$Min - Max(C_x) = \frac{C_x - C_{Min}}{C_{Max} - C_{Min}} \quad \text{(Eq.2)}$$

Where:

C_x = is the original value of the drivers to e-procurement adoption

C_{Min} = is the minimum value of the drivers to e-procurement adoption

C_{Max}=is the maximum value of the drivers to e-procurement adoption

ii) To ascertain the ideal number of components for principal component analysis, a screen plot analysis was performed in the second step (Fig. 2). The screen plot shows the relationship between the number of components and the relative magnitudes of the eigenvalues, as explained by Brown (2009). Eigenvalues were plotted against the order of factor extraction, with the shape of the curve serving as a basis for determining the cut-off point (Hair et al., 2019). As a result, three primary factor components—political and legal, competitive, and managerial—were extracted.

iii) After identifying the appropriate number of components, the retained components were rotated to facilitate interpretation (Abdi & Williams, 2010). This involved grouping highly correlated indicators based on the correlation matrix obtained through varimax rotation (Abdrabo et al., 2023). To reduce data redundancy, closely correlated variables were examined (Field, 2018; Torok, 2018). In this study, the selection of significant dimensions was determined by retaining components with eigenvalues above 1 (de Sherbinin & Bardy, 2015; Torok, 2018).

iv) The robustness of the model was assessed using the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity for sampling adequacy. KMO values are between 0 and 1 (Field, 2018; Abdrabo et al., 2023). A KMO value of 0 indicates that partial correlations outweigh correlations, indicating a scattered pattern of correlations and making factor analysis inappropriate. On the other hand, Field (2018) states that a value near 1 denotes a compact correlation pattern, which suggests distinct and trustworthy factors appropriate for factor analysis. According to Kaiser and Rice (1974), the thresholds for component analysis are categorized as follows: 0.90 (marvellous), 0.80 (meritorious), 0.70 (middling), 0.60 (mediocre), 0.50 (miserable), and below 0.50 (unacceptable). Field (2018) humorously replaced "Unacceptable" with "Merde" to maintain a pattern with words beginning with "M".

A statistically significant Bartlett test for sphericity ($p<0.001$) indicates adequate correlations between variables to proceed (Hair et al., 2019). Overall sampling adequacy in this study was rated as excellent by Kaiser and Rice (1974) with a KMO score of 0.936; individual question scores were higher, at 0.7, indicating moderate to excellent adequacy by the same authors. The result of Bartlett's sphericity test was statistically significant, (325) = 4066.957, $p < 0.001$.

Relative Importance Index

RII represents the proportional contribution of a variable to the predictor variables individually or in conjunction with others within the regression equation (Johnson & LeBreton, 2004). According to Dixit et al. (2019), RII is computed by taking the maximum value on the Likert scale and dividing the sums of all responses by the total number of responses. According to their relative importance, the criteria were prioritized in this study using the RII technique (Akadiri, Olomolaiye, and Chinyio, 2013). RII is considered a reliable method for assessing variable rankings through structured surveys (Dixit et al., 2019). Several authors (Aduwo et al., 2020; Priyatna & Sunandar,2021; Nitharsan & Francis, 2022) have applied RII methodologies to investigate anti-corruption abilities, key success factors, and the adaptability of blockchain-based e-procurement determinants, respectively. As per Dixit et al.'s (2019) definition, Equation (3) is the formula used to calculate RII:

$$RII = \frac{\sum w}{A \, x \, N} \qquad \text{(eq.3)}$$

On a scale of 1 (least) to 5 (highest), the respondents' weights for each factor are represented by the "w" in the equation. The letter "N" stands for the total number of respondents, which in this case is 213; "A" stands for the maximum weight (5). The RII values were divided into five categories by Akadiri (2011): Medium (M) ($0.4 \leq RII \leq 0.6$), High-Medium (H–M) ($0.6 \leq RII \leq 0.8$), Low (L) ($0 \leq RII \leq 0.4$), Medium-Low (M-L) ($0.2 \leq RII \leq 0.4$), and Low (L) ($0 \leq RII \leq 0.2$). The relevance of every survey question as a motivator for SME e-procurement acceptance in South Sudan was determined by assigning each question an H-M level of relative importance.

Analytical Hierarchy Process

According to Saaty (2008), AHP is a measurement theory in which expert judgments are used to establish importance scales for pairwise comparisons prioritization. Agrawal et al. (2020) describe AHP as a useful technique for making decisions that works well when organizing decision criteria into sub-criteria in a hierarchical manner. AHP method has been used in various areas including supplier selection in e-procurement (Benyoucef & Canbolat, 2007; Deepika, 2023),

identifying success factors for mass rapid transit (MRT) components in e-procurement (Hartanto et al., 2019), and evaluating the impact of e-procurement adoption on performance (Masudin et al., 2021). In AHP analysis, ranking values from RII were utilized (Gunduz & Almuajebh, 2020). The steps used in AHP analysis include:

Step 1. In the first phase, the research problems and goals are defined. This step aims to identify the essential information needed to understand the factors influencing the adoption of e-procurement.

Step 2. Principal component analysis was used to discern the criteria and sub-criteria linked to the factors influencing e-procurement introduction by small and medium-sized enterprises. The decision-making process was structured hierarchically into three levels: Level 1 represents the overarching focus, goal, or objective; Level 2 encompasses the criteria; and Level 3 comprises the sub-criteria. The hierarchical arrangement is visually depicted in Figure 3.

Step 3. In the context of pairwise comparison, the RII is used to assign numerical values to the relationships between different elements or criteria based on their actual measurements and relative significance. Gunduz and Almuajebh (2020) propose a novel approach to AHP analysis by transferring values from RII. In their research, they adopted Saaty's 1-to-9-point scale, where:1 signifies equal importance, 3 denotes moderate importance, 5 represents strong importance, 7 indicates very strong importance, 9 signifies extreme importance, and Intermediate values (2, 4, 6, 8) lie between adjacent scale points. These values are assigned based on RII ranges:

- High-Important (0.8 ≤ RII ≤ 1) corresponds to values of 7, 8, or 9.
- High-Medium Important (0.6 ≤ RII ≤ 0.8) corresponds to values of 5, 6, or 7.
- Medium-Important (0.4 ≤ RII ≤ 0.6) corresponds to values of 3 or 4.
- Low-Important (0 ≤ RII ≤ 0.2) is assigned a value of 1.

This defined scale is then employed to assign pairwise comparison values to elements corresponding to their RII values, as illustrated in Table 6. The matrix (A) for pairwise comparison is defined by the following equation (Eq. 4).

$$A = a_{ij} = \begin{matrix} \\ A_1 \\ A_2 \\ \dots \\ A_n \end{matrix} \begin{matrix} \begin{matrix} A_1 & A_2 & \dots & A_n \end{matrix} \\ \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \end{matrix} \quad \text{(eq.4)}$$

Given $0 \le a_{ij} \le 1$, and $a_{ij} + a_{ij} = 1$, the element a_{ij} (*i*, j= 1, 2, …, n) indicates the degrees to which alternative A_i is considered more important than alternative A_j. A larger value of a_{ij} (*i*, j= 1, 2, …, n) indicates that the alternative A_i is important than A_j. If a_{ij} is equal to 1, it indicates that alternative A_i is as important as A_j. The findings of the pairwise comparisons are presented in Table 7, 8, and 9.

Step 4. The decisions matrix A underwent normalisation to derive priority vectors by computing the eigenvalues and eigenvectors of Matrix A (refer to Table 10, 11, and 12). The eigenvector, represented by X_{ij} corresponding to the largest eigenvalue λ_{max} was chosen. This eigenvector, X_{ij} was normalised by dividing each element by the total sum of all elements, ensuring that the vector values collectively sum up to 1 (see equation 5). The normalised eigenvector X_{ij} reflects the prioritization of sub-criteria (X_1, X_2, X_3…Xn.). Subsequently, the priority vector X_i was calculated by averaging each row of the normalised matrix X_{ij} (refer to equation 6).

$$X_{ij} = \frac{a_{ij}}{\sum_{i}^{n=1} a_{ij}} \quad \text{(eq.5)}$$

$$X_i = \frac{\sum_{i}^{n=1} a_{ij}}{n} \quad \text{(eq.6)}$$

Step 5. The consistency ratio-(CR) was determined by calculating the consistency index (CI) to assess the reliability of the results (see Table 13). The CI is defined according to equation (Eq.7).

C.I = $\frac{\lambda_{max}-n}{n-1}$ (eq.7)

In this context, λ_{max} represents the largest eigenvalue of the comparison matrix, while n denotes the number of criteria or alternatives being compared. The formula for CI involves subtracting the number of criteria from the largest eigenvalue and then dividing the result by the difference between the number of criteria and 1.

CR is computed by dividing the CI by the Random Index (RI), which offers a benchmark value based on the number of criteria being compared, aiding in the determination of an acceptable consistency level. The equation for CR is expressed as equation 8.

CR = $\frac{CI}{RI}$ (eq.8)

Step 6. The ranking of e-procurement driving factors based on the optimal weight calculation was presented in a tabular form (see Table 14).

FINDINGS

In this section, we delve into a comprehensive quantitative analysis of the results, offering valuable statistical insights and interpretations on demography, frequency distributions, principal component analysis, relative important index, and analytical hierarchy process for decision making toward e-procurement acceptance.

Demographic Information's

Table 1 provides an overview of the demographic information of the study respondents, offering insights into their background.

Table 1: Demographic Information's

		Frequency	Percentage (%)
Your Gender	Female	30	14.1
	Male	183	85.9
Age group (years)	20-25	1	.5
	26-35	80	37.6
	36-50	117	54.9
	51-65	15	7.0
Highest completed education level	Bachelor's Degree	128	60.1
	Certificate	10	4.7
	Diploma	43	20.2
	Doctoral Degree	2	.9
	Master's Degree	30	14.1
Job status	First-level supervisor	9	4.2
	Middle Management	50	23.5
	Non-management	5	2.3
	Top management	149	70.0
Number of years employed in the company	Under 1	2	.9
	1-2	14	6.6
	3-5	65	30.5
	6-10	74	34.7
	Over 10	58	27.2

Table 1 shows that the data highlights a significant dominance of the male respondents (85.9%) in comparison to their female counterparts (14.1%), indicating a male-dominated landscape of SMEs business in the Republic of South Sudan. In terms of age distribution, the majority of respondents (54.9%) were between the ages of 36 and 50, followed by 37.6% between the ages of 26 and 35, 7% between the ages of 51 and 65, and 0. 5% aged between 20 and 25 years. This suggests that SMEs are predominantly run by people in the younger age group.

Regarding educational qualifications, greater part of

participants (60.1%) had a bachelor's degree, 20.2% had a diploma, 14.1% had a master's degree, 4.7% had a certificate, and 0.9% about a doctorate. In terms of job roles, the data showed that the majority (70%) were employed as top managers, followed by 23.5% as middle managers, 4.2% as first-level supervisors and 2.3% as non-employees - Manager. In terms of professional experience, the largest proportion of people (34.7%) reported having 6 to 10 years of professional experience, followed by 30.5% with 3 to 5 years, 27.2% with more than 10 years, 6.6% with 1 to 2 years and only 0.9% with less than 1 year of professional experience.

The frequency and percentage distribution results. Table 2 provides a frequency and percentage distribution of factors influencing the adoption of e-procurement by SMEs in the Republic of South Sudan.

Table 2: Frequency and percentage distribution of factors influencing the adoption of e-procurement by SMEs in the Republic of South Sudan

Drivers to E-procurement Adoption	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Top management support in terms of capital provision	11(5.2%)	21(9.9%)	21(9.9%)	51(23.9%)	108(50.7%)
Top management support in terms of supply of ICT equipment	16(7.5%)	19(8.9%)	14(6.6%)	61(28.6%)	102(47.9%)
Top management support in terms of staff trainings	11(5.2%)	12(5.6%)	29(13.6%)	60(28.2%)	100(46.9%)
Cost reductions in terms of processing, transaction and administration	13(6.1%)	16(7.5%)	31(14.6%)	64(30%)	88(41.3%)
Cost reductions in terms of service, material and product provision	12(5.6%)	17(8%)	29(13.6%)	59(27.7%)	95(44.6%)
Cost reduction in staffing	17(8%)	17(8%)	40(18.8%)	54(25.4%)	84(39.4%)
Needs for inventory management	11(5.2%)	13(6.1%)	28(13.1%)	78(36.6%)	81(38%)
Strategic cost savings	8(3.8%)	9(4.2%)	33(15.5%)	66(31%)	95(44.6%)
Increase in profit margins	9(4.2%)	17(8%)	33(15.5%)	59(27.7%)	93(43.7%)
Shortened overall procurement processing time	11(5.2%)	12(5.6%)	23(10.8%)	61(28.6%)	105(49.3%)
Reduction in evaluation time	14(6.6%)	18(8.5%)	19(8.9%)	77(36.2%)	84(39.4%)
Shortened communication times	11(5.2%)	15(7%)	29(13.6%)	58(27.2%)	98(46%)
Reduction in time of order fulfilment and contract completion	11(5.2%)	20(9.4%)	36(16.9%)	62(29.1%)	83(39%)
Reduction in delivery time	23(10.8%)	19(8.9%)	41(19.2%)	53(24.9%)	75(35.2%)
Improvement in internal workflow	6(2.8%)	11(5.2%)	29(13.6%)	59(27.7%)	105(49.3%)
Availability of experience and skilled personnel	9(4.2%)	6(2.8%)	33(15.5%)	59(27.7%)	105(49.3%)
Increase in quality through competition	7(3.3%)	18(8.5%)	27(12.7%)	54(25.4%)	106(49.8%)
Increase in quality through benchmarking (market intelligence)	7(3.3%)	13(6.1%)	31(14.6%)	65(30.5%)	96(45.1%)
Increase in quality through efficiency	4(1.9%)	7(3.3%)	29(13.6%)	67(31.5%)	105(49.3%)
Increase in quality through improved communication	6(2.8%)	13(6.1%)	14(6.6%)	77(36.2%)	102(47.9%)
Increase in quality through reduction of errors	10(4.7%)	15(7%)	24(11.3%)	66(31%)	97(45.5%)
Availability of government directives	20(9.4%)	38(17.8%)	42(19.7%)	56(26.3%)	56(26.3%)
Availability of policies for public procurement	13(6.1%)	19(8.9%)	30(14.1%)	66(31%)	84(39.4%)
Availability of legality for public procurement	13(6.1%)	16(7.5%)	40(18.8%)	57(26.8%)	85(39.9%)
Availability of rules for public procurement	11(5.2%)	16(7.5%)	39(18.3%)	55(25.8%)	90(42.3%)
Availability of regulation for public procurement	13(6.1%)	22(10.3%)	32(15%)	58(27.2%)	87(40.8%)

Table 2 presents the frequency and percentage distribution for each of the questions related to the

drivers to e-procurement practices by SMEs in South Sudan. Among the respondents, 23.9% (n = 51) agree, and 50.7% (n = 108) strongly agree that top management support, particularly in terms of capital provision, plays a pivotal role in driving e-procurement adoption by small and medium-sized enterprises in South Sudan. Also, more than half of the respondents agree and strongly agree to the following as the drivers to E-procurement adoption by SMEs in South Sudan : Top management support in terms of supply of ICT equipment, Top management support in terms of staff trainings, Top management support in terms of staff trainings, Cost reductions in terms of processing, transaction and administration, Cost reductions in terms of service, material and product provision, Cost reduction in staffing, Needs for inventory management, Strategic cost savings, Increase in profit margins, Shortened overall procurement processing time, Reduction in evaluation time, shortened communication times, Reduction in order fulfilment and contract completion time, Reduction in delivery time, Improvement in internal workflow, Availability of experience and skilled personnel, Increase in quality through competition, Increase in quality through benchmarking (market intelligence), Increase in quality through efficiency, Increase in quality through improved communication, Increase in quality through reduction of errors, Availability of government directives, Availability of policies for public procurement, Availability of legality for public procurement, Availability of rules for public procurement, and Availability of regulation for public procurement.

Results of principal component analysis of drivers to e-procurement adoption by SMEs in the Republic of South Sudan

A Principal Component Analysis was performed on a 26-items questionnaire assessing the drivers to e-procurement adoption by SMEs in South Sudan, with 213 respondents. The Kaiser-Meyer-Olkin (KMO) measure, which evaluates overall sampling adequacy, yielded an impressive value of 0.936, aligning with Kaiser's (1974) criteria. Additionally, individual KMO values for the questions exceeded 0.7, indicating middling to marvelous adequacy according to Kaiser's (1974). Furthermore, the Bartlett's test of sphericity produced a statistically significant result: $\chi^2(325) = 4066.957$, $p < 0.001$. This confirms a correlation between the variables, rendering them suitable for conducting a principal component analysis. The PCA results after normalization are as follows.

Screen Plot

The screen plot depicted in Figure 2 facilitated the determination of the optimal number of components to retain for principal component analysis. Notably, three components were retained, as evidenced by a noticeable change in direction after the third component.

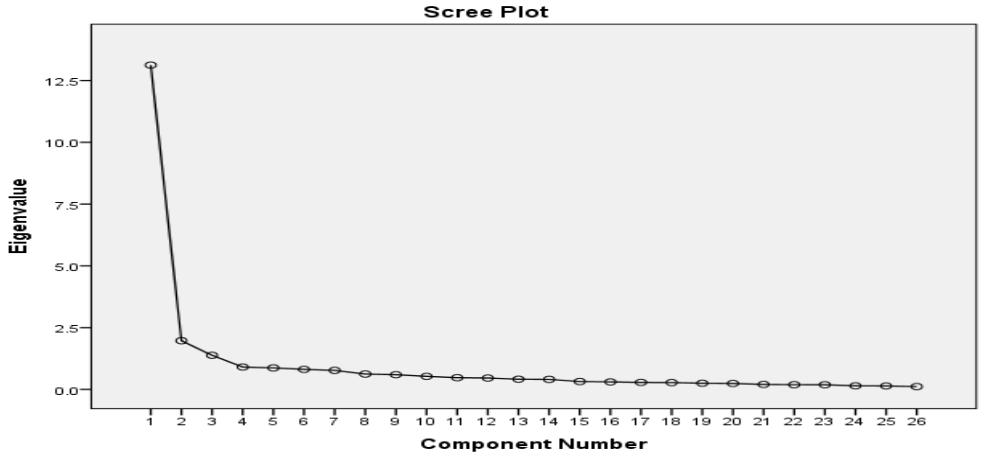

Figure 2: Screen plot for SMEs E-procurement Adoption Drivers in South Sudan.

PCA extraction method

Table 3 depicts the PCA extraction method with a cumulative variance of 63.4% explained. Factors 1, 2, and 3 contributed to 50.5%, 7.6%, and 5.3% of the variance, respectively, post-extraction.

Table 3: Component Transformation Matrix for the Drivers to E-procurement Adoption

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.123	50.5	50.5	13.123	50.5	50.5	6.135	23.6	23.6
2	1.972	7.5	58.1	1.972	7.6	58.1	5.436	20.9	44.5
3	1.380	5.3	63.4	1.380	5.3	63.4	4.904	18.9	63.4
4	.906	3.5	66.8						
5	.871	3.4	70.2						
6	.811	3.1	73.3						
7	.770	3.0	76.3						
8	.622	2.4	78.7						
9	.595	2.3	81.0						
10	.528	2.0	83.0						
11	.475	1.8	84.8						
12	.461	1.8	86.6						
13	.414	1.6	88.2						
14	.407	1.6	89.8						
15	.321	1.2	91.0						
16	.305	1.2	92.2						
17	.285	1.1	93.3						
18	.277	1.1	94.3						
19	.253	1.0	95.3						
20	.240	.9	96.2						
21	.202	.8	97.0						
22	.192	.7	97.7						
23	.189	.7	98.5						
24	.145	.6	99.0						
25	.140	.5	99.6						
26	.115	.4	100.0						

Extraction Method: Principal Component Analysis.

Varimax Rotation Method

Table 4 presents the rotated component matrix of e-procurement adoption drivers for SMEs in the Republic of South Sudan. The three-factor components are labelled as political and legal factors, competitive factors, and management factors. Thus, the PCA objective was achieved by categorizing the 26 drivers into these three components.

Table 4: Rotated Component Matrix of Drivers to E-procurement Adoption

Drivers to E-procurement Adoption	Component		
	1	2	3
Availability of policies for public procurement	**.833**	.183	.160
Availability of legality for public procurement	**.824**	.201	.174
Availability of rules for public procurement	**.807**	.240	.208
Availability of regulation for public procurement	**.781**	.220	.173
Needs for inventory management	**.661**	.282	.291
Availability of government directives	**.601**	.149	.154
Availability of experience and skilled personnel	**.587**	.372	.284
Increase in quality through efficiency	**.568**	.516	.254
Increase in quality through competition	**.445**	.409	.415
Increase in profit margins	**.427**	.418	.399
Shortened communication times	.142	**.770**	.199
Reduction in evaluation time	.166	**.762**	.231
Shortened overall procurement processing time	.305	**.703**	.272
Increase in quality through improved communication	.456	**.662**	.223
Reduction in Time of order fulfilment and contract completion	.229	**.640**	.273
Increase in quality through reduction of errors	.462	**.580**	.196
Reduction in delivery time	.318	**.563**	.222
Increase in quality through benchmarking (market intelligence)	.503	**.517**	.355
Top management support in terms of capital provision	.283	.204	**.809**
Top management support in terms of supply of ICT equipment	.212	.143	**.795**
Cost reductions in terms of processing, transaction, and administration	.153	.216	**.788**
Cost reductions in terms of service, material, and product provision	.277	.339	**.690**
Top management support in terms of staff trainings	.319	.268	**.667**
Cost reduction in staffing	.000	.458	**.578**
Strategic cost savings	.346	.504	**.518**
Improvement in internal workflow	.489	.459	**.505**

Extraction-Method: Principal Component Analysis.
Rotation-Method: Varimax with Kaiser Normalization.
The Rotation converged in 5 iterations.

In line with Table 4, the political and legal factors (component 1 or F1), comprising 10 variables, account for 50.5% of the variance. Competitive factors (component 2 or F2), consisting of 8 variables, explain 7.6% of the variance. Lastly, the management factors (component 3 or F3), which include 8 variables, contribute to 5.3% of the variance.

The results of the Relative Importance Index regarding the drivers to e-procurement adoption by SMEs in South Sudan.

The RII was used to assess the importance of each survey question related to the drivers of e-procurement adoption among SMEs in South Sudan. The ranking results for each variable based on the RII analysis are detailed in Table 5.

Table 5: The RII for SMEs E-procurement Adoption Drivers in South Sudan

Drivers to E-procurement Adoption	M	SD	Relative Importance Index	Ranking	Importance Level
Top management support in terms of capital provision	4.0566	1.21468	0.8113	11	H
Top management support in terms of supply of ICT equipment	4.0094	1.26187	0.8019	13	H
Top management support in terms of staff trainings	4.0660	1.14179	0.8132	9	H
Cost reductions in terms of processing, transaction and administration	3.9340	1.19055	0.7868	18	H-M
Cost reductions in terms of service, material and product provision	3.9811	1.19224	0.7962	15	H-M
Cost reduction in staffing	3.8066	1.26392	0.7613	24	H-M
Needs for inventory management	3.9716	1.11233	0.7943	16	H-M
Strategic cost savings	4.0948	1.05583	0.8190	7	H
Increase in profit margins	3.9953	1.14433	0.7991	14	H-M
Shortened overall procurement processing time	4.1179	1.13549	0.8236	5	H
Reduction in evaluation time	3.9387	1.19280	0.7877	17	H-M
Shortened communication times	4.0284	1.16666	0.8057	12	H
Reduction in time of order fulfilment and contract completion	3.8774	1.18204	0.7755	21	H-M
Reduction in delivery time	3.6540	1.33407	0.7308	25	H-M
Improvement in internal workflow	4.1714	1.03948	0.8343	3	H
Availability of experience and skilled personnel	4.1557	1.06175	0.8311	4	H
Increase in quality through competition	4.1038	1.12220	0.8208	6	H
Increase in quality through benchmarking (market intelligence)	4.0849	1.06756	0.8170	8	H
Increase in quality through efficiency	4.2358	.93941	0.8472	1	H
Increase in quality through improved communication	4.2075	1.00442	0.8415	2	H
Increase in quality through reduction of errors	4.0613	1.13163	0.8123	10	H
Availability of government directives	3.4245	1.30582	0.6849	26	H-M
Availability of policies for public procurement	3.8915	1.20131	0.7783	20	H-M
Availability of legality for public procurement	3.8768	1.20079	0.7754	22	H-M
Availability of rules for public procurement	3.9336	1.17731	0.7867	19	H-M
Availability of regulation for public procurement	3.8679	1.23208	0.7736	23	H-M

In the context of the introduction of e-procurement among SMEs in South Sudan, the importance of various factors is evident from the results shown in Table 5, improving quality through efficiency: this factor holds the highest significance, with a value of 0.8472. Improvement of quality through enhanced communication: following closely, this factor scores 0.8415. Enhancement of internal workflow: it ranks

third, with a value of 0.8343. Availability of experienced and qualified personnel: this aspect contributes significantly, with a value of 0.8311. Reduction in overall procurement processing time: It holds importance, with a value of 0.8236. Improving quality through competition: this factor is also noteworthy, scoring 0.8208. Strategic Cost Savings: Lastly, strategic cost savings play a role, with a value of 0.8190. Conversely, the three least-ranked questions (24th, 25th, and 26th) pertain to: Staffing cost reduction (value: 0.7613), Delivery time reduction (value: 0.7308), Government policy availability (value: 0.6849).

Analytical Hierarchy Process Results for SMEs E-procurement Adoption Drivers in South Sudan.

The Analytical Hierarchy Process, a multi-criteria decision-making method pioneered by Prof. Saaty in the 1970s, is computed as follows:

Hierarchical structure for Drivers to E-procurement adoption.

Figure 3 illustrates the hierarchical structure derived from the PCA results, organized into three levels: Level 1: This level centers on goals or objectives, specifically related to the drivers to e-procurement adoption. Level 2: It comprises of three decision criteria: political and legal factors (F1), competitive factors (F2), and management factors (F3). Level 3: within this level, there are 26 sub-criteria, describing their interrelationships and relative importance.

Figure 3: Hierarchical Structure of drivers to E-procurement Adoption by SMEs.

Pairwise comparison for Criteria (Political and Legal, Competitive and Management factors)

Table 6 illustrates the established scale used for assigning pairwise comparison values to elements corresponding to RII values.

Table 6: Assign Pairwise Comparison Values to RII Values.

Scale	Range	Assigned Value
High Importance	0.8-1.0	7,8,9
High Medium	0.6-0.8	5,6,7
Medium	0.4-0.6	3,4
Medium Low	0.2-0.4	2
Low	0.0-0.2	1

Table 7, 8 and 9 illustrates pairwise comparisons-matrix for i) political and Legal Criteria, ii) competitive factors and iii) management factors.

Table 7: Matrix of pairwise comparison of political and legal factors

				Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1	Drivers F1
Objective	Criteria	Sub Criteria	RII	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Drivers	F1	C1	0.8311	1	6	5	5	5	6	6	7	7	6
Drivers	F1	C2	0.6849	0.1666667	1	3	3	3	4	4	5	5	4
Drivers	F1	C3	0.7754	0.2	0.3333333	1	1	1	2	2	3	3	2
Drivers	F1	C4	0.7783	0.2	0.3333333	1	1	1	2	2	3	3	2
Drivers	F1	C5	0.7736	0.2	0.3333333	1	1	1	3	2	3	3	2
Drivers	F1	C6	0.7867	0.1666667	0.25	0.5	0.5	0.3333333	1	1	2	2	1
Drivers	F1	C7	0.7991	0.1666667	0.25	0.5	0.5	0.5	1	1	2	2	2
Drivers	F1	C8	0.8208	0.1428571	0.2	0.3333333	0.3333333	0.3333333	0.5	0.5	1	1	2
Drivers	F1	C9	0.8472	0.1428571	0.2	0.3333333	0.3333333	0.3333333	0.5	0.5	1	1	2
Drivers	F1	C10	0.7943	0.1666667	0.25	0.5	0.5	0.5	1	0.5	0.5	0.5	1

Table 8: Matrix of pairwise comparison of competitive factors

				Drivers F2	Drivers F2	Drivers F2	Drivers F2	Drivers F2	Drivers F2	Drivers F2	Drivers F2
Objective	Criteria	Sub Criteria	RII	C11	C12	C13	C14	C15	C16	C17	C18
Drivers	F2	C11	0.817	1	6	6	3	6	6	7	7
Drivers	F2	C12	0.8415	0.1666667	1	6	2	5	5	6	6
Drivers	F2	C13	0.8123	0.1666667	0.1666667	1	2	4	4	5	5
Drivers	F2	C14	0.7308	0.3333333	0.5	0.5	1	4	4	5	5
Drivers	F2	C15	0.7877	0.1666667	0.2	0.25	0.25	1	3	4	4
Drivers	F2	C16	0.7755	0.1666667	0.2	0.25	0.25	0.3333333	1	4	4
Drivers	F2	C17	0.8057	0.1428571	0.1666667	0.2	0.2	0.25	0.25	1	3
Drivers	F2	C18	0.8236	0.1428571	0.1666667	0.2	0.2	0.25	0.25	0.3333333	1

Table 9: Matrix of pairwise comparison of management factors

				Drivers F3	Drivers F3	Drivers F3	Drivers F3	Drivers F3	Drivers F3	Drivers F3	Drivers F3
Objective	Criteria	Sub Criteria	RII	C26	C25	C24	C23	C22	C21	C20	C19
Drivers	F3	C26	0.7613	1	6	5	3	1	4	7	7
Drivers	F3	C25	0.7868	0.1666667	1	4	2	1	3	6	6
Drivers	F3	C24	0.7962	0.2	0.25	1	6	8	2	7	7
Drivers	F3	C23	0.8343	0.3333333	0.5	0.1666667	1	9	3	9	9
Drivers	F3	C22	0.819	1	1	0.125	0.1111111	1	1	6	6
Drivers	Fe	C21	0.8113	0.25	0.3333333	0.5	0.3333333	1	1	5	6
Drivers	F3	C20	0.8132	0.1428571	0.1666667	0.1428571	0.1111111	0.1666667	0.2	1	1
Drivers	F3	C19	0.8019	0.1428571	0.1666667	0.1428571	0.1111111	0.1666667	0.1666667	1	1

Tables 7, 8, and 9 represent matrices for capturing pairwise comparisons between each element and criterion. The diagonality of the element in the matrix is 1, which means that an element is as important as itself. The top triangular elements contain values assigned from the RII, indicating the preference or importance of one element over another. The lower triangle elements represent the

reciprocals of the corresponding upper triangle elements.

Normalisation of Decision Matrix

The decision matrix was subjected to normalisation to derive priority vectors through the calculation of eigenvalues and eigenvectors, as shown in Tables 10, 11 and 12.

Table 10: Normalized Matrix of Political and Legal Factors

Criteria	Sub Criteria	ROW TOTAL	E1 NORMALIZED	Eo NORMALIZED	Diff
Political and Legal Factor	Availability of experience and skilled personnel	78521.24556	0.37545	0.37566	-0.00021
Political and Legal Factor	Availability of government directives	36851.77995	0.17621	0.17976	-0.00356
Political and Legal Factor	Availability of legality for public procurement	16940.65439	0.08100	0.08124	-0.00024
Political and Legal Factor	Availability of policies for public procurement	16940.65439	0.08100	0.08124	-0.00024
Political and Legal Factor	Availability of regulation for public procurement	17857.37807	0.08539	0.08582	-0.00043
Political and Legal Factor	Availability of rules for public procurement	9662.14983	0.04620	0.04578	0.00042
Political and Legal Factor	Increase in profit margins	10652.58165	0.05094	0.05006	0.00088
Political and Legal Factor	Increase in quality through competition	7155.48579	0.03421	0.03288	0.00134
Political and Legal Factor	Increase in quality through efficiency	7155.48579	0.03421	0.03288	0.00134
Political and Legal Factor	Needs for inventory management	7400.96772	0.03539	0.03468	0.00071
	Sum	209138.38314	1.00000	1.00000	0.00000

Table 11: Normalised Matrix of Competitive Factors

Criteria	Sub Criteria	ROW TOTAL	E1 NORMALIZED	Eo NORMALIZED	Diff
Competitive Factor	Increase in quality through benchmarking (market intelligence)	55650.67378	0.40042	0.37902	0.02140
Competitive Factor	Increase in quality through improved communication	30026.59574	0.21605	0.22883	-0.01278
Competitive Factor	Increase in quality through reduction of errors	16249.65685	0.11692	0.12738	-0.01046
Competitive Factor	Reduction in delivery time	15807.22008	0.11374	0.11893	-0.00519
Competitive Factor	Reduction in evaluation time	8174.39637	0.05882	0.06090	-0.00209
Competitive Factor	Reduction in order fulfilment and contract completion time	6312.17288	0.04542	0.04292	0.00250
Competitive Factor	Shortened communication times	3824.59663	0.02752	0.02367	0.00385
Competitive Factor	Shortened overall procurement processing time	2935.80319	0.02112	0.01836	0.00277
	Sum	138981.11552	1.00000	1.00000	0.00000

Table 12: Normalised Matrix of Management Factors

Criteria	Sub Criteria	ROW TOTAL	E1 NORMALIZED	Eo NORMALIZED	Diff
Management Factors	Cost reduction in staffing	66553.87745	0.31847	0.28728	0.03119
Management Factors	Cost reductions in terms of processing, transaction and administration	35002.49859	0.16749	0.16627	0.00123
Management Factors	Cost reductions in terms of service, material and product provision	41280.41092	0.19753	0.23131	-0.03377
Management Factors	Improvement in internal workflow	30013.05317	0.14362	0.16037	-0.01675
Management Factors	Strategic cost savings	17265.91906	0.08262	0.06918	0.01344
Management Factors	Top management support in terms of capital provision	11883.55344	0.05686	0.05592	0.00094
Management Factors	Top management support in terms of staff trainings	3508.71290	0.01679	0.01497	0.00182
Management Factors	Top management support in terms of supply of ICT equipment	3472.02199	0.01661	0.01471	0.00190
	Sum	208980.04752	1.00000	1.00000	0.00000

Tables 10, 11, and 12 shows that the eigenvector corresponding to the highest eigenvalue, denoted as $\lambda_{max,}$ underwent normalisation. This normalisation process entailed dividing each element of the

eigenvector by the total-sum of its elements, ensuring that the sum of the vector's values equates to 1. Consequently, the normalised eigenvector presents the hierarchy of importance for the sub-criteria.

Consistence Ratio

In the analytic hierarchy processes, the consistency index (CI) serves as a pivotal measure to evaluate the coherence of pairwise comparisons conducted by decision makers. It quantifies the extent of inconsistency in the judgments made throughout the decision-making process. To assess consistency more thoroughly, the consistency-ratio (CR) is calculated by dividing the consistency-index (CI) by the randomness index (RI). The result of the CR is presented in Table 13.

Table 13: Consistence Ratio for Drivers to e-procurement adoption

Management Factors		Political & Legal Factors		Competitive Factors	
Lambda Max	10.6121	Lambda Max	10.5066	Lambda Max	9.3745
Consistency index	0.0533	Consistency index	0.0063	Consistency index	0.0281
Random Consistency Index	1.4300	Random Consistency Index	1.5000	Random Consistency Index	1.4300
Consistency Ratio	0.0373	Consistency Ratio	0.0042	Consistency Ratio	0.0196

Table 13 shows that the consistency ratio approaches zero for each sub-criterion. Therefore, the normalized eigenvector is calculated accurately and can be effectively used for decision-making purposes.

Ranking of the factor based on optimal weight calculation.

Table 14 show ranking of the factor based on the optimal weight calculation on each sub-criterion.

Table 14: AHP Weightages and Ranking of Drivers to E-Procurement Adoption

Objective	CRITERIA	SUB CRITERIA	AHP Weightage	AHP Ranking
Drivers	Management Factors	Cost reduction in staffing	0.3185	1
Drivers	Management Factors	Cost reductions in terms of processing, transaction and administration	0.1675	3
Drivers	Management Factors	Cost reductions in terms of service, material and product provision	0.1975	2
Drivers	Management Factors	Improvement in internal workflow	0.1436	3
Drivers	Management Factors	Strategic cost savings	0.0826	3
Drivers	Management Factors	Top management support in terms of capital provision	0.0569	6
Drivers	Management Factors	Top management support in terms of staff trainings	0.0168	7
Drivers	Management Factors	Top management support in terms of supply of ICT equipment	0.0166	8
Drivers	Political and Legal Factor	Availability of experience and skilled personnel	0.3755	1
Drivers	Political and Legal Factor	Availability of government directives	0.1762	2
Drivers	Political and Legal Factor	Availability of legality for public procurement	0.0810	4
Drivers	Political and Legal Factor	Availability of policies for public procurement	0.0810	5
Drivers	Political and Legal Factor	Availability of regulation for public procurement	0.0854	5
Drivers	Political and Legal Factor	Availability of rules for public procurement	0.0462	7
Drivers	Political and Legal Factor	Increase in profit margins	0.0509	6
Drivers	Political and Legal Factor	Increase in quality through competition	0.0342	8
Drivers	Political and Legal Factor	Increase in quality through efficiency	0.0342	8
Drivers	Political and Legal Factor	Needs for inventory management	0.0354	8
Drivers	Competitive Factor	Increase in quality through benchmarking (market intelligence)	0.4004	1
Drivers	Competitive Factor	Increase in quality through improved communication	0.2160	2
Drivers	Competitive Factor	Increase in quality through reduction of errors	0.1169	3
Drivers	Competitive Factor	Reduction in delivery time	0.1137	4
Drivers	Competitive Factor	Reduction in evaluation time	0.0588	5
Drivers	Competitive Factor	Reduction in order fulfilment and contract completion time	0.0454	6
Drivers	Competitive Factor	Shortened communication times	0.0275	7
Drivers	Competitive Factor	Shortened overall procurement processing time	0.0211	8

The AHP results presented in Table 14 shows the key drivers for e-procurement the adoption by SMEs. The top sub-criteria in management factors include cost reduction in staffing, cost reduction in processing, transaction, and administration as well as cost reduction in service, material,and product provision. These specific factors have emerged as the most influential drivers for e-procurement adoption. The results are consistent with a previous study conducted by Al-Yahya et al. (2018), who also underlined that the motivation to implement e-procurement is based on SMEs desire to reduce processing, transaction, and administrative costs. Furthermore, findings from a report written by Svidronova and Mikus (2015) support these findings and illustrate that the motivation for the introduction of e-procurement lies in the pursuit of cost reductions in the provision of services, personnel, materials, and products.

In the political and legal driving factors, the study underscores the significance of "Availability of experienced and skilled personnel" and "Availability of government directives" as the most influential drivers, highlighting their critical role in driving e-procurement adoption. These findings are in line with the research conducted by Asare and Prempeh (2017), which emphasized the critical importance of having proficient and qualified personnel for the successful implementation of e-procurement in public procurement offices. Additionally, Muguro (2014) and Azanlerigu and Akay (2015) have similarly emphasized the pivotal role played by robust legal frameworks, underlining their foundational significance in business transactions and their promotion of e-procurement adoption among SMEs.

In the competitive factors category, increasing quality through benchmarking (market intelligence) and increasing quality through improved communication proved to be key drivers. These findings align with the research conducted by Hassan et al. (2017), indicating that employing marketing intelligence tools in procurement to enhance quality through benchmarking encourages SMEs to embrace e-procurement. Furthermore, Khan et al. (2016), and Kim et al. (2015) have also highlighted that improving quality through improved communication and information sharing between project participants is another factor driving e-procurement the adoptions.

CONCLUSIONS AND RECOMMENDATIONS

The study examined the factors influencing e-procurement adoption among SMEs in South Sudan, using a cross-sectional quantitative survey to collect data from 300 systematically selected SMEs. However, it faced various limitations, including limited financial resources, limited availability of empirical research, reliance on outdated secondary data, and inadequate sample sizes. The research findings could not be generalized to SMEs in developed and other developing countries because the focus is on the drivers of e-procurement adoption in the Republic of South Sudan, a country ravaged by war and limited resources.

Subsequent studies should contrast the main motivations for adopting e-procurement as perceived by SMEs in emerging and developed economies, while promoting the adoption of e-procurement among counterparts in the Republic of South Sudan through strategies such as: i) investing in skilled personnel by recruiting and retaining talent with proficiency in procurement processes, technology, and relevant legal frameworks, (ii) advocating for government directives and policies that support e-procurement initiatives, (iii) investing in tools and platforms that enable effective communication among stakeholders involved in the procurement process, (iv) using market intelligence tools to benchmark their procurement practices against industry standards and competitors, (v) Implementing cost reduction strategies, such as investing in technology that automate and streamlining procurement processes, reducing administrative overheads, and optimizing resource utilization that incentivize SMEs to adopt e-procurement solutions, (vi) promoting training and awareness programs to educate employees about the benefits and functionalities of e-procurement

systems, and (vii) collaborating with industry partners, suppliers, and service providers to facilitate knowledge sharing and create opportunities for joint initiatives in e-procurement adoption, (viii) adhering to data privacy laws, security standards, and procurement guidelines is essential to build trust and credibility among stakeholders. Future research should integrate qualitative methods to examine the factors that drive e-procurement adoption among SMEs. In summary, this study contributed to the existing literature on the drivers of e-procurement adoption, benefiting researchers, organizations, stakeholders, and SMEs alike.

Declaration of Competing Interest

The authors certify that they are not aware of any financial interests or personal relationships that could have influenced the research reported in this document.

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