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ORIGINAL RESEARCH ARTICLE

FRAMEWORK FOR INVESTIGATING CONTRACTOR SELECTION DECISION SUPPORT SYSTEMS' (CS-DSS) ACCEPTANCE BY PUBLIC PROCUREMENT PERSONNEL

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ABSTRACT

Laboratory-based designs of contractor selection decision support systems (CS-DSSs) are common in construction management research. However, target end-users like the public procurement entities do not usually make use of these ubiquitous technologies in practice, in spite of their enormous potentials. The absence of reliable framework for investigating technology adoption in public procurement has continued to impede the possibilities of investigating the acceptance of such technologies. The present study aims at developing a framework for investigating CS-DSS acceptance for the smallest decision making unit in public procurement. The structure of a novel theoretical techno-psychological framework for investigating CS-DSS acceptance in Nigerian public procurement is presented in this paper through the lens of an extended innovation diffusion theory - technology acceptance model (IDT-TAM). From an individual level remit (micro-level), a strategic review of literature was followed by a Delphi survey of carefully selected 18-number procurement experts in Nigeria. The study shows that the prescriptions of CS-DSSs by researchers can be supported by a foresight on the end-user behavioral intension to use such technologies. Operationalization of the framework with empirical data can model the acceptance behavior of procurement personnel on CS-DSSs before they are adopted at the organizational or strategic level for enhanced contractor selection in public procurement. The emerging framework is recommended for designers of CS-DSS for articulating the antecedent behavior of public procurement personnel.

1.0 Introduction

Contractor selection decision support systems (CS-DSS) are computer-based information systems that are designed to enhance the selection of contractors. These systems become attractive when they align with specific requirement for their use (Zhang et al., 2017). However, the acceptance of DSSs is a recognized antecedence to their adoption (Momani et al., 2017; Momani et al., 2018). Although CS-DSSs abound as readily available prescription from many construction management research, they are generally ignored by the target end-users in the midst of growing pressures on public procurement personnel to use them (BPP, 2011b; PPA, 2007). The neglect of DSSs in the face of their obvious relevance, requires a

forward-looking proposition for their use, relying on relevant technology acceptance model(s) (Al-rahmi et al., 2018; Cheung and Vogel, 2013).

Some studies have posited that the adoption of technology in public procurement is influenced by political and economic factors, in addition to government's strategic decision to introduce the technology (De Clerck and Demeulemeester, 2016; Henriksen and Mahnke, 2005). Available technology acceptance models do not sufficiently contain factors that recognize the perculiarity of the contractor selection task in public procurement. For instance, the public procurement field is neither a mandatory nor a voluntary field. The end-user's preference to the driving systems in contractor selection technologies will influence their intension to use them (El-gazzar et al, 2016; Venkatesh et al., 2003). Therefore, relevant factors in a framework will serve as suitable structure to aid the prediction of use for a contractor selection decision support system (CS-DSS) (Davis and Venkatesh, 1996; Venkatesh and Davis, 2000; Venkatesh et al., 2003). Such frameworks are, however, lacking in extant literature, hence, the justification for this paper.

In order to design acceptance framework for DSSs, the inclusion of domain-specific factors for public procurement such as the subjectivity in decision making during contractor selection (Bobar et al., 2015; Plebankiewicz and Kubek, 2015), socio-technical factors (Bana e Costaa, Correa et al., 2002) and the heterogeneous group effect (Liu et al., 2014; Liu et al., 2017) have become necessary. These factors combine in disproportionate manner to influence the adoption of technology generally and their acceptance at the individual level. The articulation of these factors will engender the understanding of target end-user, the absence of which may lead to a needless underutilization of information system resource when it is introduced for enhancing contractor selection in public procurement (Durodolu, 2016). A novel CS-DSS acceptance framework will enhance the prediction of contractor selection decision support systems acceptance in public procurement. Available technology acceptance frameworks in literature lack relevance for the Nigerian public procurement environment which is neither a mandatory or a voluntary field for the use of technology in contractor selection (Lai, 2017).

1.2 Research in Contractor Selection Techniques

Research on contractor selection techniques have been prescriptive on methods, techniques and processes, generally designing potent technologies for enhanced selection (Holt, 2010). The contractor selection process has a strategic implication for achieving better quality, reducing transaction costs, and enhancing shorter lead times (Alptekin et al., 2017; Singh and Tiong, 2005). Research on contractor selection is presented in research clusters in Figure 1. These research clusters influence the design of system architecture for contractor selection technology.

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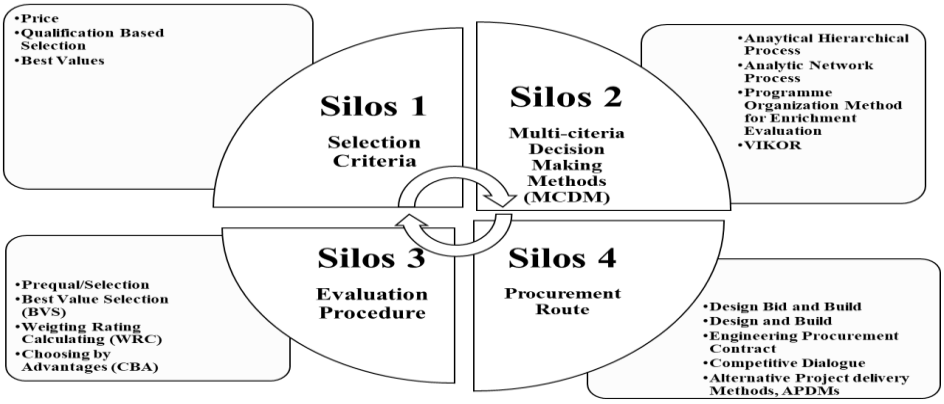

Figure 1: Clusters in contractor selection research

2. Relevance of technology acceptance frameworks

The continuous development of technology for contractor selection attracts investigation on their acceptance by understanding end-user preferences (Maguire and Brid, 2017). As a customer foresight enquiry for system vendors, prediction is a prior study for developing relevant measures to guide procurement manager in facilitating the adoption of CS-DSS in public procurement and their acceptance by public procurement personnel.

System consumers' purchase intention, antecedents and moderators are necessary (Chen and Huang, 2016; Schweitzer et al., 2019), to promote engaged scholarship by promoting the development of acceptable contractor-selection decision-support systems (Närman et al., 2012). Other anticipated benefits of this research include: enrichment of CS-DSS feedback loop (Kayande et al., 2009), guide in the design of training interventions for procurement personnel on use of technology for contractor selection (Dainty et al., 2005; Mahamadu et al., 2018; Roodhooft and Abbeele, 2008), while understanding the AEC procurement personnel as target end-users of CS-DSSs.

The adoption of technology encompasses strategic, organizational, group as well as the individual level influences, in addition to technological factors as shown in several studies (Al-Harthi et al., 2014; Shimizu et al., 2006). This focuses on the micro-level (individual) behavioral of public procurement personnel towards contractor selection technology (CS-DSS).

2.1 Concept of innovation and technology

Contractor selection techniques have attracted the application of several innovations in the past. Innovation and technology are correlated with human requirements (Legris et al., 2003; Schweber and Harty, 2010). Organizations and countries alike have modified lifestyles, continually recording experiences on the ease of handling real problems through the application of technology (Group et al., 2002; Semaan and Salem, 2017). Through the application of less efforts and reduction in manual computation, complex tasks are easier handled with associated savings on time and other resources (Mohemad et al., 2010). When such technologies are novel, they are simply described, especially by new users as innovations.

Technology has tremendously impacted on public procurement (Baldus and Hatton, 2019). Few public procuring entities have struggled to implement and effectively utilize electronic systems to track and manage business processes and strategic planning. Most of the relevant

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information on contracts, terms, and conditions, and aspects of procurement engagements are contained in hard copy (paper files and PDF copies of agreements) (BPP, 2011). The digitization of the procurement processes has witnessed many obstacles to mine the data and utilize analytic systems to conduct analysis for insight generation. Adoption models will continue to be relevant in investigating technology acceptance. In environments where decision making is extremely disorderly, it is necessary for teams to prepare to confront, inquire, and encourage the forecast on the acceptance of such technology (Cheung and Vogel, 2013; Tran et al., 2011).

2.2 Technology acceptance and technology adoption

Research on contractor selection have prescribed technologies as panaceas for contractor selection problem (Semaan and Salem, 2017). Extant information system and innovation adoption literature have focused on decision-making at organizational level, where the investigations are concerned with factors that drive organizational adoption of such technologies (Papadonikolaki, 2018; Phillips-Wren and Mckniff, 2016; Tran et al., 2011). Individual employee-level acceptance studies have been generally neglected (Brandon-Jones and Kauppi, 2018). In public procurement, the adoption of technology must recognize the organizational strata, with the procurement personnel as the smallest decision making unit as the target end-user of such technology. The efficacy of known technology adoption frameworks for assessing CS-DSS acceptance in public procurement is reduced. The inadequacy of sole models and theories; Model for PC Utilization (MPCU), Theory of Planned Action (TPA), Theory of Planned Behavior (TPB) (Tran et al., 2011), Theory of Reasoned Behavior (TRB), the Unified Theory of Acceptance and Use of Technology (UTAUT), Technology Adoption Model (TAM) and Diffusion of Innovation (DOI) (Lee et al., 2018), Technology Organization Environment (TOE) (Tran et al., 2011); and agent-based model (Nnaj et al., 2019) have been observed in literature. Previously, researchers have extended existing models or integrated them in a bid to enhance their explanatory powers to investigate technology acceptance or adoption in a wide spectra of fields (Al-rahmi et al., 2018; Kalamatianou and Malamateniou, 2017; Liu et al., 2018; Rana and Dwivedi, 2015). The frameworks are contingent upon investigating technology acceptance in construction generally (Yap et al., 2019) and public procurement in particular (Adam et al., 2016).

2.2.1 Technology Acceptance Model (TAM)

Social and behavioral psychology, ICT, and consumer marketing literature have used several fragmented theories regarding acceptance behavior for many years; TPB, TRA, TAM, DOI, Model of PC Utilization (MPCU) (Davis et al., 2017), Motivational Model (MM) (Nnaj et al., 2019), combined TAM and TPB (C-TAM-TPB) (Taylor and Todd, 1995) to predict consumers' acceptance behavior. These models have evolved in a bit to assess technology acceptance in several fields. Table 1 presents common theories in technology acceptance, which has formed reliable artifacts for modelling end-user acceptance of technology.

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Table 1: Technology/Innovation Adoption Theories

Level	Theory	Principle in the Theory	Sources
Individual Level Theories	TTF	Task Requirement Task Functionality Individual Performance Actual Tool Use	Dishaw and Strong (1999)
	TRI	Optimism Innovativeness Discomfort Security	(Parasuraman and Colby, 2015; Shonhe, 2019; Yusif et al., 2020)
	TAM	Perceived usefulness Perceived ease of use	Davis (1989) Davis et al. (1989)
	UTAUT	Performance expectancy Exertion anticipation Social impact Facilitating conditions	Venkatesh et al. (2003)
	TPB	Attitude toward the behavior Subjective norms Behavioral control	Ajzen (1985,1991, 2002)
	SCT	Attitude	Trybus et al. (2016)
	TRA	Attitude towards behavior Intention Subjective norms	Fishbein and Ajzen (1975)
Firm Level Theories	DOI	Individual characteristics Internal characteristics of the organization External characteristics of the organization	Rogers (1995)
	Institutional Theory	Attitude towards behavior Intention Subjective norms	Scott and Christensen (1995), Scott (2001)
	TOE	Technology Context Organization context Environment context	Tornatzky and Fleischer (1990)

Source: Adapted from (Ali, 2016)

2.3 Categorization of factors that influence technology acceptance in public procurement

This study merged seemingly isolated research domains to guide in investigating the acceptance of technology in public procurement, especially with the considerations on contractor selection technology; contractor selection, decision support systems, public procurement and technology acceptance. Thus, investigation on technology adoption in public procurement took cognizance of the affected areas. A cross-domain feature of this research

is presented in Figure 2, showing the convergence of the seemingly distinct, yet related knowledge domains.

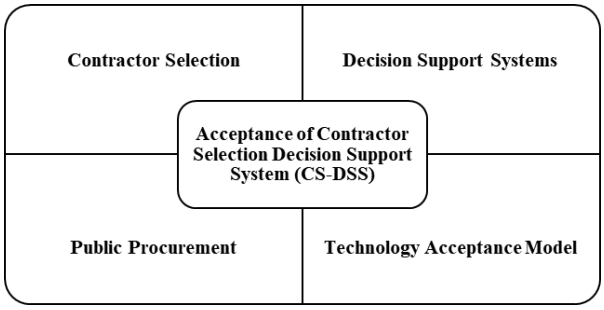

Figure 2: Study features

Investigations on the adoption or acceptance of technology for contractor selection in public procurement is a hydra-headed concept, because of the challenge of situating such a research in seemingly distinct bodies of knowledge (Halbesleben and Wheeler, 2008). Although, a typical research should follow recognized pedagogical principle, there is the need to review some codified bodies of knowledge for; contractor selection, contractor selection technology CS-DSS, public procurement as well as technology adoption/acceptance. The consideration of these concepts are necessary in determining relevant factors that will influence the adoption or acceptance of technology. Figure 4 is a flow chart for the strategic review of literature adopted for this study.

Three hundred and eleven articles had relevant contents for the seemingly distinct knowledge areas; contractor selection, contractor selection technology CS-DSS, public procurement and technology adoption/acceptance

Figure 3 shows the category of factors that influence technology adoption in public organizations as demonstrated in previous studies (Ali, 2016).

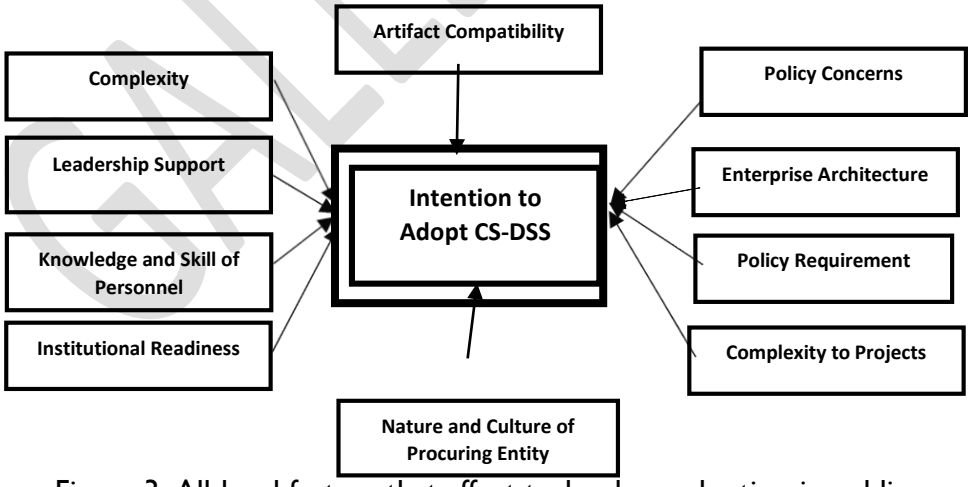

Figure 3: All-level factors that affect technology adoption in public procurement

3. Methodology

This research adopted a qualitative method, informed by a research paradigm which forms a framework as comprising commonly-held agreement about a subject and a structure of what direction researches are undertaken as demonstrated in Simmons et al. (2013). The present study is designed to develop a framework for predicting acceptance of contractor selection technology CS-DSS in public procurement. The methodology was logically and systematically aligned to augment the absence of a framework for predicting the acceptance of technology in public procurement for enhanced contractor selection (Adam et al., 2017).

A sequential methodology started from a strategic review of extant literature on seemingly distinct body of knowledge; contractor selection, decision support systems, public procurement and technology acceptance. Their convergence presented a pool of motivators of technology acceptance in public procurement which were subjected to a Delphi survey of experts in the public procurement field. Figure 3 is the flow chart of the methodology adopted. The factors with high agreement by the experts were analyzed using SPSS version 24 and the results were presented by descriptive statistical analysis, on the basis of which a framework for investigating technology acceptance in public procurement was designed

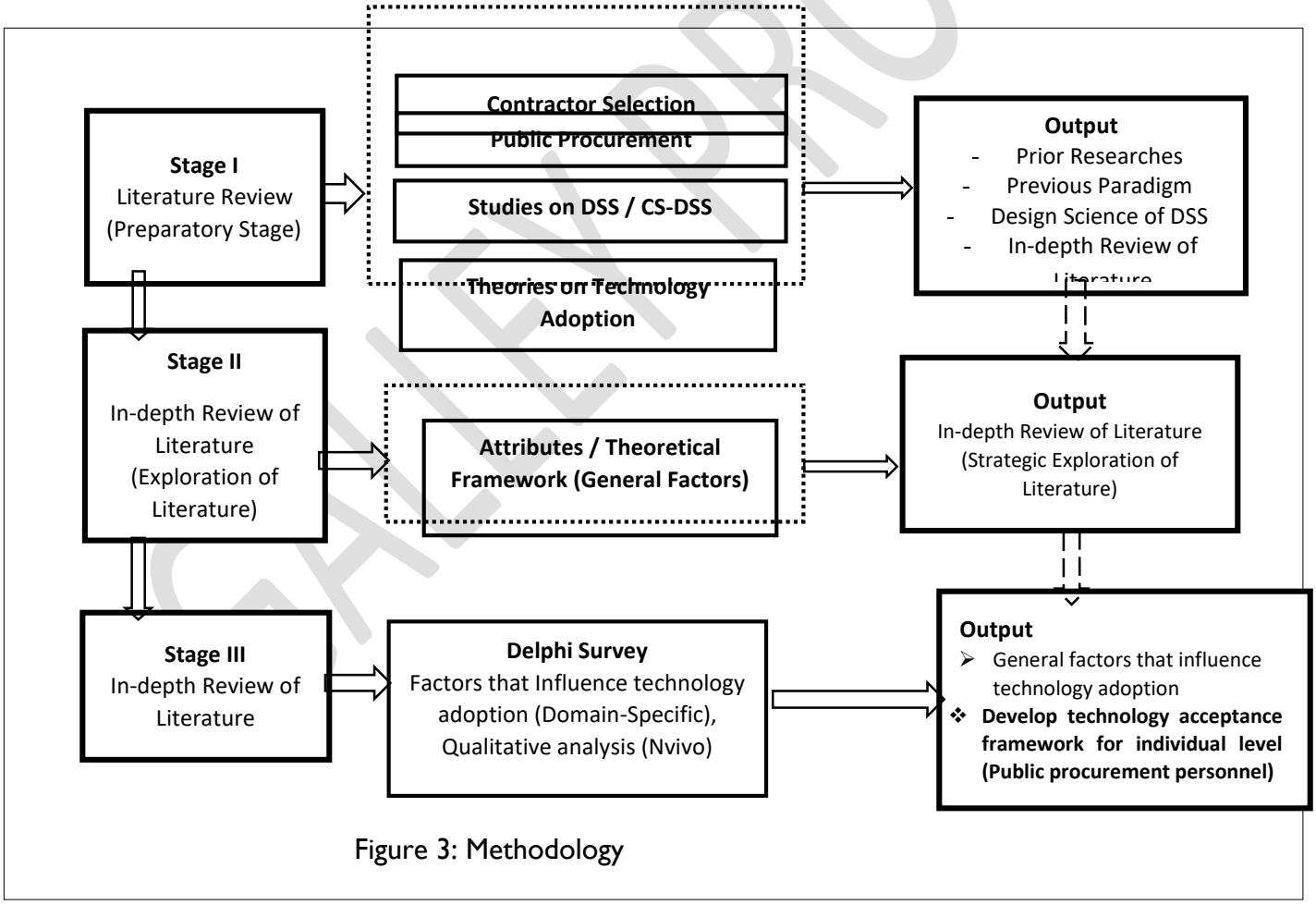

Figure 3: Methodology

3.1 Philosophical position

A deductive relativist explanatory research position, hinged on a philosophical paradigm that is grounded in theory was adopted in this study. From the philosophy, the acceptance behavior of public procurement personnel is studied by assessing the factors that influence technology acceptance by procurement personnel.

This study adopted a triangulation by sequential mixed method, verifying the importance of factors that influence technology acceptance amongst public procurement personnel.

3.2 Delphi survey

The preliminary stage of the Delphi survey (Okoli and Pawlowski, 2004) was based on established set of criteria for the identification and inclusion of relevant public procurement stakeholders as shown in Table 2.

Table 2: Criteria and scoring for inclusion of experts on Delphi survey

Expert's Description	Scoring Criteria for Experts in Public Procurement	Allotted Points	Total Allotted Point
A. Academics	(a). First or second author in academic article on Public Procurement in Nigeria	6	
	(b) First, Second or Third author on an academic article related to Procurement	5	
	(c) First or second author on any academic article on Contractor Selection	5	
	(d) First or second author on academic article on Information System/IT studies	5	
	(d) First or second author on academic publication on e-Procurement	5	
	(e) First or second author on academic publication on Technology Adoption	5	
	(f) First or second author on academic publication on Organizational Behavior	3	33
B. Public Procurement Manager	(a) Has minimum BSc./HND in any of AEC or engineering, Management, Economics, Business Administration, Computer Sciences or Information Technology, or Economics	5	
	(b) More than 10 years of experience as Built-Environment professionals, registered with Professional body	5	
	(c) 3–5 years of professional experience in Public procurement	5	
	(d) 1–3 years of professional experience in the regulation and policy on Public procurement	5	
	(e) More than 5 year experience as member of Technical Evaluation Committee for Public procurement of Works and related Goods and Services	5	
	(f) A minimum 25 years in Nigerian Federal Civil Service	4	
	(f) More than 5 years of professional experience in the planning, implementation, regulation, or development of public procurement laws	4	33

C. Consultant in Procurement of Public Construction Works	(a) More than 10 years active professional membership in AEC professional bodies	10	
	(b) 5–10 years of professional experience Consultancy Services in planning, implementation or management of procurement on construction Projects/public works	10	
	(c) Have MBA., MA., MSc. or Ph.D. in any of AEC or engineering, Management, Economics, Business Administration, Computer Sciences or Information Technology, or economics	6	
	(d) Has presented 2-3 non-academic articles/Conference Papers on Public Procurement or Information System or Technology Application in Procurement, DSS, Contractor selection	5	
	(e) Participated in Policy review on Information Technology or Public Procurement	2	34

Source: Adapted with modifications from Tabish and Jha (2018)

3.2 New factors that will influence CS-DSS adoption in public procurement

The qualitative data was collected through with open-ended question to accept the emergence of new factors that motivate CS-DSS adoption. Responses from two (2) experts suggested new factors which were further reviewed. Raw string data from the experts' responses were exported to an NVivo software program for qualitative data analysis. Subsequently, analytical techniques checked the factor clusters to form single modified variants. The analytical order followed:

a. Coding: suggested motivators by the participants were coded.

b. Cluster Analysis (CA): CA analytical technique was applied to cluster nodes by word similarity. From general review of clusters, secondary nodes denote factors recommended by experts and their primary nodes. The nodes show the most appropriate new factor to which the secondary nodes were synthesized and defined. A primary node represents one suggested factor, suggested by the public procurement experts.

c. The NVivo created the primary nodes and the secondary nodes. The secondary nodes were re-assigned to the primary nodes

d. Recommended factors were matched with the existing factors. The new factors were coded differently but fit in content with existing factors.

e. Frequencies of responses were computed as percentages of all the 18 experts in the Delphi survey with the aid of SPSS Version 24.

4 Analysis, Results and Discussion

4.1 Pilot Study

Pilot to ensure: Completeness, redundancy, operationality, mutual independence of preferences, double identification and size was carried out to ensure that the list of variables are not more than necessary or duplicated.

The result is presented in Table 3

Table 3: Importance of factors that influence technology adoption (Delphi-Round 1)

Factor	Response Rate (Percent %)	Rank
ITAM1 Perceived usefulness	100.00%	1
FITR1 Attitude towards behavior	96.88%	2
IUTAU1 Performance Expectancy	96.88%	3
ITAM2 Perceived ease of use	95.31%	4
IUTAU2 Exertion anticipation	93.75%	5
IUTAU3 Social impact	92.19%	6
ITRA3 Subjective norms	92.19%	7
ITRA1 Attitude towards behavior	90.63%	8
FTOE1 Technology Context	89.06%	9
ITRA2 Intention	75.00%	10
IUTAU4 Facilitating conditions	75.00%	11
GPSY2 Social (Social Norms and Self-image)	73.44%	12
ITTF2 Individual Performance	56.25%	13
ITRA3 Subjective norms	52.00%	14
GTRT1 Clarity	51.00%	15
GPSY1 Personality (Exploration Behavior)	50.75%	16
GTRT3 Comprehensiveness	50.76%	17
GPSY3 Cognitive (Risk Perception)	50.35%	18
GTRT2 Logical structure	48.00%	19
ITRA3 Subjective norms	47.99%	20
GTRT4 Applicability in public sector tendering	46.11%	21
ITTF1 Task Requirement	43.21%	22

Key: *Codes starting with 'I' are individual level constructs*
Source: Delphi Survey (2022)

Procurement experts (Delphi survey respondents) identified additional factors that they believed will influence the adoption of CS-DSS in public procurement. The factors are: legal requirement, system architecture, and increase in volume of data, transparency and security.

4.2 New factors that will influence CS-DSS adoption in public procurement

The qualitative data collected through the open-ended question to accept new factors to be included in CS-DSS adoption query were identified. The responses from two (2) experts who suggested new factors were reviewed. Raw string data from the experts' responses were exported to an NVivo software program for qualitative data analysis. Subsequently, analytical techniques are used to check factor clusters to form single modified variants or ensemble-enabled factors reasonably with the existing factors. The analytical order followed:

f. Coding: suggested motivators by the participants were individually coded.

g. Cluster Analysis (CA): CA analytical technique was applied to cluster the nodes by word similarity through meta-synthetic measure. From the general review of cluster analysis, the secondary nodes represent the factors recommended by experts and their primary nodes, which present the most appropriate new factor to which the secondary nodes can be synthesized and identified. Therefore, a primary node represents one suggested factor derived from the suggestions from the public procurement experts.

h. Application of NVivo created the primary nodes and the secondary nodes. The secondary nodes were carefully assigned to the primary nodes

i. Subsequently, recommended factor were matched with the existing factors manually. The new factors included were phrased differently but fit with the content of existing factors.

j. Frequencies of responses were computed as percentages of all the 18 experts in the Delphi survey.

4.3 Delphi Questionnaire Survey (Round 2)

Round 2 developed a well-rounded questionnaire from round 1 questionnaire. The questionnaire of round 2 contains all factors in questionnaire 1, rephrased from the round 1 feedback for each factor in addition to the modified factor; 'System Architecture (SA)'. All the factors were reviewed for completeness and appropriateness for application in the list. The review was necessary to encourage experts to rate each criterion in 1-9 interval scale. Three factors related to motivation to adopt contractor selection DSS were added at this stage, as shown in Table 4.

Table 4 Criteria included in round 2 by experts

S/No	Factors that influence Technology Adoption in public procurement
1	**System Architecture:** The system architecture of the DSS addresses all the concerns in contractor selection literature; Selection criteria, Selection technique, Multi-criteria decision making method and procurement route etc.
2	**Increase in Volume of Data:** Contractor selection is increasingly requiring the consideration of large data.
3	**Transparency:** CS-DSS provides an open and transparent process for contractor selection

Source: Delphi Survey (2022)

4.4. Analysis of data (Delphi Round 2)

The respondents in Round 2 were asked to rate the importance of factors using 1-9 scale. Descriptive statistical analysis was applied to describe the central tendency of data in relation to 'mean', descriptive statistical analysis was performed using SPSS, version 24. Table 5 shows the round 2 of the Delphi survey.

Table 5: Delphi round 2 result of factor importance

Factor	Response Rate (as a Percentage)	Group Mean	Standard Deviation	Rank
ITAM1 Perceived usefulness	97.20%	8.56	1.118	1
FITR1 Attitude towards behavior	96.88%	8.49	1.125	2
IUTAU1 Performance Expectancy	96.88%	8.47	1.164	3
ITAM2 Perceived ease of use	95.31%	8.42	1.105	4
AVEV2 System Architecture	93.75%	8.41	1.340	5
AVEV5 Security	92.19%	8.32	0.941	6
ITRA3 Subjective norms	92.19%	8.28	1.503	7
ITRA1 Attitude towards behavior	90.63%	8.11	1.155	8
FTOE1 Technology Context	89.06%	8.09	1.307	9

GTRT1 Clarity	75.00%	8.03	1.223	10
IUTAU4 Facilitating conditions	75.00%	8.01	1.598	11
GPSY2 Social (Social Norms and Self-image)	73.44%	7.94	1.365	12
ITTF2 Individual Performance	56.25%	7.75	1.587	13
ITRA3 Subjective norms	52.00%	7.74	1.460	14
AVEV3 Increase in Volume of Data	51.00%	7.71	1.674	15
GPSY1 Personality (Exploration Behavior)	50.75%	7.70	1.302	16
GTRT3 Comprehensiveness	50.76%	7.29	1.298	17
AVEV4 Transparency	50.35%	7.17	1.350	18
GTRT2 Logical structure	48.00%	6.66	1.322	19
ITRA3 Subjective norms	47.99%	6.43	1.294	20
GTRT4 Applicability in public sector tendering	46.11%	6.12	1.266	21
ITTF1 Task Requirement	43.21%	6.05	1.239	22
IUTAU2 Exertion anticipation	43.20%	5.58	1.211	23
ITRA2 Intention	43.19%	5.56	1.183	24
GPSY3 Cognitive (Risk Perception)	43.17%	5.54	1.155	25
IUTAU3 Social impact	43.10%	5.52	1.127	26

Source: Delphi Survey (2022)

System architecture (SA) was added by the procurement experts in the first round of the survey, it had a contrasting response of 93.75%. The results for system architecture (SA) in the second round at its first introduction implies that it is adjudged to be a very important factor that will influence the acceptance of CS-DSS in public procurement.

4.4.1 Reliability

Scale reliability of round 2 was verified by a conducting Cronbach's alpha test for the interval scale measurement on 1-9 scale. Cronbach's alpha is 0.921 for the round 2 responses measured 1-7 scale as presented in Table 6.

Table 6: Reliability statistics for round 2 survey

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of items
0.921	0.920	26

4.4.3 Non-parametric Kendall's W Test (Consensus amongst public procurement experts)

The Non-Parametric Kendall's W test (Kendall's coefficient of concordance) is used to measure group consensus. W is always between 0 and 1 (presented as 0 showing 'no disagreement' while 1 portrays a perfect agreement. Intermediate values indicate lesser or greater agreement. With the aid of SPSS, non-parametric Kendall's W test was carried out as presented in Table 7.

Table 7: Kendall's W Test Result - Test Statistics

N	**18**
Kendall's W (Kendall's Coefficient of Concordance)	0.312
Asymptomatic Significance	0.000

From Table 7 the Kendall's coefficient of concordance, *W* is 0.312 at p = 0.000. This signifies that from the Delphi enquiry, value of W is significant with p = 0.000.

4.5. Round 3 of Delphi Questionnaire Survey

4.5.1. Analysis of Data (Round 3 Survey)

A descriptive statistical analysis of the third round of the Delphi survey data is presented in Table 8

Table 8: Result for Round 3 (N=18)

Factor	Group Mean	Standard Deviation	Rank
ITAM1 Perceived usefulness	8.68	0.718	1
FITR1 Attitude towards behavior	8.19	0.677	2
ITRA1 Attitude towards behavior	8.07	0.785	3
ITAM2 Perceived ease of use	8.02	0.893	4
AVEV2 System Architecture	8.01	0.687	5
FDOI4 Trialbility	8.00	0.745	6
GTRT3 Comprehensiveness	6.80	0.680	7
GTRT2 Logical structure	6.70	0.840	8
FTOE1 Technology Context	6.50	0.943	9
GTRT1 Clarity	5.80	0.883	10
IUTAU4 Facilitating conditions	5.70	0.756	11
GPSY2 Social (Social Norms and Self-image)	5.60	0.650	12
ITTF2 Individual Performance	5.30	0.680	13
ITRA3 Subjective norms	4.80	0.598	14
AVEV3 Increase in Volume of Data	4.75	1.022	15
GPSY1 Personality (Exploration Behavior)	4.55	1.062	16
AVEV5 Security	4.45	0.760	17
IUTAU1 Performance Expectancy	4.40	0.820	18
ITRA3 Subjective norms	4.30	0.670	19
ITRA3 Subjective norms	4.25	1.020	20
GTRT4 Applicability in public sector tendering	4.18	1.001	21
ITTF1 Task Requirement	4.17	0.657	22
IUTAU2 Exertion anticipation	4.09	0.820	23
ITRA2 Intention	3.89	0.811	24
GPSY3 Cognitive (Risk Perception)	3.82	1.015	25
IUTAU3 Social impact	3.69	1.010	26

4.6. Reliability Test Outcome

Scale reliability of round 3 was tested by Cronbach's Alpha test for the interval scale measurement on 1-9 scale. As presented in Table 9, Cronbach's alpha is 0.807, indicating stronger stability of responses in round 3,

Table 9: Reliability Statistics for Round 3

Cronbach's Alpha	Cronbach's Alpha based on Standardized items	Number of items
0.807	0.810	16

Source: Delphi Survey (2022)

4.6.1 Measure of Consensus- Non-Parametric Kendall's W test

Kendall's *W* coefficient of concordance is applied in measuring the group consensus. Subsequently, non-parametric Kendall's *W* test was carried out using SPSS version 3 and result is presented in Table 10.

Table 10: Kendall's W Test Result - Test Statistics

N	**16**
Kendall's W (Kendall's Coefficient of Concordance)	0.264
Assymp. Significance	0.000

Kendall's coefficient of concordance W is 0.264, significant at p =.000. As supported in the report for round 2, where *W* is significant at p =.000, there was fair consensus among the experts. The experts in round 3 demonstrated a reasonable agreement with each other, determining the importance of factors with value of W =.264 significant at *p*=0.000. With the increased consensus from round 2 to round 3 indicates greater agreement and increased consensus, showing no further inclusion of new factor(s).

4.7. Comparison of Rounds 2 and 3

Delphi rounds and the final numbers of participants are presented in Table 11. Round 3 and prior Round 2 show slight differences in the rankings of the factors.

Table 11: Summary of round 2 and 3 survey

	Round 3		**Round 2**	
Factor	**Group Mean**	**Rank**	**Group Mear**	**Rank**
ITAM1 Perceived usefulness	8.68	1	8.56	1
FITR1 Attitude towards behavior	8.19	2	8.47	2
ITRA1 Perceived Enjoyment	8.07	3	8.47	3
ITAM2 Perceived ease of use	8.02	4	8.42	4
AVEV1 System Architecture	8.01	5	8.41	5
FDOI4 Trialbility	8.00	6	8.32	9
GTRT3 Complexity	6.80	7	8.28	8
GTRT2 Logical structure	6.70	8	8.11	7
FTOE1 Technology Context	6.50	9	8.09	6
GTRT1 Clarity	5.80	10	8.03	10
IUTAU4 Facilitating conditions	5.70	11	8.01	12
GPSY2 Social (Social Norms and Self-image)	5.60	12	7.94	11
ITTF2 Individual Performance	5.30	13	7.75	14
ITRA3 Subjective norms	4.80	14	7.74	13
AVEV3 Increase in Volume of Data	4.75	15	7.71	18
GPSY1 Personality (Exploration Behavior)	4.55	16	7.70	16
AVEV5 Security	4.45	17	7.29	17
IUTAU1 Performance Expectancy	4.40	18	7.17	18
ITRA3 Subjective knowledge	4.30	19	6.66	19
ITRA3 Subjective norms	4.25	20	6.43	20

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GTRT4 Applicability in public sector tendering	4.18	21	6.12	21
ITTF1 Task Requirement	4.17	22	6.05	22
IUTAU2 Exertion anticipation	4.09	23	5.58	23
ITRA2 Intention	3.89	24	5.56	24
GPSY3 Cognitive (Risk Perception)	3.82	25	5.54	25
IUTAU3 Social impact	3.69	26	5.52	26
Kendall's *W*	**0.264**		**0.312**	
Cronbach Alpha (α)	0.807		0.921	

Delphi Survey (2022)

Based on the consensus of procurement experts, the individual level variables were carefully selected. These guarded in the compatibility check with existing models for the design of an acceptance framework for contractor selection decision support system in public procurement. The variables are presented in Table 12. The factors had high agreement, with mean scores between 7 and 8.

Table 12: Individual level factors with highest agreement by procurement experts

Rank	Factor	High Agreement Band
1	Perceived usefulness	High agreement factors (mean Score 7-8)
2	Attitude towards behavior	
3	Perceived Enjoyment	
4	Perceived ease of use	
5	System Architecture	
6	Trialbility	
7	Complexity	

Factors that influence the acceptance of CS-DSS in public procurement and their Kendall W status from three rounds of Delphi survey are shown in Table 13. Each factor showed their descriptions as presented in the survey instrument.

Table 13: Delphi Study Findings (Factors and Agreement Weights)

Factor	Description	Kendall's W
ITAM1 Perceived usefulness	CS-DSS is useful in contractor selection	> 0.75
FITR1 Attitude towards behavior	A good CS-DSS should meet my expectations on major concerns in contractor selection	> 0.75
ITRA1 Perceived Enjoyment	CS-DSS will have better advantage in application compared to current manual approach	> 0.75
ITAM2 Perceived ease of use	CS-DSS will be easy to use	> 0.75
AVEV2 System Architecture	The system architecture of CS-DSS must address all concern in Contractor selection	> 0.75

FDOI4 Trialbility	The CS-DSS should be open to trial	> 0.75
GTRT3 Compatibility	The CS-DSS should be compatible with existing structure	> 0.75

Source: Delphi Survey, 2022

Figure 6 presents requisite features of a CS-DSS acceptance framework, which informs the design of a novel technology acceptance framework for investigating public procurement personnel, as agreed by carefully selected public procurement experts in Nigeria.

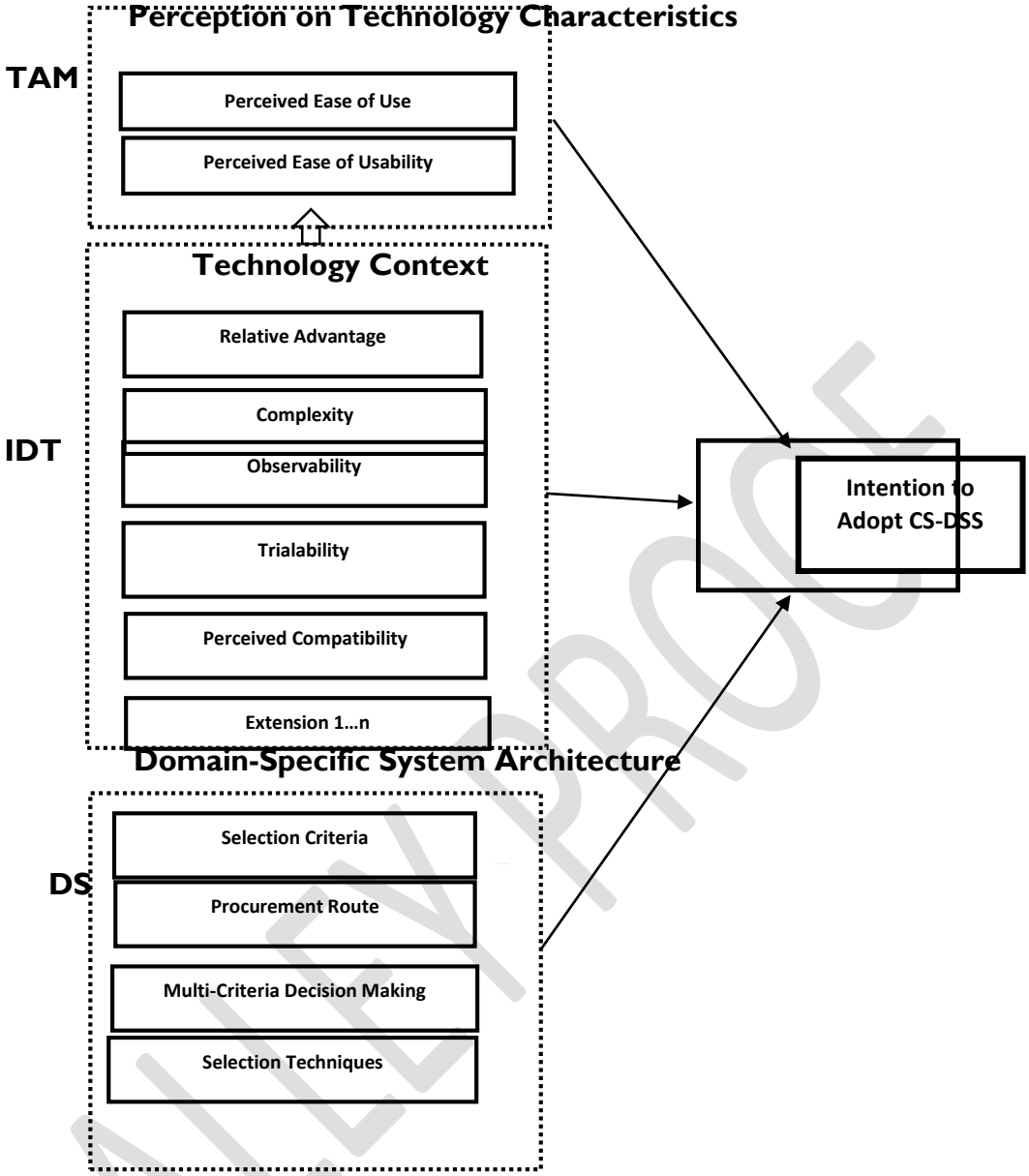

Figure 6: Theoretical framework for CS-DSS Acceptance

Key: DS = Domain-Specific; Extension 1…n = Additional variable

Three rounds Delphi survey enhanced the assessment of 23 factors that influence adoption of CS-DSS and the agreement weightings for carefully selected group of 18 public procurement experts in Nigeria. Relevant factors for influencing the adoption of technology in public procurement shows the support for a theoretical framework that includes technical as well as psychological factors for investigating acceptance behavior as considered to be most relevant in public procurement were determined.

4.8 Framework for the acceptance of CS-DSS in public procurement

The technology acceptance models as identified in literature are associated with considerable number of factors that influence the adoption and/or acceptance of technology. Modelling of behavioral intension of public procurement personnel towards contractor selection decision

support systems require the inclusion of relevant variables that influence the acceptance of behavior of personnel. The most relevant factors were included through predetermination of factors and the consideration of their associated weights. Hypotheses are proposed on the arrows, indicating the kind of relationship between variables. Preparatory to the modelling of causality, Figure 7 shows a relationship between the acceptance behavior and other dependent variables, on the basis of which meaningful enquiries can be made on the public procurement personnel.

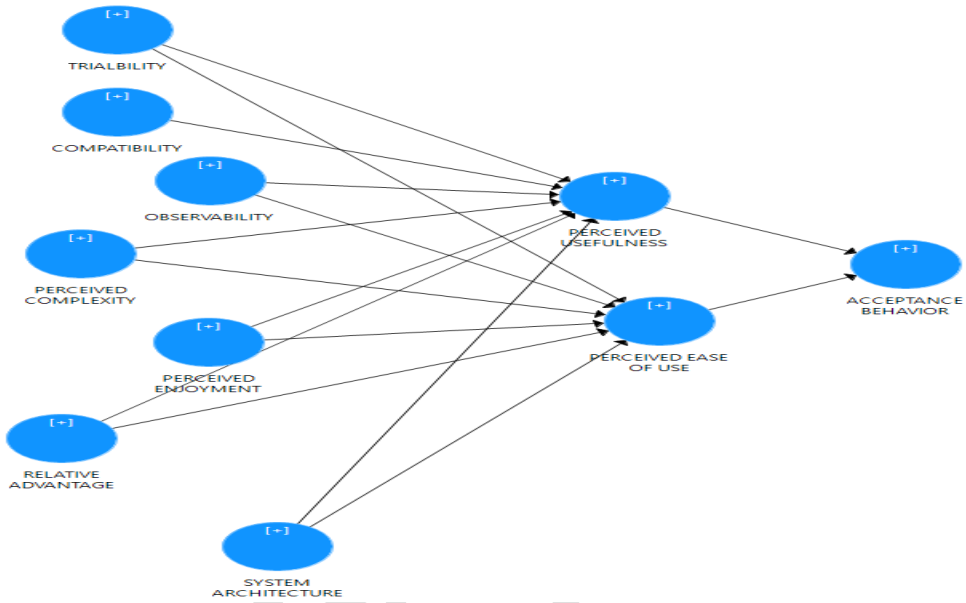

Figure 7: Extended integrated IDT-TAM framework for CS-DSS Acceptance

5. Conclusion

This study builds up a theoretical framework that requires operationalization with the aid of empirical data to achieve an important objective of investigating the acceptance behavior of public procurement personnel towards contractor selection technology in Nigerian public procuring entities. There are many technology acceptance theories in literature. These include; Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), Innovation Diffusion Theory (IDT), Technology Organization Environment (TOE), Theory of planned behavior (TPB), Unified theory of Acceptance and Use of technology (UTAUT), Model for PC utilization (MPCU), Task Technology Fit (TTF), Motivation Model (MM), Technology Readiness Index (TRI). With the aid of agreement from a team of 18 experts in public procurement, a suitable framework; integrated Innovation Diffusion Theory and Technology Acceptance framework (IDT-TAM) for assessing CS-DSS acceptance in public procurement was designed. The main factors for investigating technology acceptance are technology characteristics which include compatibility, complexity, trialbility, perceived enjoyment and technological context (system architecture) was included in addition to psychological factors of perceived ease of use and perceived usefulness. According to the procurement experts, these factor are very relevant for modelling acceptance behavior on contractor selection decision support systems amongst public procurement personnel. Such antecedent behavior is a valuable information for system vendors in proffering technologies that are needed for

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enhanced contractor selection. The system vendors can rely on the framework developed in this study to investigate acceptance behavior of procurement personnel towards contractor selection support systems to enhance the potentials of acceptance. The study builds up a theoretical framework that requires operationalization with the aid of empirical data to achieve an important objective of investigating the acceptance behavior of public procurement personnel towards contractor selection technology in Nigerian public procurement entities. Antecedent behaviors are valuable information for system vendors to proffer acceptable solution for enhanced contractor selection.

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