Corruption in Public Procurement: Can E-Procurement and Artificial Intelligence Make a Difference in Africa?

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Abstract

Corruption is a challenge that impedes countries' development, and there have been many movements to combat this severe global phenomenon. The huge spending on public procurement, mainly on capital projects, renders it highly prone to corruption. The conventional paper-based procurement process has been linked to inefficiency and corruption in procurement practices and given the expanding role of technology in an increasingly interconnected world, many leading experts suggest that technology can be a powerful tool to reduce opportunities for corruption in public procurement. In the past three decades, the use of technology including electronic procurement (e-procurement) and artificial intelligence (AI) in public procurement has globally gained seeming popularity. However, currently, technology in public procurement is not as widely used in the African continent.

Being inspired by other studies that assess how technology can help in tackling corruption in public procurement, this dissertation's main hypothesis is that technology can have an impact on reducing corruption in public procurement in Africa with a particular emphasis on the prospects and challenges for technology adoption in Ghana and South Africa. The dissertation analyzes the kinds of initiatives that helped technology implementation in other countries and the utility of adopting such mechanisms in the context of the subject countries under review. The dissertation investigates the critical success factors for adopting technology in public procurement activities in Ghana and South Africa using qualitative data analysis and mixed theories. In Sub-Saharan African countries where there is a significant level of corruption in the procurement process, there is a need for a better understanding of how technology can be used to combat corruption in public procurement.

This dissertation reveals that success factors' barriers to technology adoption in the two countries within scope could be categorized into three components: people, process, and technology. Whereas Ghana's biggest challenges are related to the technology component, in South Africa most challenges are related to people and process components while the two countries share certain common challenges as well. Bearing this in mind, this dissertation aims to discuss these challenges and suggest ways for overcoming them. The author argues that the expectations around the deployment of e-procurement and AI as an anticorruption tool in public procurement need to be reasonable. It also investigates how the potential applications of technology can help in identifying, flagging, and controlling corrupt areas, as such, technology can provide incremental improvements but not a radical eradication of corruption in public procurement in the two countries under review.

1. Introduction

The role of technology is expanding tremendously, and nearly every area of our lives and businesses are influenced by the digital revolution. This technological advancement has made available a variety of new tools and strategies that can be utilized to combat corruption more effectively. Since the late 1990s, several new electronic-commerce technologies emerged and revolutionized working practices, and accordingly, new procurement technology and applications like e-procurement and AI have been significantly adopted by organizations globally (Azanlerigu and Akay, 2015). According to Scholl and Ubaydi (2017), experts suggest that this technology can be a powerful tool for enhancing government transparency and accountability, hence preventing corruption. Figure 1 illustrates the evolution of e-procurement.

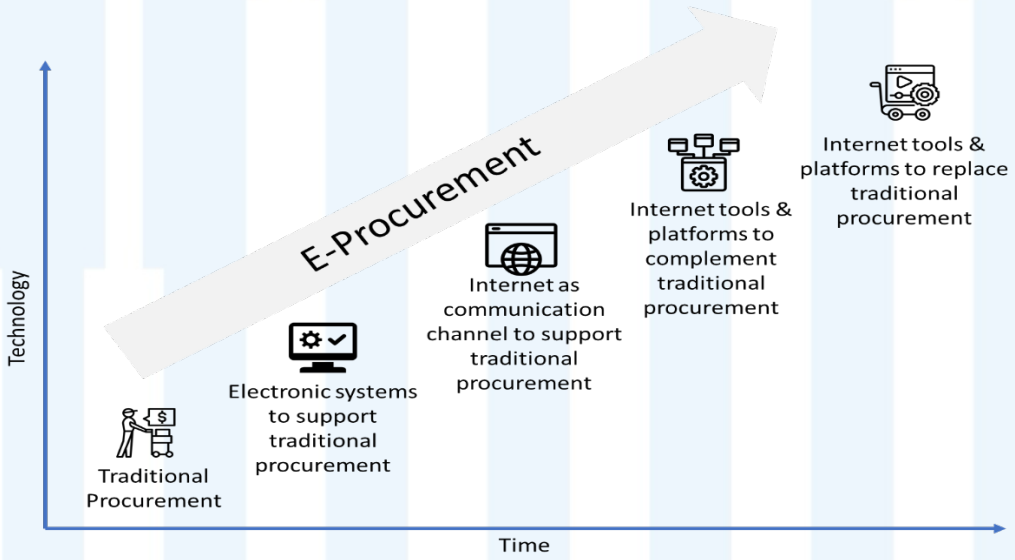

Figure 1: History of e-procurement (Addo, 2019)

While AI is not yet used in public procurement in African countries, e-procurement was slowly introduced. The World Bank states three main reasons for the slow implementation of e-procurement in Africa which are: i. the necessary capacity required was not put in place by African governments, ii. lack of information technology infrastructure and lack of internet access, iii. old-fashioned administrative cultures in African governments (Anthony, 2018).

The hypothesis mooted in this dissertation is whether Technology can have an impact on reducing corruption in public procurement in Africa with a particular emphasis on the prospects and challenges for technology adoption in Ghana and South Africa. The author tries to find answers to the following research questions through this dissertation (i) Why is the issue of corruption in public procurement important? and (ii) Can e-procurement and AI make a difference in reducing public procurement corruption in Africa? This dissertation

examines the viability of technology tools, specifically e-procurement and AI, and how their adoption could eventually result in less corruption in Ghana and South Africa's public procurement, as the characteristics of these countries are similar to other African countries. The term "technology" refers to e-procurement and AI in the context of this dissertation. The dissertation uses the People - Process - Technology (PPT) framework to categorize, discuss and analyze success factors for the successful implementation of technology to reduce corruption in public procurement in the two countries. The dissertation is underpinned by the following widely accepted theories, (i) the Technology Acceptance Theory, (ii) the Disruptive Innovation Theory, and (iii) the Principal-Agent Theory.

Ofori and Fuseini (2020) suggest that considering technology benefits, it is worth exploring, understanding, and assessing its enablers and inhibitors. In the context of this article, these enablers and inhibitors are referred to as success factors for the deployment of technology in public procurement. Bawole and Adjei-Bamfo (2019) state that there are only limited country comparative studies intended to analyze public procurement in Africa. Thus, this dissertation intends to address this issue in the context of Africa via sketching a comparative analysis of public procurement in Ghana and South Africa. The reason for selecting these two countries is that they can give a comprehensive review of technology usage in Africa's public procurement. Ghana is located in western Africa with a middle economy and was the first West African country to implement e-procurement (Whitehouse, 2019), with challenges mainly associated with infrastructure. While South Africa is located on the southern tip of Africa and is considered one of the biggest economies among African countries with relatively advanced infrastructure; hence their challenges are mainly associated with people and processes. Ameyaw, Mensah and Osei-tutu (2012) argue that Ghana's procurement issues "for example" are similar to many African countries' challenges. The country's vice president of Ghana stated that the e-procurement system will allow the public to monitor all bids in real-time (Whitehouse, 2019). The president of South Africa stated that effective and efficient public-procurement systems are crucial for the achievement of the Millennium Development Goals and the promotion of sustainable development (Van Greunen, Van Niekerk and Herselman, 2010).

The dissertation examines the extent to which the usage of technology in public procurement could minimize corruption in public procurement in both the subject countries. This dissertation uses the qualitative method to analyze secondary data. The objective of this dissertation is also to identify the success factors and discuss the challenges that militate against the smooth implementation of technology including e-procurement and AI in Ghana and South Africa's public procurement and offers a broad set of solutions. This dissertation aims further to encourage discussion and reflection on the required steps to promote public procurement reforms in Africa through leveraging technology and other countries' success stories. The dissertation will initially discuss the importance of corruption issues in Public Procurement backed with relevant facts and figures and, secondly, a literature review, theoretical framework, and dissertation methodological approach and then analysis, findings

and discussions section followed by the contribution of the dissertation, and finally the conclusion.

2. Definitions

This section includes definitions for key words used in the dissertation including procurement, public procurement, corruption, e-procurement, and AI. According to the British Association for Project Management, procurement is the procedure used to purchase the resources (goods and services) needed for a project (Hudon and Garzon, 2016). European Commission defines public procurement as the process of purchasing products, services, and public works by governments and other bodies governed by public law (Ferwerda, Deleanu and Unger, 2016). Organization for Economic Co-operation and Development (OECD) defines public procurement as purchasing goods and services by government and state-owned enterprises (Scholl and Ubaydi, 2017). Neupane *et al*. (2014) add that usually, governments spend a considerable budget on public procurement. Besides its business objectives, Addo (2019) notes that public procurement is an instrument for a wider socio-economic objective like supporting citizens' employment and supporting local suppliers and small and medium enterprises (SMEs) by giving them preference over other suppliers. Regarding corruption, The United Nations Office on Drugs and Crime (UNODC) defines the term as the use of public power for private gain (Neupane, Soar, and Vaidya, 2014). They add that corruption can take various forms, such as bribery, theft, embezzlement, abuse of discretion, exploitation of conflict, improper political contributions, favoritism, and privileging private interests over public ones. According to Transparency International, corruption is described as the abuse of entrusted power for private gains (Aduwo *et al*., 2020). Similar to the general definition of corruption, public procurement corruption is described as the abuse of power for private gain in public procurement (Modrusan, Rabuzin and Mrsic, 2021). Sharma, Sengupta and Panja (2019) state that corruption may lead to price distortion and inflated procurement costs and that it might also undermine the public sector's ability to provide satisfactory levels of public goods and services. In Neupane *et al*. (2014) view, major corruption happens in the public procurement process in developing countries. They further add that OECD states that corruption risk exists in almost every tendering stage including needs identification, tenders design and preparation, bidding and contract awards, and execution. Gallego, Rivero and Martinez (2021) also add supplier agreements in which the supplier does not perform according to the original parameters of the contract or does not perform at all to corruption forms. According to Azanlerigu and Akay (2015), e-Procurement is the use of electronic methods in purchasing process from requirements identification to payment and contract management. Ibem and Laryea (2015) define e-procurement as the use of the electronic method in buying goods and services. According to Addo (2019), e-procurement tools were developed by the key players in the e-procurement market like Oracle, and SAP. Moreover, he suggests that regardless of the various sizes and shapes of e-procurement systems, the basic procurement process is similar across the public sectors and can be addressed with technology to automate the processes. AI is defined as the capacity of digital computers or

computer-controlled robots to execute tasks typically associated with intelligent beings (artificial intelligence | Definition, Examples, Types, Applications, Companies, & Facts, 2022).

3. Corruption in Public Procurement; Why this Issue is Important?

Public procurement contributes significantly to a state's economy and is seen as an essential government function. Thus, discussing corruption in public procurement is important as it's associated with huge public funds. Regarding the importance of public procurement, Sharma, Sengupta and Panja (2019) suggest that public procurement function is a tool for long-term social and economic growth. According to Neupane *et al*. (2014), the government's primary tool for assisting in the effective management of public resources is public procurement. Ofori and Fuseini (2020) suggest that governments spend a significant amount of their operations budgets on the procurement of products, works, and services, and consequently, ineffective procurement procedures can result in the loss of enormous investments, which can be disastrous to the survival and growth of any economy. Luijken and Martini (2014) agree that public procurement has a high risk of corruption due to the significant sums of money and the presence of a high level of bureaucracy that incentives corrupt behaviors. Along with monetary loss, they add, public procurement corruption also distorts competition, lowers the quality and safety of public procurement and projects, and erodes public trust in governments (Transparency International). According to Transparency International (TI), the Millennium Development Goals (MDG) of the United Nations cannot be reached without a global reduction in corruption (Scholl and Ubaydi, 2017). Pavlovic (2021) suggests that sustainable public procurement is the top priority for achieving the Sustainable Development Goals (SDGs) by 2030, given that governments spend an estimate of 10 to 20 % of their Gross Domestic Product (GDP) on government contracts. The World Bank describes public procurement as a crucial tool for the government (Bawole and Adjei-Bamfo, 2019). Neupane, Soar, and Vaidya (2014) state that the growth of many countries' economies is threatened by public procurement corruption. The World Bank, the UN, Transparency International, and the Asian Development Bank (ADB), state that corruption in public procurement is increasing, especially in developing countries (Neupane, Soar and Vaidya, 2014). They interpret that by weakening national institutions, increasing corporate costs, eroding trust, and discouraging foreign investment, corruption can hinder a countries' development. Bosio (2021) suggests that the main focus of anti-corruption efforts should be directed toward specific features of public procurement practice. In recent decades, the phenomenon of corruption in public procurement of products and services has expanded, OECD studied the bribery cases reported from 15 February 1999 to 1 June 2014 and determined that more than half of international bribery instances occurred to gain contracts in public procurement (see Fig. 2) (Rakhel and Putera, 2021).

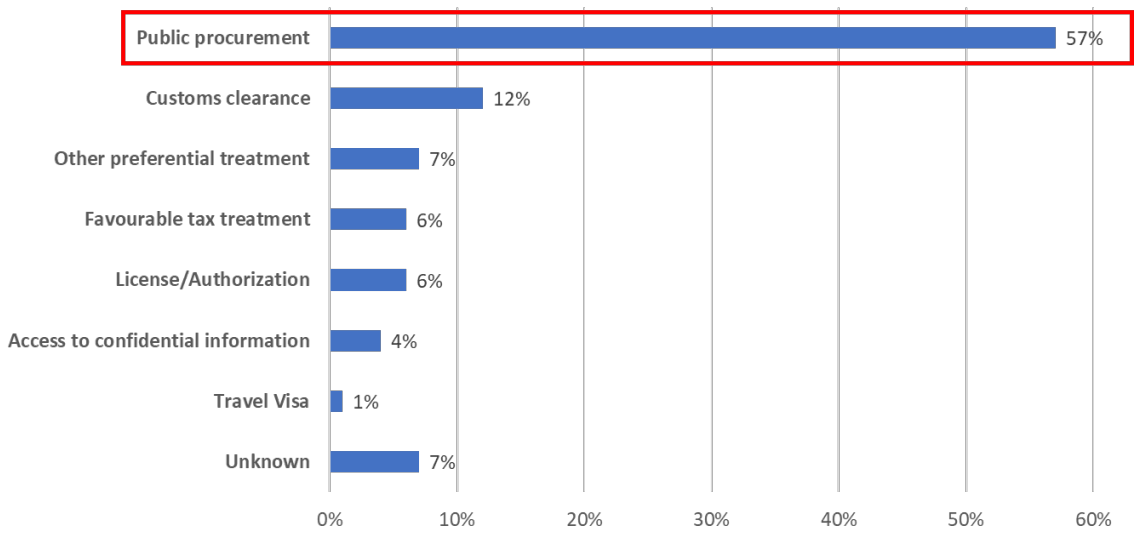

Figure 2: Purpose of the bribes (Rakhel and Putera, 2021)

Mantzaris (2014) claims that in many countries, particularly developing countries like Ghana and South Africa, corruption is most prevalent in the procurement transactions arena, as this is where the chances for corrupt activities are highest and the benefits of engaging in corrupt behavior can be very large. Soreide (2002) suggests that the most detrimental cost of corruption is frequently not the money wasted on bribes, it's rather the total economic and social impacts of corrupt conduct exceed of proportion the bribes paid by corrupt officials in terms of lost or abused resources. He adds that as investment choices are influenced by the possibility of receiving bribes, large building projects (like major dams) are prioritized above health and education programs. Even worse, Soreide (2002) further states that public procurement corruption has extensive effects on the poor because it limits financing for social services and turns decisions in favor of the wealthy and powerful, resulting in greater income disparities between the wealthy and the poor. Ofori and Fuseini (2020) suggest that ineffective procurement procedures can result in the loss of enormous investments, which is detrimental to the survival and growth of any economy. Corruption in public procurement reduces public trust in government and undermines the public integrity required to advance the public good, being one of the most corrupt government activities, corruption in public procurement deserves discussion as it has unique causes and impacts (Anti-Corruption Module 4 Key Issues: Corruption in Public Procurement, 2022). Soreide (2002) claims that the company responsible for constructing the new hospital for example may not be the one with the best price/quality combination, but instead the most successful briber or the one with the strongest government ties which may result in an overpriced project that does not meet quality requirements. Ofori and Fuseini (2020) suggest that although procurement is one of the most important aspects of a country's development, it is also an area where corruption is common. Hudon and Garzon (2016) state that although government corruption can occur at multiple levels, it is notably prevalent in infrastructure procurement for various reasons, including the substantial sums of money at stake. Due to the enormity of the financial flows involved OECD has identified public procurement as the government activity

most susceptible to corruption (OECD, 2016). Dema (2015) concurs that public procurement is one of the major corruption risk areas.

Huge public funds are spent on the procurement of goods and services. According to the UNDP, government procurement of goods and services typically account for 10–15% of the GDP of developed countries and 20–70% of the GDP of developing countries (Neupane *et al*., 2014). The World Trade Organization (WTO) confirms that public procurement accounts for 10 - 15% of global GDP and for OECD countries, the percentage is 12% (Petheram, Pasquarelli and Stirling, 2019). According to the World Bank, public procurement, the largest component of public expenditures after salaries, accounts for around 15% to 20% of public spending globally and up to 70% in developing countries (Bawole and Adjei-Bamfo, 2019). A World Bank study further revealed that 50-70% of the national budget is tied to procurement even if it is not a direct public procurement expense and as a result, a country experiencing significant developmental challenges needs an effective public procurement system to ensure value for money in government spending (Ameyaw, Mensah and Osei-Tutu, 2012). Public procurement accounts for up to 50% of global government spending annually (Anti-Corruption Module 4 Key Issues: Corruption in Public Procurement, 2022). The World Bank estimates that the annual worth of bribes paid worldwide is $1 trillion (Neupane, Soar and Vaidya, 2014). The International Monetary Fund (IMF) further states that corruption costs US$1 trillion annually for only governments worldwide (Petheram, Pasquarelli and Stirling, 2019). 20-25% of procurement budgets according to the OECD are lost due to corruption (Luijken and Martini, 2014). Pavlovic (2021) estimates that 10 to 20% of public procurement money is lost to corruption and bribery. A survey reveals that 14.6% of a companies' total bribes are typically spent to gain governmental contracts, the amount goes up to 30% and 45% in some countries (Soreide, 2002). For the two countries under review, while public spending on goods and services in Ghana according to Ofori and Fuseini (2020) accounts for around 21.5 % of the country's GDP, public spending on goods and services in South Africa accounts for around 20% of the country's GDP (Bosio, E. and Djankov, S. 2020).

4. Literature Review

4.1 Theoretical Framework

This dissertation's theoretical framework combines multiple theories including the Technology Acceptance Model Theory, the Disruptive Innovation Theory, and the Principal-Agent Theory in an integrated framework that helps in identifying the challenges and opportunities of technology implementation in public procurement in Africa to curb corruption. Ofori and Fuseini (2020) state that the Technology Acceptance Model theory (TAM) makes predictions on the adoption and utilization of information and communication technology by adopters, and it focuses on two fundamental factors, namely the perceived usability and usefulness of technology. They further state that Fred Davis developed TAM in 1986 to explain how users accept information technologies and interpret that in most developed countries, for instance, e-procurement is widespread and contributes significantly

to public procurement, effective resource utilization, and invariably enhanced performance. TAM is used in this dissertation to describe the general factors of technology acceptance in Ghana and South Africa, which lead to the analysis of challenges, opportunities, and user behavior across a broad variety of users, including government entities and their suppliers. Disruptive Innovation Theory (DIT) was first introduced by Christensen in 1997 as disruption technology, which Christensen and Raynor renamed to disruption innovation in 2003 (Ofori and Fuseini, 2020). He adds that the theory emphasizes that innovation reduces the price and complexity of products and services, resulting in enhanced organizational performance specifically, according to the Disruptive Innovation Theory, there are perceived characteristics of an innovative tool or technology that either attract or hinder its adoption by businesses and individuals. Although the theory includes multiple features, Ofori and Fuseini (2020) assert that relative advantage, compatibility, and simplicity are the key factors in the adoption of technology and e-procurement systems and that developers of e-procurement technology should ensure that these characteristics are of the highest quality and that the system is user-friendly. Applying DIT theory, the author suggests that technology can help in reducing corruption by breaking the corrupt relationship between government public procurement officers/executives and their suppliers who used often win the public project in return for bribery paid for government public procurement officers/executives. This dissertation also uses the principal-Agent theory to examine the possibilities of technology and public e-procurement to minimize corruption. According to Neupane, Soar and Vaidya (2014), the Principal-Agent theory describes the relationship between two parties: the principal and the agent who provides services on the principal's behalf, and the theory applies to the contractual relationship between suppliers and clients. They add that Principal-Agent Theory explains the possibility of corruption in public procurement processes between two parties, government entities and their suppliers and examines potential public procurement issues that can lead to corruption in their relationship. This dissertation uses the principal-agent theory to evaluate the benefits of technology in structuring the relationship between government entities and their suppliers, such as transparent and real-time information, tracking and monitoring, and fair competition, thus reducing the likelihood of corruption in public procurement.

4.2 How can technology tackle corruption in public procurement

This section and the following section discuss how technology including e-procurement and AI respectively can be utilized to reduce corruption in public procurement. Scholars suggest that technology and e-procurement minimize public procurement corruption (Aduwo *et al*., 2020; Al-ajwad and Carr, 2022; Dema, 2015; Ionescu, 2013; Miroslav *et al*., 2014; Scholl and Ubaydi, 2017). Other scholars suggest that e-procurement offers more transparency, accountability, accessibility, and availability of procurement information and maximizes the value of public funds (Ayegba *et al*., 2018; Azanlerigu and Akay, 2015; Kramer, 2016; Neupane *et al*., 2012). They further argue that it minimizes human interference, reduces personal discretion, enhances fair competition, and enables suppliers to access, thus reducing the possibility of monopoly, cartel, collusion, and riggings among the bidders. Scholars suggest that e-procurement offers a lot of benefits including price reductions,

enhanced collaborative relationships, enhanced productivity, and procurement substantially (Addo, 2019; Ofori and Fuseini, 2020). From the Disruptive Innovation Theory point of view, a dominating supplier may go out of business while an almost non-existing supplier may become dominant, these extreme outcomes illustrate the role that technology and information systems have had in the occurrence of disruptive innovation. The introduction of new suppliers shall subsequently break the corrupt ties between government entities and their frequently awarded suppliers, thus reduce corruption. Also, from the principal-agent theory lens, technology minimizes government agencies' contact with their suppliers as transactions and communication are conducted online, hence minimizing opportunities for collusion and bribery.

4.3 Case studies of e-procurement and AI in public procurement

E-public procurement promotes transparency and accountability by assisting the government with all procurement activities in an efficient manner. The UN stated that the numerous technological advancements combined with the removal of obstacles to international trade have created an unparalleled area of potential (Soreide, 2002). The government of Andra Pradesh (India) is an example of a government that conducts procurement activities such as tendering and contract awarding transparently, hence reducing opportunities for corrupt actors (Neupane *et al*., 2012). Modrusan, Rabuzin and Mrsic (2021) listed several systems like the e-procurement system in India (https://eprocure.gov.in/) which enables bidders to download tender documents and submit their bids online for free. Also, the office of government procurement (https://www.etenders.gov.ie/) which is part of the Irish government, established an electronic tendering platform that intends to serve as a single location where all public sector contracting bodies can post announcements of procurement opportunities and award notices. Some of the countries created one single platform for public-private partnerships including Tendersinfo (https://www.tendersinfo.com/) in USA and TED (Tenders Electronic Daily) at the European Union (EU) which lists European public procurement opportunities with 746 thousand procurement awards released each year, including 235 thousand requests for tenders valued at around €545 billion (Modrusan, Rabuzin and Mrsic, 2021). The Singaporean government uses the GeBIZ e-procurement platform to improve government procurement transparency, efficiency information accessibility, and bidder competition (Neupane *et al*., 2012). There are many case studies on the use of public e-procurement systems for lowering the risk of corruption in both developed and developing countries. The OECD cites the implementation of e-procurement systems in New Zealand, Denmark, and Mexico as some instances of creative information technology used to control corruption in public procurement (Neupane *et al*., 2012). The further state that in other countries, like Bahrain, Norway, Italy, Turkey, and Malaysia, it is argued that e-procurement increased bidding competition for public projects and services. He adds that governments in several countries, like those in Peru, Pakistan, New Zealand, Italy, Fiji, and Hong Kong have implemented e-procurement to achieve the highest degree of governance. The Republic of Bangladesh has implemented National e-Government Procurement (e-GP) in public auctions to stop collusive bidding and corruption, improve transparency, and increase

competition among bidders which resulted in saving public money and eliminating political influence in the public procurement process (Neupane *et al*., 2012). They state that Korea's government "Mer-Link", an e-procurement platform, has produced major advantages, for example, in 2010, more than 60% of Korea "s total public procurement (124 billion USD) was conducted electronically, and therefore, this public procurement reform was widely adopted by the international community including Pakistan, Sri Lanka, Hong Kong, Costa Rica, and Vietnam. In an analysis of the literature by Canudo *et al*. (2021), e-procurement encouraged the participation of higher-quality contractors and led to quality improvements in India and Indonesia. According to (Scholl and Ubaydi) 2017, Ukraine is one of the rare countries where a volunteer-led initiative led to the total reformation of state-owned firms that controlled national public procurement. Before ProZorro was established, Ukraine's public procurement system was prone to corruption. Moreover, half of the bids were noncompetitive and negotiation with a single supplier was the most common approach and massive sums of public monies were spent on infrastructure projects of poor quality, and in certain cases, the constructed roads, bridges, and government buildings were unusable. As ProZorro is online and accessible by the public, they state that it is easy for the public to monitor and detect violations in real-time. As opposed to 22 government employees who previously monitored public procurement in Ukraine, Scholl and Ubaydi (2017) suggest that ProZorro now allows millions of Ukrainian citizens to keep an eye on any questionable activity. They add that if an unfair procurement procedure occurred, suppliers can quickly file a complaint, and those complaints are investigated by the appropriate authorities. They conclude that ProZorro made a difference by significantly lowering prices, which ranged from 5.43% for road repair work to an astounding 26.27% for engineering consultation services.

Revealing corruption and fraud in public procurement, several AI initiatives have been established in many countries to tackle this problem. For example, Transparency International Ukraine introduced its own program, "Dozorro," an AI tool that is trained to recognize bids with a high risk of corruption and is based on machine learning. Aarvik (2019) suggests that due to its capability to quickly scan vast amounts of data, Dozorro significantly improves the effectiveness of expert analysis of tenders, and accordingly, the authorities can then investigate any illegal or suspicious bids. As a result, over the past three years, Ukraine has moved up the Corruption Perceptions Index. Scholl and Ubaydi (2017) concur that the Dozorro platform predicts corruption in Ukraine's public procurement. Other AI tools have proven their capabilities in fighting corruption in public procurement, for example, Modrusan, Rabuzin and Mrsic (2021) state that Brazil's decision support system used in public procurement for fraud detection is a robust tool for systematic analysis and identification of main risk patterns like conflicts of interest and collusion between bidders. They add that the Hungarian Red Flag system was developed in a similar way to detect risks in public procurement procedures and present early warnings accordingly. Furthermore, there is also the Integrity Observer System in Croatia which is a dashboard based on collected data from the public e-procurement system and other data collected from interviews with the local community. They further state that ERAR online service system

made in Slovenia provides information on the public money flow and is linked to the contracts signed between contractors and contracting authorities.

From the literature review, it was observed that technology including e-procurement and AI has a lot of capabilities to reduce corruption in public procurement. This was evidenced by scholars' views and successful technology implementation globally. In summary, technology capabilities vary from enhancing transparency and accountability to minimizing human interference. By reducing corruption in public procurement, technology can help in obtaining the best value for public money, thus enhancing countries' financial and social sustainability. The literature review also revealed much successful e-procurement and AI solution implementation stories. These solutions have a lot of benefits from detecting corrupt possibilities and enhancing stakeholders' trust in the public procurement process to the significant contributions to countries' bottom lines as evidenced by numbers and percentages.

4.4 Limitations of The Study

This dissertation is limited by the fact that some of the reviewed literature is relatively old from a technology point of view as technology is rapidly developing. Thus, more recent and continuous studies need to be conducted to discuss technology's impact on corruption in public procurement. Another limitation is that solutions proposed for AI cannot be empirically tested yet due to the absence of the data required for machine learning in Ghana and South Africa, this also applies to other African countries. According to Petheram, Pasquarelli and Stirling (2019), the creation and application of an anti-corruption AI machine learning model are hindered by the lack of large and high-quality data. Another limitation is that there is no clear indication as to whether technology-based solutions will act to reduce the kinds of procurement corruption in Ghana and South Africa once adopted or whether the culture and the context of each country will thwart the success these technology-based solutions have achieved in other countries and contexts. Another limitation of this dissertation is that the technology aspect of public procurement is the main focus area in this dissertation not other aspects. It should also be noted that these technology-based solutions are not a panacea for all the issues of corruption in public procurement, nor are they intended to absolve state institutions and public officials of their responsibilities about procurement corruption. However, they are expected to provide the pressure and impetus necessary for the state to respond to demands for more transparency, and accountability in the public procurement space along with acting as one of the key enablers to improve the transparency and efficiency of the procurement process.

5. Methodological Approach

Methodologically, this dissertation follows a prevalent trend in corruption research, in which empirical examples are derived from secondary sources. This methodology has been effectively used in classics of corruption studies. This dissertation employed mixed theories to examine technology implementation in public procurement and to investigate its capabilities to reduce corruption in public procurement in Africa. By applying the qualitative

method, this dissertation is expected to thoroughly evaluate technology capabilities including e-procurement and AI on public procurement, and generate a comprehensive analysis of its opportunities, challenges, and impact to reduce public procurement corruption in Ghana and South Africa. The author suggests that qualitative analysis helps in widening the understanding of corruption in public procurement and how this can be curbed by using technology. The author contends that qualitative analysis will contribute to a greater comprehension of procurement corruption and how technology might reduce it. The qualitative methodology is utilized in this dissertation to analyze secondary data to identify the prospects and challenges of technology to reduce corruption in the two countries. The dissertation obtained secondary data from relevant literature like books, journals, and the internet. The secondary data were analyzed to provide insight into factors related to people, process, and technology that could hinder or enable e-procurement implementation in Africa. The case study between the two countries with different contexts was used to enhance the robustness of this dissertation based on the three components of PPT framework. The author first identifies and categorizes the main success factors using the PPT framework, then assess these factors in the two countries, and finally proposes recommendations to enhance each component's success factors. This affords this dissertation an opportunity for an in-depth analysis of the implementation of e-procurement and the potential benefits of AI in public procurement in Africa.

6. Analysis, Findings, and Discussions

This section intends to classify the key success factors for the successful implementation of technology to tackle corruption in public procurement and then analyze these factors in the context of Ghana and South Africa followed by recommendations for solutions for the three components. For this analysis, this dissertation uses the people, process, and technology (PPT) framework. This framework will help to provide full visibility of the three components of the framework. For the application of technology including e-procurement and AI, the people do the work, the process sets the rules and guidelines while technology is the system platform. Addo (2019) suggests that it is essential to understand the obstacles and limitations of technology adoption in the public sector as, without this knowledge, the government may be unable to achieve the benefits of technology.

The people component includes success factors like users' competency, stakeholders' engagement, political will, and top management support. While process component includes success factors like legislation, planning, change management, and trust in the process.

Finally, the technology component includes success factors like infrastructure, system integration, and security of the transactions. Despite being classified into these three components, the success factors are interconnected. From the inference from the literature review, it's clear that while South Africa is considered advanced in terms of technology, it has challenges in leveraging e-procurement with people and process components. On the other hand, Ghana's biggest challenge is the technology component. The two countries have common challenges in the three PPT components. The below will discuss these challenges and how they can be overcome citing scholars' views and other successful systems globally.

6.1 People component

Procurement staff competency to use e-procurement is vital for the success of e-procurement implementation. Azanlerigu and Akay (2015) argue that the competency of procurement employees influences the adoption of e-procurement, therefore, the lack of such capacity delays e-procurement implementation. Although it is commonly believed that procurement is a 50/50 mix of infrastructure and technology, Azanlerigu and Akay (2015) rather argue that procurement is more like a 45/45/10 mix of human behavior, technology, and asset infrastructure. The World Bank states that procurement staff training to use e-procurement is a critical success factor for e-procurement implementation as it includes new changes and technologies than the traditional procurement approaches (Addo, 2019). While in Ghana, the lack of procurement staff competency cannot be ignored as it hinders the implementation of e-procurement (Addo, 2019), Kramer (2016) suggests that one of the main challenges of South Africa's e-procurement is the system underutilization, especially in high-spend categories like the construction sector. In South Africa, he adds, e-procurement is not widely used in the public sector where 45% of public procurement transactions are still conducted manually. An online survey that included 603 participants from the high-spend construction sector revealed that only around 12 % of the participants have used e-procurement systems, while only around 11 % of the participants have engaged in electronic data exchange and submission, this study demonstrated the low utilization of e-procurement systems in South Africa (Ibem and Laryea, 2015). Ayegba *et al*. (2018) suggest that the utilization of the e-procurement system in the construction industry in South Africa was limited and sparse. An online survey in the construction sector revealed that despite that 70% of the respondents being aware of e-procurement, only 33% of them had used the system (Ayegba *et al*., 2018). This survey covered different stakeholders including contractors, professional consultants, and client organizations. These findings can be linked to the Technology Acceptance Model, which suggests that for the adoption of e-procurement in the public sector to be successful, users of the e-procurement system must have the necessary skills to operate it. While the lack of staff competency is the main challenge in Ghana, it's observed that system underutilization by public procurement staff is the main challenge in South Africa.

Political will and management support are common challenges in the two countries. Ameyaw, Mensah and Osei-tutu (2012) claim that historically, political will is a paramount

success factor for e-procurement implementation. They add that according to the World Bank, political interference with the public procurement process is a challenge to the public procurement reforms including e-procurement adoption as a considerable number of politicians believe that they have the right to intervene in the procurement process thereby leading to changeable procurement decisions. Rakhel and Putera (2021) state that the politician's role should be clear and controlled as their involvement badly affect the public procurement process and jeopardize the quality of government services and infrastructure for their interest. It was also observed that management in both countries was not providing sufficient support for e-procurement systems, especially in South Africa and the implementation of the e-procurement system was not strategized and implemented properly. Kramer (2016) argues that in South Africa there is no adequate support from political leadership to improve public procurement as well as the legal and regulatory environment. According to Anthony (2018), top management support is crucial in South Africa for developing and maintaining an e-procurement system by making sure that both the infrastructure and the support are in place for employees going through the shift. Ofori and Fuseini (2020) argue that top management support was one of the obstacles to the implementation of e-procurement in Ghana. He adds that public procurement officers may be resistant to the new innovative technology, necessitating an effective change management plan and training for all stakeholders involved in the procurement process.

6.2 Recommendation for people component

Ibem and Laryea (2015) suggest that e-procurement users need to be aware of e-procurement features, and to achieve this, training programs and skill development are needed to improve the utilization of e-procurement systems. They further state that training would engender attitudinal change in favor of using e-procurement by high-spend public sectors like the construction sector and shall help to eradicate security concerns of e-procurement transactions. Kramer (2016) adds that not only the government public procurement officers in need of training but also the potential suppliers who will use the public e-procurement system need adequate training on the same. He adds that the e-procurement system will only be effective if suppliers actively participate in e-procurement activity. This can be linked to the Technology Acceptance Model theory, which describes public procurement officers' perceptions of an innovative technology's usefulness. The theory suggests that the simplicity with which public procurement officers can learn, operate, and use an innovative tool influences its acceptance. Thus, training is extremely important for the easy use of the new system. For a successful implementation of an e-procurement system, a higher level of involvement of all stakeholders in the process is required in the two countries. This should be accompanied by the willingness to change mentality to deal with the new system. Agreeing with the above scholars' recommendation, this dissertation recommends that African countries should conduct free training programs on how to use e-procurement systems for government agencies as well as suppliers for better utilization of the system as done in some countries globally with advanced e-public procurement experience. The author suggests that this shall help for better utilization of the e-procurement system in both countries.

Addo (2019) argues that stakeholders of the entire public procurement process including suppliers would naturally resist any changes to business processes that threaten the confidentiality and security of their transactions. Accordingly, the author agrees with Ofori and Fuseini (2020) that this necessitates an effective change management plan and training for all stakeholders involved in the procurement process. From the perspective of the Disruptive Innovation theory, there are characteristics of new technology that might hinder its adoption by businesses and individuals. Thus, the author concurs with Ayegba *et al*. (2018), that a clear "Change management plan" eases the adoption of the new e-procurement system. According to Nurmandi and Kim (2015), a lot of research on e-procurement revealed a positive relationship between management support and the successful implementation of e-procurement systems as it enhances the institutionalization of the e-procurement system in developing countries like Ghana and South Africa, thus management teams must give additional support from involved personnel. As the high level of political and management support is positively associated with e-procurement efficiency and effectiveness, the author suggests that relevant government authorities and regulatory bodies should extend further support for the e-procurement system in both Ghana and South Africa.

6.3 Process component

From the literature review, it was evident that both countries' e-procurement environments face challenges related to process component, especially in South Africa. This includes trust in the system process and legislation. These process challenges hinder the utilization of the e-procurement system mainly by creating a mistrust of the system amongst stakeholders due to the lack of transparency in the system and the lack of government legislation which is important for the proper implementation of a public e-procurement system. From the principal-agent theory perspective, corruption can interfere with market dynamics and retard economic growth when a public procurement officer chooses the best briber over the most qualified candidate or the best price-quality combination. In addition to high pricing and poor quality, this shall undermine the trust in the system.

Kramer (2016) argues that legislation and regulations governing public procurement in South Africa are outdated and weren't amended to accommodate the introduction of e-public procurement technologies to enable the process of reform. He adds that enforcement of using the e-procurement system is a challenge in South Africa the e-procurement system is partially implemented resulting in a dual public procurement system where electronic features are integrated with paper-based ones. Anthony (2018) concurs that South African legislation provides a variety of procurement methods, and that e-procurement is not specifically mentioned in the South African legislation that governs public procurement. According to Addo (2019), the legal framework in Ghana doesn't cover all aspects of e-procurement transactions. He adds that this framework weakness, therefore, hinders the adoption of e-procurement systems. Ameyaw, Mensah and Osei-tutu (2012) suggest that challenges to the laws' institutionalization are prevalent in developing countries and Ghana

is not an exception. They further state that in Ghana, a study found that 40% of procurement services were procured using single sourcing, this reveals challenges associated with the public procurement legislation. They add that a survey found out that out of 384 contracts reviewed, 23% contracts had one bidder, 65% had 2 to 3 bidders, 10% had 4 bidders or more and 2% had unknown bidders' numbers and this indicates a deliberate effort to limit competition effort by some procurement entities.

Transparency is another important success factor of the process component in developing countries including Ghana and South Africa. GHANEPS, Ghana's e-procurement system was launched with the intention to increase the transparency of procurement procedures by minimizing human interaction, and although it was observed an improvement in the platform's information disclosures, there were still information gaps regarding awarded contracts (Allen, 2022). Open tendering shall be the standard method of public procurement unless exceptional circumstances necessitate the employment of other methods. This shall allow equal opportunity for all capable suppliers to participate in public tenders (Dema, 2015). Addo (2019) suggests that Ghana's e-procurement system's lack of transparency has resulted in privacy risks brought on by incorrect information collection and information transparency. According to Kramer (2016), the National Treasury in South Africa reviewed the public procurement system with input from government, business, and civil society and concluded that the system lack transparency and must be overhauled and improved.

6.4 Recommendation for process component

Ayegba *et al*. (2018); Bosio (2021); Kramer (2016) suggest that e-procurement implementation is highly influenced by mandatory governmental directives and that e-procurement should be supported with appropriate laws, rules, policies, legal and regulatory frameworks, and that governments should focus on the procurement process and practices, as these are highly associated with corruption. According to Soreide (2002) and Yustiarini and Soemardi (2020), the weakening of the suppliers' confidence in the e-procurement process shall reduce the competitiveness and the number of suppliers participating in public tenders. They suggest that service providers will compete in a healthy way when they are convinced that the same information is provided to all of them and their bids will be evaluated in a transparent, non-discriminatory evaluation way, and mechanisms are available to rebut the evaluation results if requested. Aduwo *et al*. (2020) suggest that e-procurement should have also an accountability aspect by providing an auditable transactions trail. The author agrees with scholars' recommendations and suggests that the South African parliament should pass a law to unify public procurement into e-public procurement and prevent the paper-based system. This can be similar to the case of the "On Public Procurement" law passed by the Ukrainian parliament in August 2016. According to Scholl and Ubaydi (2017), this law made ProZorro mandatory for all procurement authorities for tenders exceeding 200 thousand hryvnias (Ukrainian currency) for goods and services, and 1.5 million hryvnias for works. The author agrees with Nurmandi and Kim (2015) that government entities should

have e-procurement usage obligations as well as other obligations like submitting their public procurement plan like the case of Australia where in addition to annual procurement plans and according to OECD (2016), government agencies are required by the commonwealth procurement rules to publish all bid invitations having a value of at least AUD 10,000 on the Australian government's procurement information system AusTender. Public e-procurement systems should be a trustable platform for public procurement processes in all its stages from project requirement identification to the contract award. Soreide (2002) suggests that to improve confidence in the governmental tender board, unsuccessful bidders should be provided with a reason for their bid rejection and relevant tender information and subsequently, unsuccessful bidders and other interested parties must have the right to complain about the tender procedure, selection criteria, and contract award. This feature wasn't evidenced in either country subject to this dissertation case study. The author suggests that the introduction of the supplier's complaint feature in both countries shall enhance suppliers' trust in the system and subsequently increase their participation in public tenders. The author suggests that technology can help in facilitating suppliers' complaint procedures by logging, tracing, and showing the result of the grievance or appeal. Soreide (2002) recommends that confidential parts of the bidding information like bidders' prices except the awarded bidder have to be kept undisclosed, while other open information like the number of participants must be accessible for all as its absence will provide possibilities for corruption. Accordingly, this dissertation recommends that governmental tender and all its information in Ghana and South Africa should be published in major newspapers, and specialized journals as well as in government tenders' portals.

6.5 Technology component

Inadequate technological and e-procurement facilities infrastructure are amongst the main hinderers for Ghana to better utilize and leverage the e-procurement system. It also impacts South Africa with a lesser impact as the infrastructure in South Africa is relatively developed. Issues concerning technology systems infrastructure development and adoption are key to the e-procurement implementation and on the other hand, suppliers' understanding of how the technological infrastructure is integrated is key to facilitating the adoption of e-procurement (Azanlerigu and Akay, 2015). Ofori and Fuseini (2020) argue that for e-Procurement technologies to sufficiently permeate the public procurement system fabrics of Ghana, government and stakeholders should enhance the necessary physical ICT infrastructure.

Another common challenge associated with the technology component is the security of procurement transactions. While Ibem and Laryea (2015) assert that there are security concerns over the South African e-procurement system, Addo (2019) indicates that the security of procurement transaction data posed a significant barrier to e-procurement adoption in Ghana. This includes incomplete or misleading information, penetration of trading platforms, and inability to protect data during transmission or storage (Azanlerigu and Akay, 2015). They suggest that buyers and suppliers considered the lack of security measures for data protection as the main obstacle while implementing e-procurement. A

study conducted in South Africa indicated that the e-procurement process's trustworthiness was affected by fears of manipulation and corruption, which discouraged participation in the process (Ayegba *et al*., 2018). A survey revealed that concerns over data security and confidentiality were perceived among the barriers to e-procurement implementation in Ghana. This includes i. incomplete or misleading information resulting in wrong products purchased; ii. unauthorized penetration of e-procurement platforms resulting from failure to protect data transaction related; and iii. risks arising from inappropriate information collection Addo (2019).

Suppliers' integration into the e-procurement system is another common challenge that hinders the utilization of the system in the two countries. According to Addo (2019), electronic integration with suppliers is one of the challenges of e-procurement implementation in Ghana. This is relevant to technological infrastructure, which plays a crucial role in the adoption of e-procurement and without which integration of public procurement entities cannot occur. Over the years, the majority of suppliers in Ghana have viewed the traditional procurement process as often discriminatory based on "whom you know," and as a result, they refuse to engage in the majority of public procurement processes (Ofori and Fuseini, 2020). However, the complete integration of e-procurement will assure transparency and accountability, hence reducing corruption and inevitably encouraging more suppliers to take part in the operation. In South Africa, this challenge is mainly faced by most small to medium enterprises (SMEs) as well as other developing countries where they face countless technological challenges that deter their participation in public tenders (Madzimure, Mafini and Dhurup, 2020). The author suggests that suppliers' integration into the system in South Africa is affected also by the reluctance of the procurement officers to use the system which was discussed earlier in the people component.

6.6 Recommendation for technology component

The main success factors for the technology component are the readiness of the technology infrastructure, security of procurement transactions, and suppliers' integration with the system. A study revealed that the degree of infrastructure quality is positively linked with e-procurement efficiency and effectiveness (Nurmandi and Kim, 2015). They suggest that a comprehensive system must be provided by the government to integrate online systems like e-procurement and relevant databases, and the technology gap between the procurement committee and the goods/services providers must be bridged by the e-procurement system. From their side and with the rapid technology changes and implementation of the e-procurement system, companies especially small to medium enterprises (SMEs) require governmental support to adapt to the new technology and use the e-procurement system (Madzimure, Mafini and Dhurup, 2020). Evidence from the UK and the Republic of Korea shows how user-friendly digital procurement systems may make public contracts available to SMEs. They also permit greater competition and transparency in public procurement (2021, Pavlovic). According to Azanlerigu and Akay (2015), for Ghana's infrastructure to function properly, large expenditures on hardware, software, and employee training are needed. The author suggests that if the government is unable to invest in infrastructure

owing to budgetary restrictions, it may be wise to seek private sector and international assistance as in the absence of the requisite infrastructure for procurement tasks, the potential of e-procurement may not be achieved. The author further suggests that global funding agencies like the World Bank and IMF should help countries with infrastructure upgrades as this will positively impact mega-projects funded by these global funding agencies. The author also suggests that volunteer-led initiatives might be beneficial to enhancing the technology component in Ghana and South African public procurement functions as similar platforms were successful in countries like Ukraine (i.e. ProZorro Program).

6.7 Can Artificial Intelligence make a difference?

Fighting corruption in the public procurement sector through AI is not a novelty, but it wasn't utilized in Africa in general and specifically the subject two countries of this dissertation. AI can enhance procurement anti-corruption efforts by increasing control, promoting integrity, and improving accountability. Petheram, Pasquarelli and Stirling (2019) describe AI and machine learning mechanisms that the programmer who's teaching an anti-corruption algorithm would collect and clean data, the programmer then labels the outputs, for example, contract awards as corrupt or non-corrupt. This requires a clear definition of corruption. The programmer then shall train the machine by following a particular machine learning algorithm to learn a complex function determining the relationship between inputs and outputs considering the programmer's corruption definition. Accordingly, the machine acts as a predictive or monitoring tool to flag the conditions that are likely to result in corrupt outcomes according to the algorithms learned earlier by the machine for further human investigation. Petheram, Pasquarelli and Stirling (2019) argue that there is an increased opportunity for governments through digitizing their operations to develop anti-corruption tools based on using AI. They add that AI has significant corruption predictors including single source purchasing, contracts change once the project starts, and the tender documents fees. Rabuzin and Modrusan (2019) suggest that in the public procurement process, corruption-detecting can occur in different stages from tenders' initiation to the implementation, tender documents writing, and award of contracts, and in each stage of the procurement process, different indicating red flags specific to each stage indicate the possibility of corruptive actions can be identified. For example, the short bid submission period in the tender preparing stage can be interpreted as one potential red flag as this leaves only a short time and makes it harder for suppliers to bid. They add that some other indicators which are indirectly linked to the tendering process are the analysis of whether the same bidder always gets awarded the bid and the bidding time interval. The author suggests that the red flags mechanism can be utilized in Ghana and South Africa to highlight corrupt areas in the public procurement process. Modrusan, Rabuzin and Mrsic (2021) agree that AI through business intelligence techniques can develop models to find any suspicious process or potential collusion in public procurement. This includes things like single-bid tenders, split purchases, unusually short bidding time, a short time between the award announcement and signing the contract, a high number of administratively rejected bids, an unusually small number of

correct bids, and bid acceptance before the bid closing date, etc. Aarvik (2019) suggests that the AI's ability to work with large datasets which are difficult to analyze manually makes it possible for AI applications to predict fraud or corruption that was impossible to detect previously. Additionally, he states that procedures assisted with AI can substitute previously corruption-prone ones. Oxford Insights states that due to AI's ability to reveal the large datasets patterns that humans can't manage, AI is 'the next frontier in anticorruption' (Aarvik, 2019). This releases humans to focus on following up and further investigating suspected fraud, misuse, or corruption. From an anti-corruption standpoint, AI can positively contribute as it can aggregate information that was previously inaccessible by human officials, cross-check the information in a way that was not possible or time-consuming to check and raise flags around potential corruption (Sanchez-Graells, 2021). The author suggests that this feature can detect the problem of the limited suppliers' number participating in public tenders in both countries and then public procurement officers can analyze the reasons behind this low participation and act accordingly. AI not only facilitates the discovery of corruption after the event, but it may also be predictive, exposing danger areas and warning signs. Microsoft's Anti-Corruption Technology and Solutions (ACTS), which is now being piloted in Mexico, is an early example (Pavlovic, 2021). The author recommends that AI capabilities to detect corruption and fraud can be utilized in Africa in the public procurement process. The interesting fact about AI is that it can be developed to detect corruption according to each country's challenges. Therefore, the author recommends that neither Ghana nor South Africa should adopt any readymade AI solution, instead, they should develop their own AI solution based on their existing challenges; notwithstanding the capacity and skillset gap that these authorities in these countries may face.

6.8 Technology Limitations

Although technology has a lot of benefits for reducing corruption in public procurement, it has certain limitations. For example, the difficulty to construct effective corruption detection algorithms through AI if there are insufficient quantities of high-quality and diverse data. With the ongoing digitization of the public procurement process, Neupane, Soar and Vaidya (2014) argue that there is an ever-increasing amount of disconnected and largely unstructured data that requires effort and specific techniques so scientists can analyze these data in the public procurement process and identify adequate corruption indicators. Aarvik (2019) concurs that with all perceived AI benefits in detecting fraud and corruption in public procurement, only a few African countries have the required level of digitization to leverage AI. Neupane, Soar and Vaidya (2014) further argue that another limitation for technology to eradicate corruption in public procurement is the fact that a number of the process's crucial steps depend on human decisions having the authority to override AI-proposed recommendations. Therefore, the procurement process and decisions must be coupled with effective oversight and legal proceedings. Miroslav *et al*. (2014) agree that eradicating corruption is extremely challenging since a number of the process's crucial steps depend on human selection and accountability. Nevertheless, the provision of any tool capable of automating and supporting the supervision process would be of great value. Another

limitation is that suppliers might not use an e-procurement solution due to several reasons. According to Neupane, Soar and Vaidya (2014), there is a possibility that suppliers will not participate in the usage of e-procurement tools, for instance, certain suppliers have sufficient influence to insist on paper-based solutions while other suppliers may not have affordable internet-based technology that would grant them access to the purchasers' e-procurement tools. They further state that factors other than the price, such as quality and delivery time might receive insufficient consideration for the sake of a lower price, and this may pose a variety of difficulties in countries like Ghana and South Africa. Celentani and Ganuza (2002) concur that the risk of corruption reduces the expected value of a higher quality weighting. The possibility of an IT failure during the procurement process is another limitation that could result in legal issues about who is responsible for a failed process or an incorrectly awarded offer (Neupane, Soar and Vaidya, 2014). Mantzaris (2014) argues that one tool cannot combat all forms of corruption, nor can technology alone prevent corruption in public procurement, thus, technology should be supported by proper governance, knowledge, and monitoring, and once corruption has been recognized, another crucial move is the ability to respond to it. This is a fundamental component of a successful anti-corruption policy. Soreide (2002) argues that infrequently is corruption confined to a single sector, institution, or level of the bureaucratic structure, and where it is a problem, it tends to permeate a significant portion of the government. In this regard, the degradation of judicial systems, police, and investigative agencies is extremely harmful. In such a context, adding anti-corruption technology-based measures into public procurement procedures to combat corruption may appear optimistic, however, the public procurement system is an excellent starting point for broader anticorruption reform (Soreide, 2002). Williams-Elegbe (2018) argues that it is vital to build a structure that allows government employees to speak up about inappropriate behavior and misbehavior in the institution without fear of retaliation from their superiors, also crucial is the enforcement of the code of conduct in all state government institutions. Nevertheless, there is a chance that public procurement corruption will still exist if people continue to look for ways to undermine the e-public procurement system. Williams-Elegbe (2018), therefore, suggests that to detect and deter corruption, the government should continuously enhance the e-procurement system. Another important limitation is that neither contractors nor public officials are static agents. Instead, they adapt to their environment. Corruption-involved actors would likely adjust their behavior in order to reduce the likelihood of being identified by AI algorithms adopted by government agencies (Gallego, Rivero and Martinez, 2021). The author suggests that these limitations exist in the two subject countries, thus these limitations shall be considered while planning for any e-procurement enhancement or AI adoption in both countries considering their local context.

7. Contribution to the literature

This dissertation, leaning on a multi-theory framework, makes an effort to demonstrate technology’s ability to reduce corruption in public procurement in Africa. Following are the four major contributions of this dissertation to the existing literature: first, it uses the PPT

framework and mixed theories in studying new technology-based public procurement solutions; second, it demonstrates why people are the main component in the PPT framework as it affects the other two components; third, how the enhancement of the existing e-procurement systems can help to leverage opportunities and overcome challenges in public procurement in Africa through a comparative approach between Ghana and South Africa; fourth, how AI can help to leverage opportunities and overcome challenges in public procurement in Africa.

8. Conclusion

In recent years, the detection of public procurement corruption has become one of the most pressing challenges globally. Due to the vast number of services and the huge amount of money that passes via public procurement, it is necessary to detect and eliminate any corrupt behavior (Sharma, Sengupta and Panja, 2019). According to Madzimure, Mafini and Dhurup (2020), e-procurement and AI are amongst the most significant advancements in public procurement in recent times. When implemented appropriately, with a sound reform agenda in place, and a proper legislative and regulatory framework, an e-public procurement, and AI can fulfill certain objectives, the most notable include the reduction in corruption, increased transparency, and cost reductions (Kramer, 2016). This dissertation extends and enriches the literature on technology adoption in public procurement. It examined technology capabilities and the required context to reduce corruption in public procurement. By revealing the anti-corruption benefits of technology in public procurement, the dissertation aimed to benefit academics, public procurement officers, and international funding organizations that fund projects in Africa by analyzing the prospects and challenges of technology (e-procurement and AI) to reduce corruption in public procurement using PPT framework. Gallego, Rivero and Martinez (2021) state that transparency is essential for preventing unwanted outcomes in public procurement, such as corruption, contract violations, and inefficiency in general, thus e-procurement has gained popularity in both developed and developing countries, as they enable anti-corruption agencies, watchdog organizations, and citizens to closely monitor the process and decisions governing the public procurement. According to Neupane *et al*. (2012), although many countries have implemented e-procurement with the primary objective of making public procurements more efficient, transparent, and optimum expenditure of public funds. However, the case in several countries demonstrates that the effects of regulating this field can occasionally prove to be double-edged. Al-ajwad and Carr (2022) suggest that ambiguity in the procurement system's legal framework encourages corruption and permits officials to abuse loopholes in the regulations. This is the reason that technology needs to be accompanied by the right set of laws, regulations, and legislation to achieve its intended objectives in fighting corruption in the public procurement sector.

This dissertation answered the questions about the importance of corruption issue in public procurement and the technology capabilities of reducing public procurement corruption in Africa. The dissertation using scholars' views and global organizations' estimations and numbers demonstrated the importance of discussing corruption in public procurement as it

has a destructive effect on many aspects. It also revealed that technology can have a big impact on reducing corruption in public procurement in Africa. This impact is subject to many factors including staff competency improvement, infrastructure development, and legislation enhancement. The comparative review between Ghana and South Africa might explain how factors characterizing the implementation of technology including the e-public procurement environment in the two African countries differ according to the country's context. The dissertation categorized challenges in Africa using the (PPT) framework which underlies the technology implementation environment in public procurement in Africa. Addressing corruption in public procurement in African countries is a complicated, multifaceted issue that the author believe necessitates a multi-theoretical approach to comprehend its complexities, considering the economic, social, cultural, and political characteristics of each country. As a result, the traditional anti-corruption strategies may not be very effective because the politicians and senior personnel in charge of upholding these frameworks are also complicit in the issue. This is one of the reasons why this dissertation concentrated on the people component of the (PPT) framework since it affects the process and technology components.

This dissertation's findings are compatible with most of the previous readings on the potential technological capabilities to reduce corruption in public procurement. However, this dissertation seeks to fill a gap in the existing literature by examining the impact of AI technology in reducing corruption in public procurement in African countries, in addition to further discussing the success factors of e-procurement, which have been shown (in some writings) to have an appreciable impact on reducing corruption in this field. Another purpose of the dissertation was to determine to what extent can AI and machine learning detect signs of corruption in public procurement. The author suggests that additional qualitative analysis would enhance comprehension of procurement corruption in Africa. Even though these findings are underpinned by several theoretical explanations and well-established qualitative analytic methodologies, the argument of the dissertation can be further supported by further corroborated and added by more sustained and wider efforts. This dissertation does not imply that corruption can be eradicated entirely using e-public procurement and AI. The dissertation does not also claim to have reinvented the wheel in the anti-corruption in public procurement in Africa, but it has demonstrated unequivocally that further identifying and enhancing success factors in the three PPT components of e-procurement and implementing AI is promising to reduce corruption in public procurement. For this purpose, to be achieved, the author suggests that the will of the political leaders would be the first step of a thousand-mile journey; all the rest will follow.

In conclusion, the two countries covered in the comparative analysis together with other African countries can learn the opportunities that technology creates in public procurement including transparency and accountability, public access to procurement information, minimizing face-to-face contact, and many more. Although there are, and probably always will be, some obstacles to implementing technology in the public procurement system such as the existing procurement process, high infrastructure setup cost, lack of political support,

and user resistance to adopting new systems, a proper technology implementation strategy can surely help to overcome these problems, and eventually repay back great dividends. This dissertation, therefore, hoped to assist the public procurement practitioners, government entities, and funding organizations in a better understanding of the technology role including public e-procurement and AI in their drive to minimize the scourge of corruption in public procurement.

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Result driven Procurement & Strategic Sourcing Manager with 15 years' experience and extensive track record of building effective Procurement governance and implementing strong procurement procedures that ensure best value for money for the organization. Familiar with leading departments with wide experience in completing managerial and administrative tasks and maintaining organized approach to efficient and effective procurement function. Excellent knowledge in Procurement best practices including CIPS Platinum standard and adept in developing strategic relationships with partners to ensure organization continually moves toward its objectives. Bringing forth the capacity to effectively oversee procedures and processes related to the advantageous procurement of goods and services.