



TECHNOLOGY AWARENESS OF ARTIFICIAL INTELLIGENCE (AI) APPLICATION FOR PUBLIC PROCUREMENT PROCESS IN NIGERIA

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ABSTRACT

The public procurement process of acquiring goods, works and services has been observed to be suffering from inefficiencies in the forms of corruption cases, absence of transparency, faulty procedures, and dysfunctional bureaucratic ties. In Nigeria, it was discovered that the public procurement process has the potential of reaping the benefits of Artificial Intelligence (AI). However, the level of awareness of the public procurement practitioners of the significance of incorporating AI in procurement is yet to be studied. This study assessed the awareness of Artificial Intelligence application for public procurement processes in Nigeria. Data was collected using questionnaire survey. The questionnaire was distributed to public procurement practitioners with at least 5 years of experience in procurement. Data was analysed using Mean, Standard Deviation, and Relative importance index. Analysis of variance and Independent t-test was then used to ascertain the level of awareness of the respondents based on their attributes. The study discovered information about Artificial intelligence is quite vast as the parameter 'I have heard about AI' got the highest ranking with mean score of 3.63 and RII of 72.58%, while 'I use AI for procurement processes' to be the lowest ranking attribute with mean score of 1.50 and RII of 30.00% meaning even though information is available, the usage of AI for procurement is quite low. Additionally, the results show that while AI is a popular concept within procurement organisations, majority of the procurement practitioners have little knowledge of its application in public procurement. The research recommends that, public procurement organisations should develop the capacity of their employees on the utilisation of AI in procurement process.

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1.0 Introduction

The public procurement process of acquiring goods, works and services has been noted to be suffering from inefficiencies such as corruption, absence of transparency, faulty procedures, and dysfunctional bureaucratic ties (Yap et al., 1994). This led to several calls for transition from the manual paper-based approach to a digitised method (Expert Group Meeting Report; EGMR, 2011). The transition came along with numerous positive feedbacks. These include reduced procurement expenses, expanded aptitude as well as transparency, abridged corruption and enhanced accountability (EGMR, 2011; eTEG, 2012).

Several efforts have been made to transit from the manual paper-based procurement method towards digitising the procurement approach. This started with the development of one-way

information systems that digitise only tender advertisement. This was followed with more encompassing systems which were developed to digitise the entire front-end and back-end procedures of the procurement system (Betts *et al.*, 2006). Studies were carried out to address different aspects of the systems development. They include design and implementation (Lai *et al.*, 2007); interoperability and integration across manifold platforms (Noor *et al.*, 2003); legal and security requirements (Du *et al.*, 2004a,b; Betts *et al.*, 2006); and tender evaluation through decision support system (Padumansa and Rehan, 2009; Noor and Man, 2010; and Noor and Mohemmad, 2010); and e-Tendering research in Africa (Adebiyi *et al.*, 2010; Muchiri *et al.*, 2015; and Afolabi *et al.*, 2017).

More recently, Artificial Intelligence (AI) is being used to automate procurement processes. This is because the procurement lifecycle generates tonnes of data, and AI is heavily reliant on data. Studies have been conducted where AI has been applied to different procurement processes including analysis of spend (Domingos *et al.*, 2016), prequalification and selection of contractor/supplier (Khosrowshahi, 1999; Lam *et al.*, 2000; Lam *et al.*, 2001; Elazouni, 2006; and Zhang *et al.*, 2016), evaluation and classification of tender (Kim, *et al.*, 2018; Ovsyanniko and Domashova, 2020) as well as in contract management (Hassan and Le, 2020).

In Nigeria, several efforts have been made to digitise the public procurement lifecycle (Adebiyi *et al.*, 2010; Afolabi *et al.*, 2017; and Abdullahi *et al.*, 2022, 2020, 2019). Yamusa *et al.* (2020) found that the public procurement process in Nigeria has the potential of reaping the benefits of AI. This was further confirmed by studies who modelled requirements and developed machine learning models for a web-based e-procurement system for Nigerian public procuring entities (Abdullahi *et al.*, 2024; Yamusa *et al.*, 2023). However, the level of awareness of the public procurement practitioners of the significance of incorporating AI in the conduct of their daily procurement tasks is yet to be studied. It is important to establish whether public procurement users are aware of how to use AI in various public procurement processes. Hence, this study aims to determine the level of awareness of procurement practitioners of using AI for procurement processes. This study will reveal to public procuring entities the benefits of AI methods in carrying out procurement processes effectively.

2.0 Methodology

A quantitative research approach was adopted for this study, where questionnaire survey was used. Thirteen statements regarding awareness level of AI are established (Basaif *et al.*, 2020) and used in designing the questionnaire for data collection. The questionnaire was distributed purposively to public procurement practitioner with at least 5 years of experience involved in the procurement of goods, works and services.

A Likert scale (5-point) was adopted for gauging the variables of the questionnaire where 1 represents “Totally Disagree” and 5 represents “Totally Agree”. The sample size was determined using the Krejcie and Morgan (1970)’s formula in equation 1:

$$S = \frac{Z^2NP(1-P)}{d^2(N-1)+X^2P(1-P)} \quad (1)$$

Where:

S = required sample size

χ^2 = table of value of chi-square for 1 degree of freedom at the desired confidence level (3.841)

N = the population size

P = the population proportion (assumed to be 0.50)

d = degree of accuracy expressed as a proportion (0.05)

A minimum sample size of 186 was determined. The questionnaires were sent via online using e-mails and social media platforms. 62 valid responses amounting to approximately 32% of the total distributed were retrieved and found to be adequate for analysis. This is because Moser and Kalton (1979) noted that amount of feedback is fitting as it yields a return percentage of 30-40%.

Data collected was analysed using SPSS (Statistical Package for the Social Sciences) Version 23 (IBM). Firstly, the frequencies, measures of central tendency (the Mean), measurements of dispersion based on the Mean (Standard Deviation), and Relative Important Index (RII) were determined. The RII was used in ranking the variables according to the retrieved responses to the level of awareness on AI. The RII was calculated using the Field (2013) formula in equation 2:

$$RII = \frac{\sum W}{A * N} \quad (2)$$

Where:

RII = Relative Important Index

W = the weight of each factor as obtained by the respondents (1 to 5).

A = the highest weight (5 in this questionnaire).

N = the overall number of respondents.

The RII has a range of 0 to 1, where 0 was not included, and the variables are presented with the highest on top and the lowest at the bottom. The natural value of RII was determined and the total average RII of the awareness attributes/statements was compared against the neutral RII to make decision on the level of awareness of the practitioners. Total average RII of the awareness attributes \geq the neutral RII implies high awareness while total average RII of awareness variables $<$ the neutral RII implies low awareness. This method can be found in similar studies by Enhassi et al. (2019) and Basaif et al. (2020).

Inferential statistical analysis using analysis of variance (ANOVA) (for attributes with three groups) and Independent t-test (for attributes with two groups) was further conducted to ascertain the level of awareness of the respondents based on their various attributes.

3.0 Results and Discussion

3.1 Demographic Information of Respondents

Table I presents us with demographic information of the respondents of this study.

Table I: Respondents' Profile

Attributes	Classification	Frequency	Percentage
Years of Existence of Procuring Entity	1-5 years	12	19.4
	6-10 years	12	19.4
	11-15 years	26	41.8
	Above 15 years	12	19.4
Annual Turnover of PE	50-250 million	14	22.6
	501-750 million	16	25.8
	Above 750 million	32	51.6
Gender	Female	12	19.4
	Male	50	80.6
Academic Qualification	Bachelor	22	35.5
	Masters	32	51.6
	Others	8	12.9
Rank	Operational management level	14	22.6
	Middle management level	30	48.4
	Senior/strategic management	18	29
Years of Experience	At least 5 years	30	48.4
	6-10 years	14	22.6
	11-15 years	12	19.4
	Above 15 years	4	6.4
BPP Conversion Status	No	14	22.6
	Yes	48	77.4
Other Relevant Certification	No	12	19.4
	Yes	50	80.6
Status of Certification	Fellow	8	12.9
	Corporate member	24	38.7
	Probationer member	4	6.4
	Other	25	41.9

Source: Authors' Analysis (2022)

The result shows that, 41.8% of the PE have been in existence for about 11-15 years and 19.4 have been in existence for over 15 years hence, 61.2% of the procurement entities have been in existence for over 10 years which adds credibility to the findings of this study. Additionally, it was discovered that the PEs are engaged in procurement activities with 51.6% having an annual

turnover above 750 million naira and 25. 8% having an annual turnover of 500 to 700 million naira.

Results received from the respondents show that male respondents constitute 80.6% whereas the female was only at 19.4% which shows that the number of male procurement officers far outweighs that of female officers. Interestingly, 87.1% of the respondents are having a bachelor or master's degree hence, majority of procurement officers are graduates. Middle level managers made up 48.4% of the respondents while strategic managers made 29% of the respondents, this implies that people with the desired information about procurement administration make majority of the respondents. which is further buttressed by the finding that 51.6% of the respondents have an experience above 5 years. Also, 77.4% have attended the conversion training offered by the Bureau of Public Procurement. However, 80.6% of the respondents hold other relevant certification, where 38.7% of them are corporate members and 12.9% of them are fellows. These qualifications and level of experience in terms of years, education and conversion training helped in shaping the level of accuracy of this study.

3.2 Level of Awareness of the Public Procurement Practitioners of Using AI for Procurement Processes

This section assesses the level of awareness of AI by public procurement practitioners in Nigeria. The established set of 13 statements presented in the questionnaire were used in assessing the respondents' level of awareness of using AI for procurement processes. Means, Standard Deviations, RII, were used to analyse the data and results are presented in Table 2.

Table 2: Awareness of the Public Procurement Practitioners of Using AI for Procurement Processes

Attributes/statements	Mean	SD	RII (%)	Rank
I have heard about AI	3.63	1.462	72.58	1
I think AI can help and add value to my daily work	3.44	1.500	68.71	2
I have knowledge about the concept of AI technology	3.35	1.380	67.10	3
I think AI will be a useful tool for procurement processes	3.11	1.404	62.26	4
I know that AI technology is important for carrying out procurement processes in the Nigerian construction industry	3.05	1.431	60.97	5
I have read some research and studies about AI	2.95	1.498	59.03	6
I have knowledge on how to use AI technology tools	2.34	1.070	46.77	7
I practice AI in my job	1.94	1.158	38.71	8
People within my organisation are talking about using AI for procurement processes	1.74	.626	34.84	9
I have attended training on AI	1.69	.781	33.87	10
My Organisation provides formal training on AI including follow-up programs	1.65	.726	32.90	11
I have taken some courses about AI	1.60	.664	31.94	12
I use AI for procurement processes	1.50	.671	30.00	13
Total Average	2.46		49.21	

Source: Authors' Analysis (2022)

From Table 2, according to the mean score and relative importance index (RII) of the awareness attributes, 'I have heard about AI, I think AI can help and add value to my daily work and I have Knowledge about the concept of AI technology are the top three attributes with mean score of 3.64, 3.44, 3.35 AND RII of 72.58, 68.71 and 67.1 respectively. The study also discovered that the factors with lowest mean score and RII are My organisation provides formal training on AI including follow up, I have taken some courses about AI and I use AI for procurement processes with low mean scores of 1.65, 1.60, 1.5 and low RII of 32.9, 31.94 and 30.00 respectively.

This means that despite the fact that most procurement officers are aware of AI and its potential to make their work better, they receive very low support on training from their organisation and also do not make personal efforts to learn about AI hence, they barely use it in procurement process.

The overall average mean scores of the 13 statements used to assess the respondents' level of awareness of AI in procurement process is 2.46 which implies that the awareness of artificial intelligence in procurement is low, this is further buttressed by the average Relative importance index of 49.21 which is below the neutral RII of 60 The result agrees with Basaif *et al.* (2022) who found that, the awareness of AI is low in the Malaysian construction industry. Moreso, there is lack of knowledge of the application of AI among practitioners (Basaif *et al.*, 2020).

3.3 Awareness of the Public Procurement Practitioners of Using AI for Procurement Processes Based on the Respondents' Attributes

This section assesses the differences in the level of awareness in the use of AI by public procurement practitioners in Nigeria based on their demographic classifications. The ANOVA test was used to check if there is significance difference in the level of awareness of the Procurement officers based on Years of Existence of the Procurement Entity, Annual Turnover of the Procurement entity, Academic Qualification, Rank and Years of Experience and Status of Certification.

From Table 3, it can be seen that the attribute Years of Existence showed no significant difference in the respondents' awareness of 'I have taken some courses about AI', 'I have attended training on AI' and 'People within my organisation are talking about using AI for procurement processes'. For the other 10 factors, the result shows statistical significant difference in the awareness of the respondents as the significance level is less than 0.05.

Based on the Annual Turnover of PE, six factors, including 'I have knowledge about the concept of AI technology', 'I have read some research and studies about AI', 'I have taken some courses about AI', 'I have heard about AI', 'I think AI can help and add value to my daily work' and 'My Organisation provides formal training on AI including follow-up programs' reveal statistical significance difference in the level of awareness of the respondents. The remaining 7 factors have no statistical significant difference.

Table 3: Awareness of the Public Procurement Practitioners Using the Respondents' Attributes

Attributes/statements	Years of Existence of PE	Annual Turnover of PE	Academic Qualification	Rank	Years of Experience	BPP Conversion Status	Status of Certification
	Sig. (.05)						
I have knowledge about the concept of AI technology	0.000	0.001	0.000	0.031	0.007	0.506	.584
I have read some research and studies about AI	0.000	0.000	0.001	0.481	0.703	0.004	.000
I have taken some courses about AI	0.061	0.022	0.000	0.029	0.000	0.001	.025
I have knowledge on how to use AI technology tools	0.008	0.161	0.004	0.003	0.095	0.044	.000
I know that AI technology is important for carrying out procurement processes in the Nigerian construction industry	0.000	0.233	0.001	0.608	0.225	0.012	.000
I have heard about AI	0.000	0.003	0.004	0.101	0.631	0.020	.000
I have attended training on AI	0.064	0.983	0.002	0.056	0.017	0.002	.208
I practice AI in my job	0.037	0.961	0.168	0.045	0.857	0.000	.185
I think AI can help and add value to my daily work	0.000	0.009	0.000	0.718	0.294	0.161	.000
My Organisation provides formal training on AI including follow-up programs	0.038	0.010	0.004	0.067	0.000	0.000	.114
I use AI for procurement processes	0.000	0.339	0.146	0.146	0.632	0.502	.004
People within my organisation are talking about using AI for procurement processes	0.086	0.191	0.044	0.007	0.340	0.946	.000
I think AI will be a useful tool for procurement processes	0.000	0.793	0.017	0.000	0.135	0.896	.028

Source: Authors' Analysis (2022)

Respondents' Academic Qualification affects their level of awareness. This is obvious as eleven factors have been found to be significantly different. Only 'I practice AI in my job' and 'I use AI

for procurement processes' have shown no statistical significant difference in the level of awareness of the respondents.

Based on the Rank of the respondents, 6 factors which include 'I have knowledge about the concept of AI technology', 'I have taken some courses about AI', 'I have knowledge on how to use AI technology tools', 'I practice AI in my job', 'People within my organisation are talking about using AI for procurement processes' and 'I think AI will be a useful tool for procurement processes' have been found to reveal statistical significance difference. The other factors have a significance level greater than 0.05.

The Years of Experience of the respondents has shown little effect on the level awareness of the respondents with only four have statistically significantly different. 'I have knowledge about the concept of AI technology', 'I have taken some courses about AI', 'I have attended training on AI' and 'My Organisation provides formal training on AI including follow-up programs' have a significant level less than 0.05. The rest of the nine factors have a significance level above 0.05.

The BPP Conversion Status of the respondents has shown a significant level of impact on the awareness of the respondents on the use of AI in public procurement process. Five factors including 'I have knowledge about the concept of AI technology', 'I think AI can help and add value to my daily work', 'I use AI for procurement processes', 'People within my organisation are talking about using AI for procurement processes' and 'I think AI will be a useful tool for procurement processes' have a significance level greater than 0.05. This indicates that there is no significant difference in the respondents' awareness of these factors. However, there is high significance level of awareness by the respondents on the remaining eight factors with a significance level less than 0.05.

'I have knowledge about the concept of AI technology', 'I have attended training on AI', 'I practice AI in my job' and 'My Organisation provides formal training on AI including follow-up programs' have shown no statistical significant difference with a significance level higher than 0.05 for the Status of Certification attribute. The remaining nine factors have a significance level lower than 0.05. This shows that the awareness of the respondents in these factors are statistically significantly different.

4.0 Conclusion

The result of the study indicates that most procurement officers have heard about AI, they believe AI can add value to their daily work and have knowledge about the concept of AI however procurement officers barely attend any training on AI, this is further buttressed by the finding of this study that indicates that organisations hardly provide formal training on AI also, procurement officers barely take courses on AI and its usage for procurement processes is very low.

The study discovered that there is significant difference in the respondents level of awareness of artificial intelligence based on their Years of Existence, Academic Qualification, BPP Conversion, Status of Certification, Annual Turnover and Rank. On the contrary, the study found out that

there was no significance difference on the awareness level based on Years of Experience of the respondents.

The research concludes that the level of awareness of Application of Artificial intelligence in public procurement is low owing to the overall low mean score of 2.46 and a 49.21 score of relative importance., The analysis of variance also shows that there is a significant difference in the awareness level of application of AI in public procurement based on the difference in demographics of the procurement officers. The study recommends that, public procurement organisations as well as the government should demonstrate commitment to develop the capacity of their employees on the utilisation of AI in procurement process. Emphasis should be paid on the newly established public procurement organisations. Also, special attention should be given to public procurement professionals with low Academic Qualification and Status of Certification, as well as professionals with no BPP Conversion.

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