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E-Procurement Adoption and Public Sector Service Performance: The Moderating Effect of Citizen Expectations and Digital Infrastructure

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Abstract

The adoption of e-procurement in the public sector is increasingly recognized as a pivotal factor in improving service performance. However, the precise nature of the relationship between e-procurement adoption and public sector service performance remains inadequately understood, particularly considering the moderating influences of citizen expectations and digital infrastructure. Procurement plays a crucial role in the performance of institutions and serves as a strategic avenue for fostering organizational growth. This study therefore seeks to examine the relationship between e-procurement adoption and public sector service performance: the moderating effect of citizen expectations and digital infrastructure. An explanatory research design was employed where purposive sampling techniques was used to obtain a sample size of 384. The findings of the study indicate that e-procurement adoption has no significant effect on public service delivery performance. The study establishes that digital infrastructure has significant positive influence on e-procurement adoption. The findings of the study concluded that digital infrastructure does not moderates the relationship between e-procurement adoption and public service delivery performance. Citizen expectation significantly and positively moderates the relationship between e-procurement adoption and public service delivery performance. E-procurement adoption does not mediate the relationship between digital infrastructure and public sector delivery service performance. The study recommends that organizations are to establish regular channels for citizen feedback and engagement, such as surveys, focus groups, and public forums, to gather insights on their expectations and experiences with public

services. Companies are to design e-procurement systems with a user-centric approach, ensuring that they meet the needs and preferences of citizens. Organizations are to conduct public awareness campaigns to educate citizens about the benefits and functionalities of e-procurement systems, highlighting how these systems can improve service delivery. Organizations are to establish performance metrics that reflect citizen expectations and satisfaction levels, and regularly monitor these metrics to assess the impact of e-procurement adoption on service delivery.

Keywords: E-Procurement Adoption, Public Sector Service Performance, Citizen Expectations, Digital Infrastructure

1.1 Introduction

Procurement plays a crucial role in the performance of institutions and serves as a strategic avenue for fostering organizational growth (Khanapuri et al., 2011). Tutu et al. (2019) observe that the global adoption of e-procurement has positively impacted various aspects such as cost reduction, streamlining of bureaucratic processes, curbing corruption, ensuring compliance, and standardizing procurement practices. Aldenius and Khan (2017) define e-procurement as the utilization of electronic platforms or techniques for procurement processes. Khanapuri et al. (2011) further highlight the evolution of technologies like electronic data interchange (EDI) and modern advancements in digital procurement, including tools like e-auctions, reverse e-auctions, e-retailing, and request for information (RFX), which have facilitated collaboration and resulted in significant cost and time savings. Williams and Hardy (2007) and Ocloo et al. (2020) emphasize that electronic procurement, as a component of business-to-business (B2B) e-commerce and information systems (IS), enhances the transformation of business practices and processes. Despite efforts by the Public Procurement Authority (PPA) in Ghana to promote electronic procurement within public institutions, its full implementation remains elusive (Tutu et al., 2019). Hamma-Adama and Ahmad (2021) point out that a lack of awareness among stakeholders, including the government, regarding the benefits of electronic procurement poses a challenge to its adoption and realization of fiscal independence.

While the Public Procurement Act of Ghana outlines multiple stages of procurement, these processes often do not utilize electronic platforms, leading to issues such as inadequate publication of tender notices and award notices, as well as incomplete records of procurement processes (Tutu et al., 2019; Addo, 2019; Boafo and Ahudey, 2020). Adoption of electronic procurement and web technology can enhance procurement notices and information dissemination, enabling timely access to accurate information about public procurement while minimizing costs. This approach also facilitates access to procurement plans and bid documents, fostering competition among potential bidders (Tanner et al., 2008; Sava and Dragoş, 2022). Despite the attention e-procurement has garnered from researchers and practitioners, its implementation remains limited in many organizations (Boafo and Ahudey, 2020). However, there exists a significant correlation between e-procurement and procurement performance within organizations. Krisanthi et al. (2014) argue that continuous advancements in internet technology offer opportunities to enhance transparency and efficiency in procurement processes. E-procurement has not only revolutionized business transactions but also holds the potential to elevate procurement from basic purchasing to strategic sourcing activities (Rajkumar, 2001; Kim et al., 2015). Business relationships now emphasize two-way communication, cross-functional teams, and increased purchasing power (Kamotho and Kamotho, 2014). Many companies have

forged deeper ties with their suppliers, focusing on long-term cooperation and supplier development. Institutions globally are enhancing supplier performance through staff exchange, provision of training and technological tools, and performance evaluation (Azanlerigu and Akay, 2015). Supplier development is closely linked to improvements in client-supplier performance, particularly with the adoption of e-procurement, which ultimately contributes to institutional performance (Kumar and Routroy, 2017; Sambasivan et al., 2009). This study seeks to exploring the relationship between e-procurement adoption and public sector service performance.

1.2 Problem Statement

The adoption of e-procurement in the public sector is increasingly recognized as a pivotal factor in improving service performance. However, the precise nature of the relationship between e-procurement adoption and public sector service performance remains inadequately understood, particularly considering the moderating influences of citizen expectations and digital infrastructure. Khanapuri et al. (2021) underscore the significance of e-procurement adoption in enhancing institutional performance, highlighting its potential to revolutionize traditional procurement practices. Tutu et al. (2019) elucidate the positive impact of e-procurement adoption on cost reduction, process streamlining, and compliance promotion within public sector organizations, thereby suggesting its potential influence on service performance. Hamma-Adama and Ahmad (2021) identify a gap in understanding the full benefits of electronic procurement due to limited awareness among stakeholders, including governmental entities, suggesting a need for further exploration into the relationship between e-procurement adoption and service performance.

The findings of Tutu et al. (2019) emphasize that although the Public Procurement Act of Ghana outlines various stages of procurement, the utilization of electronic platforms remains limited within public sector procurement processes, indicating a potential area for improvement in service performance through enhanced e-procurement adoption. Krisanthi et al. (2014) advocate for continuous advancements in internet technology to ensure transparency and efficiency in procurement processes, suggesting a potential avenue for enhancing public sector service performance through improved digital infrastructure. These citations collectively highlight the importance of investigating the relationship between e-procurement adoption and public sector service performance while considering the moderating influences of citizen expectations and digital infrastructure. Despite existing research acknowledging the potential benefits of e-procurement adoption, there is a gap in understanding how these factors interact to influence service delivery outcomes in the public sector. Addressing this gap is crucial for informing policy and practice aimed at leveraging e-procurement to enhance public sector service performance effectively. This study therefore seeks to exploring

the relationship between e-procurement adoption and public sector service performance: the moderating effect of citizen expectations and digital infrastructure.

2.0. Literature Review

2.1. E-Procurement Adoption

In recent decades, the adoption of e-procurement has experienced a significant increase among organizations worldwide. Numerous studies have identified various factors that directly or indirectly impact the adoption of e-procurement across different contexts. For example, Soong, Ahmed, and Tan (2020) found that social influences and performance expectancy significantly influenced the adoption of electronic government. It's noteworthy that many of these studies share common factors, as summarized in Table 1. In Nigeria, Ibem et al. (2016) conducted a study on the factors influencing the adoption of e-procurement in the Nigerian building industry. Their findings highlighted the benefits of e-procurement in enhancing project delivery efficiency, overcoming geographic barriers, and facilitating effective communication among project team members as crucial factors influencing its adoption.

Additionally, Ibem, Aduwo, Afolabi, Oluwunmi, Tunji-Olayeni, Ayo-Vaughan, and Uwakonye (2020) explored the adoption of e-procurement and user experiences in the Nigerian construction industry. They discovered that technology benefits, operational environment, change management challenges, and the availability, accessibility, and interoperability of e-procurement systems influenced users' experiences with e-procurement in Nigeria. Furthermore, Afolabi, Ibem, Aduwo, Tunji-Olayeni, and Oluwunmi (2019) evaluated critical success factors for e-procurement adoption in Nigeria's construction sector. Aduwo et al. (2017) examined e-procurement usage and its extent of adoption in the Nigerian building industry, noting that quantity surveyors and construction project managers in consulting firms were the primary users. They found that emails and websites were the most commonly utilized e-procurement technologies for various purposes, such as soliciting bids, sharing project details, and sourcing materials and equipment. However, the majority of these studies have predominantly focused on the adoption of e-procurement in the private sector, particularly in the building and construction sectors, while overlooking its significance in the public sector.

Table 2.1 Authors definitions of e-procurement adoption

Author(s)	Definitions
Soong, Ahmed and Tan (2020)	They define e-procurement adoption as the organizational uptake and utilization of electronic systems and technologies for procurement purposes, encompassing the implementation of digital platforms and tools to facilitate various procurement activities such as supplier management, tendering, contract management, and purchasing goods and services electronically.
Ibem et al. (2016)	Ibem and colleagues view e-procurement adoption as the process whereby organizations in the Nigerian building industry integrate and utilize electronic systems and technologies for their procurement operations. They

	emphasize the benefits of e-procurement in enhancing efficiency in project delivery, overcoming geographic barriers, and promoting effective communication among project team members.
Aduwo et al. (2017)	Aduwo and collaborators perceive e-procurement adoption as the extent to which organizations, particularly in the Nigerian building industry, have embraced and implemented electronic systems and technologies for procurement purposes. They focus on the usage patterns of e-procurement technologies such as emails and websites for various procurement activities.
Afolabi et al. (2019)	These authors define e-procurement adoption as the organizational acceptance and utilization of electronic procurement systems in Nigeria's construction sector. They emphasize the identification and evaluation of critical success factors that facilitate the effective adoption and implementation of e-procurement practices.
Ibem et al. (2020)	Ibem and co-researchers define e-procurement adoption as the organizational uptake and experiences of users with electronic procurement systems in the Nigerian construction industry. They emphasize the impact of technology benefits, operational environment, change management challenges, and system accessibility on users' experiences with e-procurement.

Each of these definitions provides a nuanced understanding of e-procurement adoption within specific organizational contexts, highlighting various aspects such as technology utilization, organizational benefits, and user experiences.

2.2. Digital Infrastructure

The deployment of 5G networks holds significant policy implications, both in terms of potential benefits and challenges (ITU, 2018, p. XII). These include not only global competition but also security concerns, as networks increasingly influence the power dynamics between states and regions. In the European Commission's Recommendation on Cybersecurity of 5G networks, 5G networks are defined as encompassing all relevant infrastructure elements for mobile and wireless communications, with advanced performance characteristics (ITU, 2018; ITU 2019). 5G presents policymakers with the opportunity to empower citizens and businesses, transforming cities into smart cities and facilitating participation in the benefits of a data-driven digital economy. It also enables wireless operators to develop new solutions and services beyond mere connectivity, utilizing wired and wireless converged networks. With virtually ubiquitous, high-bandwidth, and low-latency connectivity, 5G networks, coupled with the Internet of Things (IoT), are expected to serve various sectors such as energy, transport, banking, healthcare, and

industrial control systems (Walport, 2014, p. 16). Despite the potential benefits, there are obstacles to overcome, including cybersecurity, spectrum fragmentation, standards development, device availability, high capital expenditure, coverage range, and the development of profitable use cases for 5G's competitive advantages. Additionally, the deployment of 5G must consider the EU's strategic position in the global competitive and geopolitical landscape (Albrycht & Swiatkowska, 2019, pp. 1-3). Critical infrastructures and military applications relying on 5G/IoT could be vulnerable to intentional hostile breaches or overreliance on suppliers from third countries. Competition among platforms and industrial coalitions is emerging, with various infrastructures forming IoT networks. Moreover, the IoT's reliance on internet-connected devices poses challenges in adequately protecting personal data (Feldstein, 2019, p. 23).

2.3. Citizen Expectation

Citizen expectations serve as crucial lenses through which individuals form their perceptions of public services and politics (James, 2021). They function as benchmarks against which reality is measured: Does the service meet expectations or fall short? Consequently, expectations significantly shape public sentiment towards governmental policies, politicians, and services, and understanding their influence is essential for comprehending citizen evaluation and the development of public opinion. Despite their importance, existing research has offered limited insight into the origins of citizen expectations (James, 2021). Particularly, the distinctions between the precursors of the two primary types of expectations identified by James (2021) predictive and normative are not well understood. Predictive expectations pertain to citizens' perceptions of how the future will unfold, while normative expectations relate to their ideals of how the future should be. Predictive expectations are often described as detached calculations of probability, lacking an emotional dimension, whereas normative expectations are grounded in personal values and norms, making them more subjective and value-oriented. Despite these significant disparities, the differences between predictive and normative expectations have not received adequate research attention. This research endeavor explores a range of potential precursors of citizen expectations, which theoretically should influence the two types of expectations differently: personality traits. Personality traits have recently emerged as important yet underexplored factors in explaining bureaucratic attitudes, motivation, and behavior. Given that normative expectations are thought to be rooted in citizens' personality, norms, and values, personality traits are expected to play a particularly significant role in explaining normative expectations.

2.4. Theoretical Foundation

In any study, the theoretical foundation serves as the conceptual framework upon which the research is built. It provides a structured approach for understanding the phenomena under investigation and helps guide the research process from conceptualization to data analysis and interpretation. Justification for the chosen theoretical framework is crucial as it establishes the rationale for its relevance and applicability to the research topic.

2.4.1. UTAUT Theory

The theoretical framework of UTAUT posits that the actual adoption of technology is influenced by behavioral intention, which, in turn, is shaped by four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs are further moderated by factors such

as age, gender, experience, and voluntariness of use (Venkatesh et al., 2013). Performance expectancy refers to the belief that using the system will enhance job performance, drawing from various models such as TAM, TAM2, CTAMTPB, MM, MPCU, IDT, and SCT. It serves as a robust predictor of usage intention, significant in both voluntary and mandatory settings (Zhou, Lu & Wang, 2010; Venkatesh, Thong & Xu, 2016).

Effort expectancy represents the ease associated with using the system and is derived from TAM, MPCU, and IDT. Although initially significant, its effect diminishes with prolonged technology usage (Gupta, Dasgupta & Gupta, 2008; Chauhan & Jaiswal, 2016). Social influence reflects the perception of important others regarding the adoption of the new system, akin to subjective norms and social factors in related models. Its impact is pronounced in mandated technology use scenarios (Venkatesh et al., 2013). Facilitating conditions gauge the belief in organizational and technical support for system usage. Initially influential, its effect wanes after initial use, yet it maintains a direct positive impact on usage behavior (Venkatesh et al., 2013). Age, gender, experience, and voluntariness of use moderate the strength of predictors on intention. Age moderates all four predictors, while gender influences the relationships between effort expectancy, performance expectancy, and social influence. Experience moderates the relationships between effort expectancy, social influence, and facilitating conditions. Voluntariness of use moderates solely the relationship between social influence and behavioral intention (Venkatesh et al., 2013). UTAUT significantly contributes to technology acceptance literature by synthesizing prominent acceptance theories, explaining 70 percent of variance in usage intention, and offering superior predictive power compared to alternative models. Moreover, its acknowledgment of the interactive effects with personal and demographic factors underscores the complexity of technology acceptance processes (Venkatesh et al., 2013).

2.4.2. Technological Acceptance Theory

The study was underpinned by either the Technology Acceptance Model (TAM) or the Theory of Planned Behavior. The TAM, initially proposed by Davis in 1989, posits that the perceived ease of use (PEOU) and perceived usefulness (PU) of technology significantly influence users' perspectives (Siricha and Theuri, 2016). This theory has been widely adopted in various studies, including those focusing on the adoption of new technology in government institutions (Aboelmaged, 2010; Wahid, 2010; Davis, 2012). TAM is instrumental in investigating and evaluating factors that hinder user acceptance of new technologies, thereby aiding companies in enhancing performance through increased usage and acceptance, considering individual differences, social aspirations, beliefs, attitudes, and situational impacts (Gupta and Gupta, 2020).

According to this theory, technology usage is contingent upon users' perceptions and the perceived benefits of the system. Users' positive or negative perceptions shape their attitudes towards technological use, with perceived usefulness and perceived ease of use often identified as key determinants of user adoption patterns. In this context, perceived usefulness of the system is categorized as a technological factor challenge, while perceived ease of use is categorized under institutional, employee, and supplier challenges, respectively. This study aims to delve deeper into these factor challenges of e-procurement implementation and assess their impact on government institutions in Ghana.

2.5. Empirical Review

Owusu (2014) conducted research on e-procurement within public procurement entities in Ghana. The study revealed that significant challenges of e-procurement in these entities include low end-user uptake and training, supplier adoption issues, lack of an implementation strategy, expensive technological solutions, and inadequate top management support. Addressing these challenges is crucial for the successful implementation of e-procurement, particularly in the road sector in Ghana. Quinnox (2012) concluded that a well-implemented e-procurement system can directly connect firms and their business processes with suppliers, leading to enhanced performance. Kennedy (2015) investigated the relationship between e-procurement systems and procurement function performance in Kenya Commercial Banks. The study found that e-informing aids in both decentralizing operational procurement processes and centralizing strategic procurement processes, ultimately improving organizational communication and performance.

Zhang (2017) surveyed firms with varying attitudes towards technology to determine the optimal e-procurement system adoption process. Grimani et al. (2020) explored factors affecting e-procurement adoption among SMEs in the Southcoast of Massachusetts and found that it enhances performance. Nancy (2017) studied the impact of e-informing and e-ordering on the supply chain performance of State Corporations in the County Government of Nairobi. The research revealed that e-informing significantly improves supply chain performance. Kunnapadeert and Thepmongkorn (2017) focused on Thailand's e-procurement adoption, identifying critical success variables and businesses' readiness to adopt electronic procurement. Osei Tutu et al. (2019) evaluated critical factors for e-procurement implementation in Ghana, highlighting stable power and internet connectivity as major factors, while the mandatory use of e-procurement and technical interoperability were of lesser importance. Belisari et al. (2020) investigated e-procurement adoption in the Italian market, emphasizing the role of consultancy and advisory services in overcoming challenges and realizing benefits. Singh et al. (2022) examined the adoption of e-expansion procurements and its relation to green procurement methods, finding a significant positive association between e-procurement technology and green procurement, suggesting that implementing e-procurement technology could enhance business sustainability.

2.5.1. Relationship between E-Procurement adoption and public sector service performance

E-procurement significantly influences firms' performance, primarily aimed at enhancing organizational efficiency and productivity (Ngeno & Kinoti, 2017). This is achieved through the facilitation of B2B purchasing, streamlining the buying process, and furnishing essential information to support informed purchasing decisions. E-procurement contributes to productivity by reducing transaction costs, enhancing internal procurement process efficiency, and fostering collaboration with suppliers (Mutangili, 2019). Efficiency in productivity is maximized when e-procurement activities automate procurement processes, resulting in streamlined workflows and improved coordination among organizations. Furthermore, e-procurement systems contribute to cost reduction in goods and administrative expenses (Lucca, 2019). The benefits of e-procurement can be categorized into tangible forms such as price and cost savings and intangible forms such as time savings and cultural shifts, eliminating bureaucracy and stress from processes (Lucca, 2019).

Moreover, e-procurement facilitates marketing activities by simplifying and expediting processes (Tiwari et al., 2019). Additional advantages include minimized purchasing cycle time and costs, enhanced budgetary control, reduced administrative errors, increased buyer productivity, lower prices through standardization and consolidated purchases, improved payment processes, and enhanced information management (Sarpong et al., 2017). Furthermore, e-procurement contributes to productivity by facilitating easy acquisition of items by internal customers, thereby optimizing resource utilization and streamlining procurement processes. Investing in e-procurement technology is advantageous for companies as it enhances efficiency and removes bottlenecks from the procurement process. Long-term cost reduction enables companies to allocate resources towards strategic initiatives. This study proposes that:

H1: e-procurement has positive influence on public service delivery performance

2.5.2. Relationship Digital Infrastructure and e-procurement adoption

To begin with, it is essential to recognize the foundational role of digital infrastructure in enabling the functionality of e-procurement platforms. Digital infrastructure encompasses various components such as stable internet connectivity, hardware resources, and software applications, all of which are essential for the seamless operation of e-procurement systems (Osei Tutu et al., 2019). Without adequate digital infrastructure in place, the feasibility and effectiveness of e-procurement initiatives are inherently limited. Moreover, digital infrastructure serves as an enabler for overcoming logistical barriers and streamlining procurement processes. Research by Zhang (2017) highlights that a robust digital infrastructure facilitates the seamless integration of e-procurement systems with existing procurement workflows and information management systems. This integration enhances data accuracy, transparency, and accessibility, thereby optimizing procurement operations and decision-making processes.

Furthermore, the availability of digital infrastructure fosters organizational readiness and capacity building for e-procurement adoption. Grimani et al. (2020) emphasize that digital infrastructure provides the necessary technological backbone for training procurement officers and stakeholders, enhancing their digital literacy and proficiency in utilizing e-procurement tools. As a result, organizations equipped with robust digital infrastructure are better prepared to navigate the complexities of e-procurement implementation and maximize its benefits. Additionally, digital infrastructure plays a pivotal role in promoting interoperability and data exchange among procurement stakeholders. Osei Tutu et al. (2019) note that interoperable digital infrastructure facilitates seamless communication and collaboration between public procurement entities, suppliers, and other stakeholders involved in the procurement ecosystem. This interoperability enhances information sharing, procurement transparency, and stakeholder engagement, thereby driving the adoption and diffusion of e-procurement practices. Empirical studies have demonstrated the tangible benefits of digital infrastructure in catalyzing e-procurement adoption and performance improvement. For instance, Owusu (2014) identified stable power supply and internet connectivity as critical factors influencing e-procurement adoption in Ghana. Similarly, Belisari et al. (2020) found that organizations with robust digital infrastructure experience higher levels of e-procurement adoption and utilization, leading to improved

procurement efficiency and cost savings. Digital infrastructure plays a pivotal role in driving the adoption and success of e-procurement initiatives within public sector organizations. By investing in robust digital infrastructure, governments can create an enabling environment that fosters procurement modernization, enhances operational efficiency, and ultimately delivers greater value for taxpayers' money. This study proposes that:

H2: digital infrastructure has a positive influence on e-procurement adoption

2.5.3. Moderating effect of Citizen expectation

Research by Grimmelikhuisen and Porumbescu (2017) underscores that citizen expectations serve as essential benchmarks for evaluating public services and political performance. As such, they significantly influence how citizens perceive the quality and effectiveness of government initiatives, including e-procurement implementations. Moreover, the adoption of e-procurement systems inherently seeks to enhance efficiency, transparency, and accountability in public service delivery. However, the realization of these objectives is contingent upon aligning e-procurement processes with citizen expectations. Venkatesh et al. (2003) emphasizes the importance of perceived usefulness and ease of use—factors akin to citizen expectations in technology adoption models. Therefore, when citizens hold high expectations regarding the efficacy and user-friendliness of e-procurement systems, they are more likely to positively influence their performance outcomes.

Furthermore, the moderating effect of citizen expectations is particularly salient in the context of service quality perceptions. Research by James (2011) suggests that citizen expectations encompass both predictive (perceptions of future outcomes) and normative (perceptions of desired outcomes) dimensions. Therefore, when citizens anticipate tangible benefits from e-procurement implementations, such as enhanced service accessibility and responsiveness, their expectations serve as catalysts for improved service delivery performance. Empirical studies have also highlighted the nuanced interplay between citizen expectations, e-procurement, and service delivery outcomes. For instance, Osei Tutu et al. (2019) identified stable power supply, internet connectivity, and infrastructure availability as critical factors influencing e-procurement implementation in Ghana. However, they also noted the importance of managing citizen expectations regarding the role of technology in mitigating service delivery challenges. In light of these insights, it becomes evident that citizen expectations act as a moderating variable that shapes the relationship between e-procurement and public service delivery performance. Governments and policymakers must proactively manage and align citizen expectations with the capabilities and limitations of e-procurement systems to optimize their impact on service delivery outcomes. This study proposes that:

H3: citizen expectation positively moderates the relationship between e-procurement and public service delivery performance

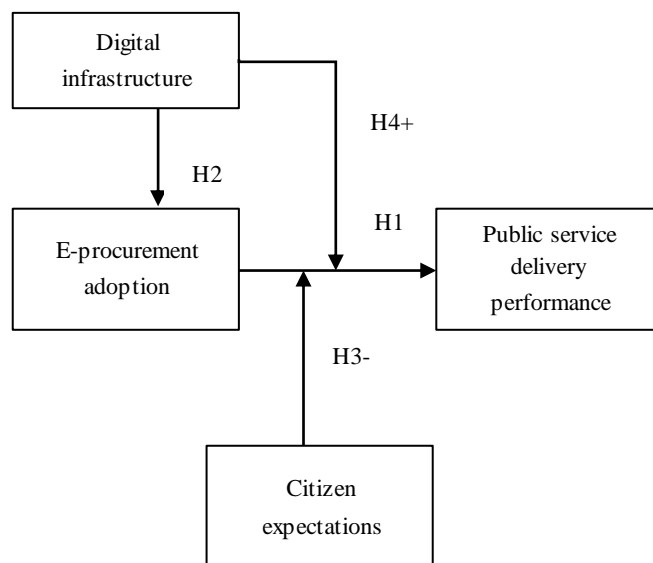
2.5.4. Moderating effect of digital infrastructure

E-procurement necessitates companies' investment in technology. Nowadays, technology is ubiquitous in both households and businesses. Many businesses opt to delegate non-core functions like human resources, IT, and engineering services. The digital transformation of procurement has enhanced its efficiency, prompting numerous firms to shift away from traditional procurement methods. Technology enables various methods of data collection, accessible and shareable among all supply chain

participants. It facilitates extensive communication and network creation throughout the procurement process by integrating ICT systems into firms' planning stages. Procurement has evolved into a multifaceted process involving complex procedures such as need acknowledgment, technical description advancement, supplier evaluation, and purchase decision-making. Consequently, businesses are compelled to innovate to mitigate procurement risks. Procurement is increasingly strategic, with technology serving as a pivotal tool for enhancing procurement performance. E-procurement, as defined by Alvarez-Rodríguez et al. (2014), involves business transactions conducted electronically between sellers and buyers. It acts as a platform connecting government agencies and suppliers in an online environment, streamlining public sector procurement. The overarching goal is to leverage Internet technologies to create a virtual trading environment encompassing government agencies and global suppliers. E-procurement enables government agencies to function as independent buyers under a unified buying organization, facilitated by organizational characteristics and influences. It fosters product design and industrial innovation initiated by suppliers and end-users. In essence, procurement offers a unique avenue for buyers to identify potential suppliers through standard search engines or specialized trading portals. Researchers suggest that users' intention to use and actual usage behavior significantly improve with the adoption of new systems, primarily driven by perceived usefulness. Numerous studies indicate that perceived usefulness is a key predictor of intention to use new systems across voluntary and mandatory settings. This study proposes that:

H4: digital infrastructure moderates the relationship between e-procurement and public service delivery performance.

Conceptual Framework



3.0. Methodology

3.1. Research Design

Research design is a crucial aspect of any study as it outlines the plan and structure for collecting, measuring, and analyzing data. It serves as a blueprint that guides the researcher in addressing the research question, ensuring that the evidence obtained allows for a clear and valid conclusion. Research designs can be broadly categorized into three types: exploratory, descriptive, and explanatory. The Exploratory Research Design is a type of design used when the research problem is not clearly defined. It aims to explore the research questions and gain insights into the subject

matter. Techniques such as literature reviews, expert interviews, and pilot studies are commonly used in exploratory research (Saunders, Lewis, & Thornhill, 2019).

The Descriptive Research Design aims to accurately and systematically describe a population, situation, or phenomenon. It involves collecting data that provides an accurate portrayal of characteristics, behaviors, and events. Methods include surveys, observational studies, and case studies (Yin, 2018).

Explanatory Research Design also known as causal research, this design seeks to determine cause-and-effect relationships between variables. It involves manipulating one or more variables to observe the effect on another variable. Experimental and quasi-experimental designs are typical examples (Creswell & Creswell, 2018).

Explanatory research design, also known as causal research, is suited for studies aimed at understanding the cause-and-effect relationships between variables. For the study of the influence of e-procurement adoption on public service delivery performance, considering the role of citizen expectations and digital infrastructure, an explanatory research design is highly appropriate. The primary objective of this study is to determine whether and how the adoption of e-procurement impacts public service delivery performance. An explanatory research design focuses on identifying causal relationships between variables, which aligns perfectly with the goal of understanding the effects of e-procurement adoption (Creswell & Creswell, 2018). Explanatory research design allows for the manipulation of independent variables (e-procurement adoption) to observe changes in the dependent variable (public service delivery performance). This design enables the researcher to control for other influencing factors, such as citizen expectations and digital infrastructure, thereby isolating the specific impact of e-procurement (Bryman, 2016). In this study, specific hypotheses can be formulated, such as "E-procurement adoption improves public service delivery performance" or "The effectiveness of e-procurement adoption on public service delivery is moderated by digital infrastructure." Explanatory research is ideal for testing these hypotheses through structured methodologies, such as experiments or quasi-experiments, providing empirical evidence to support or refute these claims (Punch, 2013).

3.2. Source of Data

Primary data are original firsthand data collected by the researcher for a specific research purpose. These data are gathered directly from the source or through direct observation and are typically more reliable for specific research questions. Secondary data are data that have already been collected, processed, and published by others. Using primary data provides direct evidence and specific insights into the research question, while secondary data offer context and broader perspectives, enhancing the depth and reliability of the research findings. This study used primary source of data because of its relevance and accuracy. The primary data was collected with the specific research question or objective in that were stated. This was done to ensure that the data is directly relevant to the issue at hand. The primary data reflects the current conditions or behaviors, which is particularly important in rapidly changing fields. The primary data was utilized because using primary sources of data is essential for ensuring the accuracy, relevance, and depth of research findings, as well as for gaining unique insights that secondary data cannot provide. It empowers researchers with control over the data collection process, enhances

the validity of the research, and supports innovation and exploration in their respective fields.

4.0. RESULTS AND DISCUSSIONS

4.1. Introduction

This section explores the outcomes and conversations drawn from the data presented in the methodology section of the study. The study concentrated on exploring the relationship between e-procurement adoption and public sector service performance: the moderating effect of citizen expectations and digital infrastructure. It encompasses details about the participants' demographics, statistical summaries of the study's variables, evaluations of validity and reliability, correlations between variables, hypothesis testing, and an extensive examination of the findings.

4.1 Respondents Demographics

Profile	Category	Frequency	Percentage
Age	20 – 25 years	0	0
	26 – 30 years	43	11.2
	31 – 35 years	54	14.1
	36 – 40 years	84	21.9
	41 – 45 years	160	41.7
	46 – 50 years	43	11.2
	51 – 55 years	0	0
	56 – 60 years	0	0
	Total	384	100.0
Gender	Male	287	74.7
	Female	97	25.3
	Total	384	100.0
Position/Role	Procurement Manager/Officer	230	59.9
	Warehouse Manager/Officer	26	6.8
	Logistics Manager/Officer	55	14.3
	Inventory Manager/Officer	73	19.0
	Total	384	100.0
Educational Background	High School Graduate	0	0
	Bachelor's Degree	154	40.1
	Master's Degree	90	23.4
	HND/Diploma	112	29.2
	PhD/DBA	28	7.3
	Total	384	100.0

This table provides a breakdown of the demographic characteristics of the respondents who participated in the study. It includes information on their age, gender, position or role within their

organization, and educational background. The respondents are categorized into different age groups ranging from 26 to 50 years old. The majority fall within the age brackets of 36-40 years and 41-45 years, comprising 21.9% and 41.7% of the sample, respectively. Notably, there are no respondents in the younger (20-25 years) or older (51-60 years) age groups. The gender distribution shows a predominance of male respondents, constituting 74.7% of the sample, while female respondents make up 25.3%. Respondents are categorized based on their roles within their organizations. The highest representation is from Procurement Managers/Officers (59.9%), followed by Inventory Managers/Officers (19.0%), Logistics Managers/Officers (14.3%), and Warehouse Managers/Officers (6.8%). The educational qualifications of the respondents vary, with the majority holding a Bachelor's degree (40.1%) or a Master's degree (23.4%). Additionally, a significant portion has completed an HND/Diploma program (29.2%), while a smaller percentage hold higher academic qualifications such as PhD/DBA (7.3%). The demographic profile provides insights into the characteristics of the respondents involved in the study, offering a comprehensive understanding of the sample composition and facilitating interpretation of the research findings within relevant demographic contexts.

2.1. Reliability and Validity Tests

Reliability and validity tests are crucial components of data analysis, ensuring that research measures are consistent, accurate, and meaningful. Reliability refers to the consistency and stability of measurement over time or across different conditions. Reliability tests assess the degree to which a measurement tool produces consistent results. Internal Consistency Reliability examines the extent to which items within a scale or instrument are interrelated. Common measures include Cronbach's Alpha where a coefficient that indicates the internal consistency of a scale by measuring the average correlation between all items.

Validity refers to the extent to which a measure accurately captures the construct or concept it is intended to measure. Validity tests assess whether a measurement tool measures what it claims to measure. Content Validity evaluates the extent to which a measurement tool adequately covers the domain of interest and it involves expert judgment and qualitative assessment of the instrument's content which were achieved through a pilot test and expert scrutinization of the scale items. The Construct Validity assesses whether a measurement tool accurately measures the theoretical construct it intends to measure. It involves testing hypotheses about relationships between the measure and other variables.

Table 4.2 Reliability and Validity Results.

Digital Infrastructure	E-procurement Adoption	Citizen Expectations	Public Service Delivery Performance
Cronbach's Alpha=.868	Cronbach's Alpha=.835	Cronbach's Alpha=.873	Cronbach's Alpha=.899
N of Items=17	N of Items=15	N of Items= 6	N of Items= 10
Kaiser-Meyer-Olkin Measure of Sampling	Kaiser-Meyer-Olkin Measure of Sampling	Kaiser-Meyer-Olkin Measure of Sampling	Kaiser-Meyer-Olkin Measure of Sampling

Adequacy=.616	Adequacy=.576	Adequacy=.720	Adequacy=.760
Factor loadings	Factor loadings	Factor loadings	Factor loadings
.581	.816	.791	.414
.850	.840	.744	.389
.705	.837	.839	.715
.765	.872	.819	.841
.740	.666	.748	.761
.811	.727	.782	.831
.687	.775		.619
.839	.866		.653
.769	.776		.735
.792	.691		.829
.758	.890		
.783	.803		
.804	.828		
.590	.824		
.848	.764		
.689			
.755			

Digital Infrastructure Cronbach's Alpha = .868: This value indicates high internal consistency, suggesting that the 17 items used to measure digital infrastructure are reliably capturing the same underlying construct. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .616: This value is above the minimum acceptable threshold of 0.5, indicating that the sample size is adequate for factor analysis for the digital infrastructure construct.

E-procurement Adoption Cronbach's Alpha = .835: This value shows good internal consistency, implying that the 15 items used to assess e-procurement adoption are consistently measuring the intended construct. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .576: This value is slightly above the minimum acceptable threshold, suggesting that the sample size is marginally adequate for factor analysis for the e-procurement adoption construct.

Citizen Expectations Cronbach's Alpha = .873: This value signifies high internal consistency, meaning that the 6 items used to measure citizen expectations are reliably capturing the same underlying construct. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .720: This value indicates a good adequacy level, meaning that the sample size is suitable for factor analysis for the citizen expectations construct.

Public Service Delivery Performance Cronbach's Alpha = .899: This value indicates very high internal consistency, suggesting that the 10 items used to measure public service delivery performance are reliably capturing the same underlying construct. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .760: This value

signifies a good level of sampling adequacy, suggesting that the sample size is appropriate for factor analysis for the public service delivery performance construct. These results indicate that the measurement scales used in the study are both reliable and valid, providing confidence in the consistency and accuracy of the data collected for each construct. Factor loadings represent the correlation coefficients between observed variables (items) and the underlying latent factors. They indicate how strongly each item is associated with the factor. A higher factor loading suggests that the item is a better indicator of the factor. A factor loading threshold of 0.5 is often used as a benchmark to determine whether an item should be retained or excluded. This threshold ensures that items have a strong enough relationship with the factor to be considered meaningful. By excluding items with loadings below 0.5, researchers enhance the construct validity of the factor. Construct validity refers to how well a set of items represents the concept being measured. Items with low loadings may not adequately capture the construct and can introduce noise or reduce the clarity of the factor structure. Items with factor loadings below 0.5 are weakly correlated with the underlying factor. Retaining such items can dilute the strength of the factor and lead to a less coherent measurement model (Hair et al., 2010). Theoretical frameworks and prior research often guide the selection of items. Excluding items with low loadings ensures that the factors are theoretically sound and consistent with established literature (Tabachnick & Fidell, 2013). Including items with low loadings can lead to an overly complex and less practical measurement tool. Excluding these items simplifies the instrument, making it more user-friendly and efficient for both respondents and researchers.

2.1. Correlation among the variables

Table 4.3 presents the Pearson correlation coefficients between four variables: Digital Infrastructure (DIIN), E-procurement Adoption (EPAD), Citizen Expectations (CIEX), and Public Service Delivery Performance (PSDP). The table includes the correlation coefficients, significance levels, and the sample size (N) for each pair of variables.

Table 4.3 Correlations among the variables

	DIIN	EPAD	CIEX	PSDP
DIIN Pearson Correlation	1	.480**	.044	.151**
DIIN Sig. (2-tailed)		.000	.392	.003
DIIN N	384	384	384	384
EPAD Pearson Correlation	.480**	1	-.019	.085
EPAD Sig. (2-tailed)	.000		.704	.095
EPAD N	384	384	384	384
CIEX Pearson Correlation	.044	-.019	1	.821**
CIEX Sig. (2-tailed)	.392	.704		.000
CIEX N	384	384	384	384
PSDP Pearson Correlation	.151**	.085	.821**	1
PSDP Sig. (2-tailed)	.003	.095	.000	
PSDP N	384	384	384	384

** . Correlation is significant at the 0.01 level (2-tailed).

Note: DIIN= Digital Infrastructure; EPAD =E-procurement Adoption; CIEX=Citizen Expectations; PSDP= Public Service Delivery Performance

There is a moderate positive correlation between Digital Infrastructure and E-procurement Adoption, which is statistically significant at the 0.01 level. There is a very weak positive correlation between Digital Infrastructure and Citizen Expectations, which is not statistically significant. There is a weak positive correlation between Digital Infrastructure and Public Service Delivery Performance, which is statistically significant at the 0.01 level. There is a very weak negative correlation between E-procurement Adoption and Citizen Expectations, which is not statistically significant. There is a weak positive correlation between E-procurement Adoption and Public Service Delivery Performance, which is not statistically significant. There is a very strong positive correlation between Citizen Expectations and Public Service Delivery Performance, which is statistically significant at the 0.01 level. Citizen Expectations (CIEX) and Public Service Delivery Performance (PSDP) with a very strong positive correlation ($r = .821^{**}$). Digital Infrastructure (DIIN) and E-procurement Adoption (EPAD) with a moderate positive correlation ($r = .480^{**}$). Digital Infrastructure (DIIN) and Public Service Delivery Performance (PSDP) with a weak positive correlation ($r = .151^{**}$). E-procurement Adoption (EPAD) and Public Service Delivery Performance (PSDP) with a weak positive correlation ($r = .085$, not significant). Digital Infrastructure (DIIN) and Citizen Expectations (CIEX) ($r = .044$, not significant). E-procurement Adoption (EPAD) and Citizen Expectations (CIEX) ($r = -.019$, not significant). The significant correlations (marked with **) indicate where meaningful relationships exist between the variables, while the non-significant correlations suggest that there is no strong evidence of a relationship in those cases.

Table 4.4 Hypotheses Testing and Findings

Hypothesis	Relationship	Beta value	T value	P<	Decision
H1	EPAD --- > PSDP	.428	.189	.850	Not supported
H2	DIIN --- > PSDP	.081	3.810	0.000	Supported
H3	DIIN --- > EPAD * PSDP	.094	1.142	.254	Not supported
H4	CIEX--- > EPAD* PSDP	.107	4.222	0.000	Supported
H5	EPAD --- > DIIN --- > PSDP	.235	.037	.971	Not supported

4.4. Discussion of Results

Influence of e-procurement adoption on public service delivery performance

The study examined the influence of e-procurement adoption on public service delivery performance and findings of the study indicate that e-procurement adoption has no statistically significant effect on public service delivery performance. For e-procurement to significantly enhance public service delivery, it must be well-integrated with existing IT systems and processes. Poor integration

can lead to operational inefficiencies and data inconsistencies, undermining the potential benefits of e-procurement (Gunasekaran & Ngai, 2008). In many cases, public sector organizations struggle with legacy systems that are not compatible with new e-procurement platforms.

Influence of digital infrastructure on e-procurement adoption

The study examined the influence of digital infrastructure on e-procurement adoption and the findings of the study indicate that digital infrastructure statistically significant positive influence on e-procurement adoption. Modern digital infrastructure, characterized by high-speed internet, advanced networking capabilities, and robust cloud services, facilitates seamless connectivity and integration between procurement systems and suppliers. According to a study by Kshetri (2020), improved connectivity reduces transaction times and enhances the efficiency of procurement processes, making e-procurement more attractive and feasible for organizations. Advanced digital infrastructure supports better data management and analytics capabilities, which are crucial for effective e-procurement. Platforms leveraging big data and AI can analyze procurement data to identify patterns, optimize spending, and predict future needs (Lacity & Willcocks, 2021). This capability makes e-procurement systems more powerful and reliable, encouraging adoption.

Moderating effect of digital infrastructure

The study examined how digital infrastructure moderates the relationship between e-procurement adoption and public service delivery performance. The findings of the study indicate that the interaction term's effect is negative but not statistically significant, suggesting that while digital infrastructure is important on its own, its moderating role is not strong enough to significantly alter the impact of e-procurement adoption on the outcome. Implementing digital infrastructure and e-procurement systems is a complex process that requires significant resources, training, and change management. While robust digital infrastructure provides a necessary foundation for e-procurement, the complexity of integrating these systems effectively can dilute the moderating impact. According to Venkatesh et al. (2020), such implementations often face hurdles that can overshadow the potential moderating effects.

There may be threshold effects where digital infrastructure only starts to significantly enhance the impact of e-procurement after reaching a certain level of maturity and integration. If many organizations in the study are still in early stages of digital infrastructure development, the moderating effects might not yet be apparent. Zhang, Guo, and Zhao (2021) discuss how incremental improvements in infrastructure may not immediately translate into significant performance gains.

Moderating effect of citizen expectation on the relationship between e-procurement adoption and public service delivery performance

The study examined the moderating effect of citizen expectation on the relationship between e-procurement adoption and public service delivery performance. The findings of the study indicate that citizen expectation significantly moderates the relationship between e-procurement adoption and public service delivery performance. Citizen expectations shape how e-procurement systems are designed, implemented, and perceived. When e-procurement systems align with public demands for efficiency, transparency, and accessibility, their impact on public service delivery performance is amplified. This alignment ensures that the

systems address actual needs and improve user satisfaction. Heeks (2019) argues that understanding and meeting citizen expectations is crucial for the success of e-government initiatives. High citizen expectations for transparency and accountability in public services drive governments to adopt e-procurement systems that provide greater visibility into procurement processes. This transparency can reduce corruption and enhance trust in public institutions, thereby improving public service delivery performance. According to Bannister and Connolly (2020), e-procurement systems that meet citizen demands for transparency contribute significantly to perceived government integrity and effectiveness.

Mediating effect of e-procurement adoption on the relationship between digital infrastructure and public sector delivery service performance.

The study assessed the Mediating effect of e-procurement adoption on the relationship between digital infrastructure and public sector delivery service performance and results indicate that digital infrastructure directly enhances public service delivery performance, but the mediating role of e-procurement adoption in this relationship is not significant. This suggests that improvements in public service delivery performance are more directly attributable to enhancements in digital infrastructure rather than through the pathway of e-procurement adoption. The benefits of e-procurement adoption might take time to materialize, especially in complex public sector environments. There could be a lag between the implementation of e-procurement systems and the realization of their full benefits, whereas the impact of digital infrastructure improvements can be more immediate. This time lag might contribute to the non-significant mediating role observed in the study. Dawes et al. (2020) note that the maturity and full adoption of e-procurement systems often require significant time and iterative improvements. The effectiveness of e-procurement systems can be hindered by implementation challenges such as resistance to change, lack of training, and integration issues with existing systems. These challenges might reduce the potential mediating impact of e-procurement on public service delivery performance, even when supported by strong digital infrastructure. Reddick, Chatfield, and Ojo (2021) discuss various implementation barriers that can limit the effectiveness of e-procurement systems in public sector contexts.

5.0. Managerial Implication

Managers should actively solicit feedback from citizens throughout the e-procurement adoption process to ensure that the system adequately addresses their needs. This feedback can inform adjustments and improvements to the system, enhancing its effectiveness in delivering public services.

Government agencies should invest in initiatives to raise awareness and educate citizens about the benefits and functionalities of e-procurement systems. By fostering public understanding and acceptance of these systems, agencies can facilitate smoother adoption processes and maximize their impact on service delivery performance.

Managers should recognize the role of citizen expectations as a driving force behind e-procurement success and prioritize strategies that enhance citizen satisfaction and engagement. This may involve incorporating user-friendly features, ensuring transparency and accountability in procurement processes, and providing avenues for citizen participation and feedback.

5.1. Theoretical Contribution

The study enriches theories related to public service delivery by incorporating citizen expectations as a critical variable. This underscores the importance of citizen-centric approaches in public administration and suggests that the success of public service initiatives is significantly influenced by how well they align with the expectations of the citizens they serve.

The research contributes to the development of a moderated mediation framework in the context of public administration. By showing that citizen expectations can moderate the relationship between e-procurement adoption and public service delivery performance, it provides a basis for future studies to explore other potential moderating factors and their impacts on public sector innovations.

This finding contributes to the broader literature on digital government and e-governance. It emphasizes the role of citizen engagement and expectations in the success of digital initiatives, providing empirical evidence that supports the need for inclusive and participatory approaches in the design and implementation of digital government projects.

5.2. Recommendation

Organizations are to establish regular channels for citizen feedback and engagement, such as surveys, focus groups, and public forums, to gather insights on their expectations and experiences with public services.

Companies are to design e-procurement systems with a user-centric approach, ensuring that they meet the needs and preferences of citizens. This may involve simplifying interfaces, enhancing usability, and ensuring accessibility.

Organizations are to conduct public awareness campaigns to educate citizens about the benefits and functionalities of e-procurement systems, highlighting how these systems can improve service delivery.

Organizations are to establish performance metrics that reflect citizen expectations and satisfaction levels, and regularly monitor these metrics to assess the impact of e-procurement adoption on service delivery.

5.3. Limitations for the Study

The study was a cross-sectional, capturing data at a single point in time. This limits the ability to assess how citizen expectations and their moderating effects on e-procurement adoption and public service delivery performance evolve over time.

The findings might be influenced by context-specific factors such as cultural, political, or economic conditions that are unique to the study's setting. This context-specificity can limit the applicability of the results to different environments.

5.4. Suggestions for Future Study

A future study should conduct longitudinal studies to examine how the relationship between e-procurement adoption, citizen expectations, and public service delivery performance evolves over time. This would help in understanding the long-term impacts and any temporal changes in citizen expectations. A future study can expand the study to include a broader geographic scope, encompassing diverse regions and countries. This would enhance the generalizability of the findings and provide insights into how different cultural, economic, and political contexts influence the relationship.

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