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Technological Approach to Ensure Ethical Procurement Management

David Fourie and Cornel Malan

Abstract

Various studies have reported a positive connection between the public procurement and economic performance of a country, in terms of value for money, enhanced human welfare and improved economic growth. According to the World Bank, a distinction can be made between accountable governments where public procurement's share of the GDP is over fourteen percent, medium accountability countries with a share of thirteen percent and low accountability countries with less than twelve percent. In response to the ever-increasing complexity of procurement, many disruptive innovations as well as rapid developments in digitalization are reforming global supply chains. The principles of a sound procurement system include accountability, competitive supply, and consistency, which when viewed together with ethics and good governance, become the cornerstones of an effective, efficient, transparent, and reliable procurement system. Ethical risks are possible in every stage of the procurement process; however, e-procurement has become a powerful tool to curb fraud, corruption, and unethical behaviour in public procurement as it reinforces the ethics of transparency, accountability, and integrity in procurement functions. With e-procurement being a relatively new form of procuring goods and services, it has been up against several challenges, notwithstanding the proven benefits of using electronic means in procurement. The movement to e-procurement has been a slow process globally, but various countries such as Germany, Korea, Brazil, and Zambia have already started to reap the fruits of their efforts. The main benefit of introducing e-procurement recorded by the World Bank has been a marked upturn in transparency and competition. This chapter aims to unpack the link between technology, procurement, and ethics towards the provision of goods and services by governments for the greater good of all.

Keywords: public procurement, public service delivery, information technology, ethics, e-procurement

1. Introduction

Public expenditure and procurement form a major part of a country's economy and is considered an important indicator of the efficacy of a government, given the direct link of such to public service delivery - policy instruments that governments use. Studies showed a connection between public procurement and economic performance that is reflected in a country's economy and citizen's well-being [1]. Public procurement is a factor when measuring productivity of the public sector [2]. Wagner's law argues that economic growth leads to an increase in public expenditure. Thus, there is a correlation between public spending and a country's

economic development [3]. The essence of public procurement is to achieve value for money, which manifests in enhanced human welfare and improved economic growth [4]. Sound practises is important for countries' international trade and foreign investment. Public purchase of goods and service is estimated to be 13.3% of the Gross Domestic Product (GDP) of European countries [5]. The GDP also reflects government's ability to deliver services. In fragile states less than 5% is spent on public procurement. The World Bank makes a distinction between accountable governments where public procurement's share of the GDP is over 14%, medium accountability countries with a share of 13% and low accountability countries with less than 12% [6].

The International Trade Centre submits that "governments are market regulators and market participants" and as such legal and regulatory frameworks are established while spending trillions of dollars to purchase goods works and service to fulfil their public functions [7]. Public procurement is a key economic activity that is used by governments for amongst others the attainment of horizontal or secondary objectives such as supporting Small Macro Enterprises, protection, and advancement of previously disadvantaged social groups (which includes empowering of women), and to stimulate innovation as well as green technologies. There are mainly two opinions from opponents of secondary objectives. Firstly, public institutions should only aim to achieve value for money and timely delivery of goods and services in these times of tight budgets. Secondly, the creation of unnecessarily complex procurement process will increase the cost of the procedure, compromise the primary objective disproportionately and reduce competition [8]. Government's accountability responsibility is not only towards the public whose money is spent but also disappointed tenderers and potential suppliers. For this reason, procedures and practices must be developed that can stand up to scrutiny. Public institutions achievement of effective and efficient procurement objectives and results are dependent on three elements. Firstly, setting procurement standards, specifications, objectives, and goals and achieving them. Secondly, ensure satisfaction of all role players and lastly, enforcing applicable procurement policies and regulations [9].

In response to the ever-increasing complexity of procurement, many disruptive innovations as well as rapid developments in digitalization are reforming global supply chains. The current modus operandi of the procurement function within and between countries, in both the private and public procurement environments is being challenged to adapt accordingly, to be able to align procurement to aspects such as transactional automation, proactivity of supplier relationship management and predictability [10]. In addition, e-procurement has become a powerful tool to curb fraud, corruption, and unethical behaviour in public procurement as it reinforces the ethics of transparency, accountability, and integrity in procurement functions [11].

2. Procurement contextualised

The primary function of public procurement is "procuring goods and providing services and infrastructure on the best possible terms" [11]. The definition can be broadened by distinguishing between procurement and public procurement. "Procurement means obtaining goods, works, consultancy or other services through purchasing, hiring or obtaining by any other contractual means; and public procurement means procurement by a public body using public funds" [12]. "Public procurement processes are sequences of activities starting with the assessment of needs through awards to contract management and final payment" [13].

In most countries public procurement follows a cycle based on legislative requirements, administrative processes, and budget timelines. Legislation requires fair and transparent process where competition adds to decreased cost and increased quality [14]. Policy developers are challenged by dilemmas such as: develop flexible structures yet maintain accountability and control, limit opportunity for fraud/mismanagement while reducing operational constraints, increase economic efficiency while satisfying political demands, increase open and transparent competition while achieving best value, and applying best practices while confronting legal limitations [15].

2.1 Principles of procurement

In general, principles of a sound procurement system include accountability, competitive supply, and consistency, which when viewed together with ethics and good governance, become the cornerstones of an effective, efficient, transparent and reliable procurement system [11].

In order to avoid a lack of integrity, an all-inclusive approach to risk mitigation and prevention of corruption through the entire public procurement process is essential. Integrity refers to the protection of ethical norms and standards relating to the principles of “honesty, professionalism and righteousness” [16], and as such provides the foundation for guaranteeing that public procurement processes are fair, compliant and non-discriminatory in nature and application.

By only addressing integrity issues in one step of the process may result in risks in some other stages or mitigating only one type of risk may give pave the way for integrity infringements through other methods. For example, measures aimed at ensuring compliance during the initial bidding phase when the procurement needs are being determined, may not completely prevent political influencing. In a similar fashion, declarations of interest by procurement officials may not necessarily prevent large scale so-called “bid rigging” or small fraudulent actions from occurring [16]. In adopting such a holistic approach, the Organisation for Economic Co-operation and Development (OECD) Recommendation on Public Procurement places emphasis on mutually supportive principles which may, “directly or indirectly, prevent corruption and stimulate good governance and accountability in public procurement” [16] and include:

- Integrity
- Transparency
- Stakeholder participation
- Accessibility
- E-procurement
- Oversight and control [16].

2.2 The stages of the procurement process

The United Nations published a flowchart reflecting various stages in the procurement process [17], as illustrated in **Figure 1** below. Directives or standard operating procedures provides guidance to procurement officials that acts as a reference tool for coordinated and integrated actions that inherently leads to the

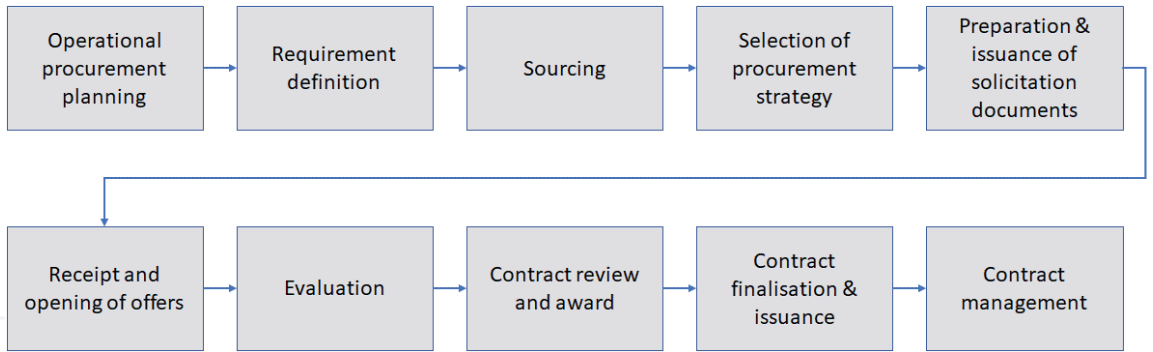


Figure 1.
The stages of the procurement process [17].

attainment of an open, efficient, effective, and transparent process. Directives are unique to procuring entities that largely depend on their vision, mission, and service delivery mandate.

The acquisition process commences when a societal need is identified, and availability of funds is confirmed. Operational procurement planning clarifies what is needed by who at what time as well as the quantity and quality of goods and services required. Failure to plan effectively may result in service delivery goals not being achieved [17]. Operational procurement, requirement definition, sourcing, selection of procurement strategic and preparation and issuance of solicitation documents are elements of Demand Management where consolidated procurement plans are annually developed for the whole institution. During demand management government entities must take into consideration social, economic, and environmental aspects that may have an impact on appropriate and sustainable service delivery. The demand plan is aligned to the institution’s approved strategic plans and procurement may not take place outside of the approved plan, except in cases of emergency. To allow for sound procurement principles and prudent financial spending institutions would have standard operating procedures in place for emergency procurement.

Cost effective procurement are dependent on accurately estimated costs which will at a later stage determine the procurement method. During the planning stage government institutions need to consider secondary policy objectives that will impact on drafting of specifications and the selection of an appropriate procurement strategy. Secondary policy objectives are defined as objectives focussing on promoting innovation and new ventures such as small and medium-sized enterprises, or objectives aiming at increasing sustainability. Secondary objectives could also be to illustrate social accountability or to support other wider policy objectives aiming for economic growth, given the increasing use of procurement by many governments to promote social welfare, in addition to the primary procurement objective of providing goods or services [18]. Fairness, value for money [competitiveness and cost-effectiveness] and transparency are internationally regarded as the cornerstones of good procurement practices [19]. For this reason, most countries utilise a committee system. The Bid Committee must be constituted with knowledgeable members where specifications are not treated as hindrances to access the market but as defining what the government wants to buy. In order to abide to the principles of fairness and competitiveness, and to avoid the possible chance of favouritism or exclusion of entities in the bidding process, procurement entities are prohibited from including any specific reference to a certain process, or inclusion of descriptions of products or goods by using a specific model, type or make, the registered product name or brand, production location of methods used, in their bid specifications [20].

Although their names may vary, there are generally six methods on how the market can be approached. The first being open tendering or competitive bidding that encourages effective competition but is not ideal for large or complex works. Open tendering lends itself for maximum competition where the potential of favouring a specific tenderer is lower and collusion is less likely. The disadvantage being overall cost and time-consuming. Restricted tendering also known as 'selective tendering' is a method where limited agencies are invited by the procuring entity. The process is still considered to be fair and transparent when the entity pre-determined a set of guidelines for invitation. The potential for corruption is higher due to exercise of discretion. Another method of procurement is Request for Proposals (RFP) where prospective suppliers are requested to propose why their goods or services are the best for a specific institution's need. Two Stage Tendering takes place when suppliers are requested to provide two envelopes. The one envelope containing the proposal and one with the financial information. Selection takes place in two phases. First the best proposal is selected and then matched to ascertain whether it is also the best price. Request for Quotations are used for small-valued goods or services. The advantage being that it is fast with limited paperwork. The last method, Single-Source selection is non-competitive and requires prior management approval. This method is used when the procuring entity pre-selected a sole provider due to emergencies, if only one supplier is qualified, where the product or service are only available from one supplier or when it is a continuation of existing work [21]. Issuing of solicitation documents serves as an invitation for prospective or interested bidders to participate in the process. Fair access to solicitation documentation was restricted until most countries implemented e-procurement. The advantages and disadvantages of e-procurement will be discussed later in the chapter.

The next major stage in the bidding process is where offers are received and opened, evaluated in terms of compliance with minimum qualification criteria and awarded. Ethics and fair dealing are of critical importance during this stage in order to maintain public trust. Tender Evaluation committees must be constituted of members who has been cleared of a potential conflict of- interest (e.g., through mandatory disclosure or declaration) [21] and are competent and knowledgeable officials in accordance with the general law of equal treatment, non-discrimination, transparency, and confidentiality of information [22]. The following activities will usually be carried out; formal compliance check (submission of solicitation documents), technical and substantive compliance check (evaluation against advertised specifications), choice of the best tender on the basis of the advertised award criteria and recommendation for the award of the contract. The main objective of bid evaluation is to ensure that the lowest acceptable bid has the necessary qualification, experience, and staffing to perform the contract [23]. However, the choice of a successful tenderer should be based on value for money such as the most optimum tender and not only the lowest bidder. The aforementioned contradicts the misguided belief that price is the determined factor. Recommendation for award is made to a third committee, the Bid Adjudication committee.

Bid adjudication committees in most instances comprise of senior officials and as is the case with the other committees, the members are appointed in writing. For the sake of unbiasedness and transparency, members of the evaluation committee should not be a member of the adjudication committee as well. Bid specification committees compile specifications, bid evaluation committees evaluate responses against the published specifications and the bid adjudication committee approve that a tender may be awarded to the recommended bidder. The adjudication committee is not mandated to select a tender but to confirm that the process followed was fair, transparent and that the product will satisfy society's needs and contract commencement can follow. Clear separation and segregation of functions should

allow for integrity in the public procurement system. All matters prior to award is of an administrative nature and post tender award legal rectification is sought when so required [22].

2.3 Using functionality during procurement

The use of functionality in procurement refers to the application of predetermined evaluation criteria, as per the tender specifications, aimed at evaluating the operational, technical, and practical ability of a tenderer to provide goods or services as required in terms of specific aspects such as the quality of the goods, or the dependability, sustainability, and durability of a service [24]. The evaluation criteria for measuring functionality must be objective and suppliers must be informed of the following: (i) the evaluation criteria for measuring functionality; (ii) the weight of each criterion; (iii) the applicable values; and (iv) the minimum qualifying score for functionality [25].

Certain aspects must also be taken into account, in the event that an institution invites a bid which will be evaluated by means of specific functionality criteria. These include:

- the specific functionality evaluation criteria;
- the specific weight of each criterion during evaluation of the bid;
- the relevant value which will be allocated during the bid in terms of the performance of the tender against the criteria; and
- the minimum score required in terms of the functionality criteria [25]

Functionality criteria requires bidders to obtain a predetermined minimum score for the functionality criteria, in order to be considered for further appraisal during the award stage, with regards to price and preference. Functionality evaluation criteria must be stipulated as such in the bid documents and may require additional information such as proof of previous performance or applicable experience, credentials of the envisaged personnel to be involved, or how the tender intends to ensure the necessary skills transfer during the project, etc. The specific weighting allocated to each criterion must be bid-specific – a generic or blanket approach does not justify the use of functionality. In the same manner, the scoring for each criterion should also be specific to the tender requirements to be viewed as objective [24].

3. Ethics and governance in procurement

3.1 Contextualisation of ethics

Ethics is defined by the Oxford dictionary as “moral principles that govern a person’s behaviour or the conducting of an activity” [26]. In a public sector context, ethics is defined as “standards that guide the behaviour and actions of public officials in public institutions and (that) may be referred to as moral laws” [27] while ethical behaviour is described as behaviour that is “not only good for oneself, but also good for another” [28]. Hence, it can be argued that, within the context of a public sector supply chain, ethical behaviour necessitates a person not only to act in the best interests of the particular institution involved, but also to adhere to certain stewardship criteria [29].

Public procurement is an important tool towards the well-functioning of government and delivery of services which in turn are fundamental for development, growth, and improved social welfare in any country. Sadly, public procurement is one of the government activities most exposed to acts of corruption, fraud, and mismanagement, given the substantial amounts of public funds used for public procurement [16, 30]. Over and above the sheer volumes of transactions and the financial interests involved, corruption risks are aggravated by the intricacy of the procurement process, the array of stakeholders and the close interaction between public officials and external entities [16].

Various types of corrupt acts may take advantage of these weaknesses, such as “embezzlement, undue influence in the needs-assessment, bribery of public officials involved in the award process, or fraud in bid evaluations, invoices or contract obligations” [16]. Ethical risks are therefore possible in every stage of the procurement process, and red flags include undue influence, conflict of interest, and various kinds of fraud risks, as illustrated in **Figure 2** below.

Non-compliance with Supply Chain Management (SCM) policy and regulations is identified by Fourie and Malan as challenges in Public Procurement [11], with

Pre-tendering phase	Needs assessment and market analysis	<ul style="list-style-type: none">• Lack of adequate needs assessment• Influence of external actors on officials' decisions• Informal agreement on contract
	Planning and budgeting	<ul style="list-style-type: none">• Poor procurement planning• Procurement not aligned with overall investment decision-making process• Failure to budget realistically or deficiency in the budget
	Development of specifications/ requirements	<ul style="list-style-type: none">• Technical specifications are tailored for a specific company• Selection criteria is not objectively defined and not established in advance• Requesting unnecessary samples of goods and services• Buying information on the project specifications
	Choice of procurement procedure	<ul style="list-style-type: none">• Lack of proper justification for the use of non-competitive procedures• Abuse of non-competitive procedures based on legal exceptions: contract splitting, abuse of extreme urgency, non-supported modifications
Tendering phase	Request for proposal/bid	<ul style="list-style-type: none">• Absence of public notice for the invitation to bid• Evaluation and award criteria are not announced• Procurement information not disclosed and not made public
	Bid submission	<ul style="list-style-type: none">• Lack of competition or cases of collusive bidding (cover bidding, bid suppression, bid rotation, market allocation)
	Bid evaluation	Conflict of interest and corruption in the evaluation process through: <ul style="list-style-type: none">• Familiarity with bidders over time• Personal interests such as gifts or future/additional employment• No effective implementation of the “four eyes-principle”
	Contract award	<ul style="list-style-type: none">• Vendors fail to disclose accurate cost or pricing data in their price proposals, resulting in an increased contract price (i.e., invoice mark-ups, scope creep)• Conflict of interest and corruption in the approval process (i.e., no effective separation of financial, contractual and project authorities/ lack of disclosure)• Lack of access to records on the procedure
Post-award phase	Contract management/ performance	Abuses of the supplier in performing the contract, in relation to its quality, price and timing: <ul style="list-style-type: none">• Substantial change in contract conditions to allow more time and/or higher prices for the bidder• Product substitution or sub-standard work or service not meeting contract specifications• Theft of new assets before delivery to end-user or before being recorded• Deficient supervision from public officials and/or collusion between contractors and supervising officials• Subcontractors and partners chosen in an on-transparent way or not kept accountable
	Order and payment	Deficient separation of financial duties and/or lack of supervision of public officials leading to: <ul style="list-style-type: none">• False accounting and cost misallocation or cost migration between contracts• Late payments of invoices• False or duplicate invoicing for good and services supplied or even worse, not supplied, and for interim payment in advance entitlement

Figure 2.
Possible risks per procurement phase [16].

one of the challenges being unethical conduct of procurement officials. They view unethical conduct in the same light as acts of corruption, fraud, nepotism, and bribery, all of which have an adverse bearing on the service delivery quality levels. Munzhedzi investigated whether procurement processes and- practices and corruption are inseparable twins. He is of the opinion that whenever one of the two is mentioned, the other one has to follow in the next line. The illusion that rules have been respected is important to the transgressor in order to reduce the risk of being caught [31]. Instances are found where the composition of bid adjudication members is manipulated to serve the purpose of those who do not wish to act with integrity. For example, a senior supply chain practitioner is replaced with a junior official that can easily be intimidated to agree with the decisions of the rest of the committee. At every stage during the procurement process, procurement is a prime candidate for corrupt activities, cronyism, favouritism as well as bribery. During bid evaluation a more expensive offer can be selected based on 'legitimate reasons' however corrupt bid rigging took place behind the scenes [18] that in most instances will not stand up in a court of law. In most instances it is not the procurement system that failed the most vulnerable in society but rather greed of those in positions of trust. Patras [32] agrees that "errors", or infringements of the rules, can also happen. Human errors for example incorrect calculations of assessment criteria, take place with public funds and has the same financial impact as corrupt practises [32]. Procurement should be viewed as a profession where governments ensure that procurement officials meet high professional standards of knowledge, skills and integrity [21].

3.2 Combatting corrupt activities in public procurement

The fight against public procurement corruption is a global phenomenon. Governments have become reliant on prescriptive procurement standards, exclusions, and formal processes that according to the World Economic Forum increased the costs of corruption instead of preventing it from happening. "Limited political will" is identified as the main culprit for the lack of efficacy of preventive actions. The World Economic Forum advocates for "technologically induced sunlight" in an effort to disinfect procurement processes [33]. One of the policy objectives of a procurement approach should be to deter, detect, and punish corruption, versus the objectives of public procurement which are fairness, equity, transparency, competition and achieving value for money. These objectives though complementary can represent a trade-off or "dual challenge" for good governance as integrity in the form of fairness and transparency, is crucial for a successful public procurement system whilst also aiding in the uncovering of corrupt activities [30].

Integrity standards being a core element of professionalism, influences the behaviour of procurement officials and contributes towards the creation of a culture of integrity [21]. It is submitted that procurement officials have a responsibility to familiarise themselves on legislation, regulations, and standard operating procedures. Ignorance towards procurement regulations by procurement officials is no excuse as no one is deemed ignorant of the law. McCue and others have a different view of the impact of a proverbial "stick". The stick being rules and processes that limit discretion. They are of the opinion that procurement professionals might struggle with what they perceive as the right choices and what is defined by other as the right choices [34].

The OECD maintains that protection of integrity should be the point of departure to prevent corrupt activities in public procurement. Public procurement policies as well as role-specific standards and codes of conduct, for procurement officials are essential. It is especially important to prevent officials' private interests from having any inappropriate or illegal sway on their performance of their public

duties and responsibilities and strict regulations prohibiting such must be in place. In fact, research indicates that the majority of conflicts of interest are linked to either an opportunity to gain in terms of personal, family or business interest, promises of possible career opportunities, donations or presents, and the failure to disclose confidential information relating to such activities [29].

Regulatory compliance to public procurement is largely dependent on ethical behaviour where ethics is a pre-requisite for reducing non-compliance. Sarawa and Mas'ud [35] developed a mediation model that identifies four determinants that impacts on public procurement regulatory compliance. The first determinant being 'professionalism' is closely related to cognitive development of an individual whereby training and professional development will manifest itself through moral obligation [ethical behaviour] which will ultimately direct an individual to comply with public procurement regulations. The second determinant for compliance is 'familiarity' which can be achieved through on the job learning and reading of procurement regulations. According to Sarawa and Mas'ud [35] the third determinant, 'enforcement' "will make public procurement officers behave ethically and consequently comply with public procurement regulations." The fourth and last determinant is 'resistance to political pressure'. They are of the opinion that public procurement officers should evaluate the legitimacy of instructions from powerful forces and resist any pressure towards violation. Persistent ethical behaviour will eventually ensure compliance with prescribed regulations [35].

A SCM Code of conduct has been implemented in a number of OECD countries which focuses in detail on preventing conflicts of interest. In addition, training programmes are also in place to increase the levels of ethical behaviour and public accountability. Furthermore, the OECD advocates for the promotion of transparency, by means of provision of public access to information, and timely and effective responses to information request, as means of protecting public interest and procurement integrity. It is presumptuous to assume that the relationship between maintaining transparency and increased integrity is guaranteed. It is in fact reliant on a number of requisite and enabling factors to be in place for accountability to be truly effective, and includes public access to data, accurate, reliable, and timely feedback, quality data, regular and comprehensive reporting as well as effective whistle-blowing processes and methods, including the protection of whistle-blowers [16, 29].

External stakeholders' participation during the procurement stages has also proven to lead to increased transparency and honesty, given the increase in public scrutiny, provided that privacy or confidentiality, equality in treatment, as well as other legal requirements in the procurement process are adhered to [29].

4. The use of technology in procurement

The utilisation of information and communication technologies (ICT) in public procurement can promote increased transparency and facilitate ease of access to public tenders, in fact some argue that technology is essential to the modern-day public procurement in terms of fair competition, equity and transparency [36]. E-procurement, which is the application of information and communication technologies in public procurement, increases public procurement transparency, enables greater access to public tenders, increasing outreach and competition, decreases direct contact between procurement officials and enterprises, and provides for easier uncovering of irregularities and corrupt activities, such as bid manipulation [16]. Digitalisation reinforces internal corruption prevention controls, strengthens the early detection of integrity infringements, and provides audit trails for investigation purposes [29].

Fraud, corruption and unethical behaviour are serious concerns badgering public institutions. E-procurement is globally considered to be a reorganisation or procurement reform process of goods and services procurement in an effort to prevent or reduce corruption levels and improve efficiency. Transparency International uses the following definition to explain information and communication technologies: “the use of any internet-based inter-organisational information system that automates and integrates any parts of procurement process in order to improve efficiency, transparency and accountability in the wider public sector” [37]. Added advantages are reduced cost, increased accessibility of information and automation practices prone to corruption. Automation of basic steps in the bidding process such as distribution of forms and acceptance of documents eliminates direct human interaction there by limiting opportunities of manipulation and requests for bribes and kickbacks [38].

Transparency and openness in public procurement contributes to more efficient allocation of resources, investment is attracted by lowering risk, efficiency of local suppliers is increased due to fair competition, and local suppliers may become competitive exporters. Advances in technology can be used as a key to respond to transparency demands from both the public and prospective suppliers. Agwot in [39] considers e-procurement to be a double sword principle; on the one side it contributes to the principles of transparency, value for money and fairness while increasing private practitioners’ confidence in the procurement system [39].

The public procurement process is at its most vulnerable during tendering and contract award. Influential contractors use coercive power to get a contract. Other contractors are not able to submit tender documents due to coercive threatening and/or government officials who are indirectly involved for their own benefit. Online bidding through e-procurement reduces cartels and bid rigging amongst bidders. Poor, infrequent auditing that lack co-operation with other relevant agencies are deterrents for transparent and effective flow of information. E-procurement centralises data to improve audit and analysis [38]. Not enough attention is given to contract implementation. Corrupt practices take place through fraudulent invoicing, overbilling, under performance, and failure to adhere to specification standards. The use of e-procurement facilitates easier control and oversight over the procurement cycle through standardised and streamlined processes.

4.1 Link between technology, procurement, and ethics towards the provision of goods and services by governments for the greater good of all

A series of major technological shifts has transformed the global procurement environment in recent times, given the need for lower computing costs, higher volumes of data mining and storage, superior forecast precision, dependence on reliability of data, and evaluation of supplier performance. As the needs of governments become more intricate, technological development have aimed to streamline the procurement function, towards higher levels of consistency, automation of manual transactions and improving the management of the supplier relationship [40].

Governments acquire goods and services to support their operations in providing public services. Services include amongst others, security, transportation, educational systems, medical services, and infrastructure. Service delivery is hampered by unethical conduct where only a few benefits from government’s service delivery responsibilities. Unethical business practices are heightened in the absence of transparency. Increased performance and service delivery can be achieved where systems are introduced that allows for transparency, fair treatment in bidding and awards of tenders, accountability and responsible purchasing and supply [41].

Electronic procurement has been in use in various countries for a number of years, in different ways, each with its distinct advantages [42]. The OECD and its

member States developed a “Compendium of good practices for integrity in public procurement” [43]. The Compendium recognises opportunities for the use of technology during the various procurement stages for the greater good. The online publication of relevant public procurement information results in increased confidence in procurement and leads to more competition. One example is found where the Argentinian government not only publishes procurement opportunities, the timelines for submitting, selection and evaluation criteria, but they also provide a platform for “common questions” regarding the functioning of the public procurement system. Another example is the use of a central procurement system by the government of Mexico, thereby creating empowerment mechanisms for society, their civil organisations, and the watchdog media to examine government procurements at depth and in detail [43].

Corruption during the project planning phase takes place when an unwanted project for private gain is planned by a senior official or political office bearer. Spending public money on unwanted projects does not fall in the ambit of good governance. Such projects are likely not appropriate to society’s needs and therefore seldom sustainable. Confidential information may be leaked, or unnecessary qualification criteria is added. E-procurement plays an anti-corruption role by providing the public or potential bidders with a platform to view and monitor procurement activities through the government web portal. Replacement of paper-based procedures with digital technology-based communication does however not prevent unethical decisions outside of the approved demand plan. During product design, documentation specifications can be compiled to favour a particular supplier, or the prevalence of corruption is concealed in an unnecessary complicated tender. Transparency as a corruption antidote is applicable when project specifications can be viewed on a web portal [38].

The primary procedure most frequently used for the acquisition of goods and services by government, is Competitive Bidding, given its competitive nature and value for money results. The electronic version of competitive bidding is known as the so-called electronic reverse auction procedure [42]. The United Nations Commission for International Trade Law’s (UNCITRAL) Model Law on Public Procurement of Goods, Construction and Services Article 2 describes electronic reverse auctions as an on-line purchasing method which, is used by the procuring entity in a present or real-time state to decide on successful tender proposals, and entails suppliers or contractors presenting lowered bids during a scheduled period of time and the automatic evaluation of bids until a successful bidder is selected. It therefore requires active bidders’ participation during both bidding and award processes [44]. A traditional means of bidding, the English Auction, occurs when bidders gather at a determined location and publicly reveal their bids to the other bidders. As reserve prices are continuously increased, a bidder is permitted to bid several times until no other bidders increase and only one bidder remains claim the item at the last bid price [44]. The same principles apply during electronic reverse auctions; however, the bid values are disclosed electronically, and the values of bids are decreased instead of increased. Points for various aspects of the bids are awarded based on the results of a mathematical formula. The UNCITRAL Model Law requires the procuring entity to publish an invitation to tender electronically, which must stipulate the subject matter of the procurement, the contractual terms and conditions, examination criteria of the bids, including the mathematical formula to be used, as well as the evaluation procedure. The invitation must further inform bidders whether any other component than price will be evaluated, such as preference or quality [44].

Governance in the form of procurement oversight and control is crucial to ensure accountability and is promoting integrity in the public procurement process. In addition, valuable evidence on the performance and efficiency of the procurement cycle

is to be gained from these processes. The governance process should be based on an environmental risk analysis of the government process to ensure an adequate oversight and control system, which will be supported by observations from oversight and control activities, in terms of new and/or emerging risks or red flags, thus allowing for continuous updating and adjustment of the oversight and controlling system [10].

Likewise, suitable sanctions in the form of consequent management actions for illicit behaviour revealed by management control actions, may serve as a useful warning to those contemplating corrupt actions. Management control and oversight are fundamental pillars of the OECD instruments underpinning the utilisation of comprehensive governance systems in the public sector, more specifically in the public procurement domain. The OECD Recommendation of the Council on Public Integrity promotes a so-called framework for control and risk management to preserve public sector integrity, through:

- enabling a procurement environment controlled by clear and fair objectives, indicative of senior officials' commitment to upholding public service values and principles of integrity and, which provides for a sufficient assurance of an organisation's performance, its effectiveness, and its compliance;
- guaranteeing a strategic risk management approach; and
- ensuring consistent control mechanisms, inclusive of clearly defined and applicable procedures to provide for reporting of plausible suspicions of violations of laws and regulations, without fear of reprisals, as well as the facilitation and investigation thereof [10].

The use of blockchain technology in procurement has also been found to be effective in managing integrity of the process [45]. A blockchain is described as "an open, decentralized, and distributed digital ledger that is used to create a trusted peer-to-peer network for exchanging information, value, and assets across many computers (i.e., nodes)". A blockchain records and encrypts time-stamped transactions between the involved partners which are then unassailable or unchangeable. These transactions are grouped in a bundle or "block" in a chronological and logical order [10]. The use of blockchain thus creates new opportunities to drive increased procedural integrity and authenticity through the use of a technology driven decentralised platform for validating data, information, and transactions, independently of any third-party control in a transparent, verifiable, secured and lasting format. One of the important features of blockchain in procurement is that the different SCM and procurement stakeholders involved in the procurement processes have access to an unalterable, secure and shared database in that under one platform, entities can access the accumulated data of suppliers' portfolios, various services level agreements, project details etc. Refer to **Figure 3** below for leveraging aspects to be obtained from using blockchain technology [10].

4.2 Examples of successful E-procurement practices

Effective internal controls are intended to guarantee efficient public procurement processes while at the same time achieving integrity-related goals and objectives. Internal controls in procurement are intended to verify the degree of compliance to legal, financial, and administrative procedures, and include internal audit activities as well as management and financial controls. Furthermore, coherent internal control practices across the public sector safeguard the consistent application of procurement rules, regulations, and standards [16].

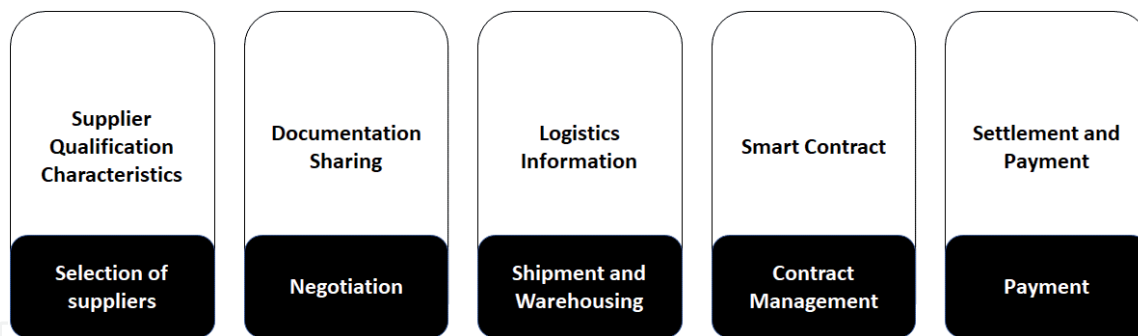


Figure 3.
 Leveraging procurement process with blockchain technology [40].

4.2.1 Electronic workflow: processing and tracking information on public procurement in Germany

The Federal Procurement Agency in the Ministry of the Interior in Germany (FPA) has implemented an electronic workflow process which aims to centralise all procurement related information of the FPA and record the outcomes of ongoing procurement procedures during the different stages. The FPA maintains a document management system to ensure transparency as well as provide for an audit trail of all procurement decisions, investigations of suspicious transactions and also allows for the department to apply quality management to examine documents randomly or systematically in the system, while the internal audit teams can review previous transactions that have been identified as having a higher corruption risk. These inspections are not only to prevent or detect corruption, but also to ensure economically beneficial public procurement practices [16].

4.2.2 Public spending observatory in Brazil

E-procurement plays a key role in public procurement practices in Brazil, which is reliant on advanced technology, both internally, in terms of management and database systems, as well as externally, for example, the Internet. E-procurement is of strategic importance at the Federal level for producing efficient and transparent results and maintaining effective control over public expenditure [36]. In 2008 the Office of the Comptroller General of the Union launched the Public Spending Observatory (Observatório da Despesa Pública) towards continuous detection of misconduct and corruption and appropriating the relevant sanctions. Through the Public Spending Observatory, procurement expenditure data is being cross-checked or verified against other government databases, to identify possible situations that, while not per se confirming any irregularities, may justify further investigation. Using data analytics and historical trends, daily cross-checking actions are performed between the procurement database and other government data, and this cross-checking exercise produces so-called red or orange flags, which are followed up and investigated by officials within the Office of the Comptroller General of the Union, if so required. Follow-up activities are often conducted in conjunction with special advisors on internal control as well as internal audit units to pinpoint possible procurement irregularities, such as:

- Business relations between suppliers participating in the same procurement procedure.
- Personal relations between suppliers and public officials in procurement procedures

- Non-compliance by suppliers with tender submission deadlines.
- Supplier's bid submissions or company records with the same registered address.
- Contract amounts above the legally prescribed ceiling for the procurement modality used.
- Contract amendments above an established limit, in violation of the specific tender modality.
- Micro- and small enterprises linked to other enterprises.
- Micro- and small enterprises with shareholders in other micro- and small enterprises [16].

The Transparency portal hosted by Brazil's government offers real-time access to people on information of budget execution and direct monitoring of government programs [43].

4.2.3 Integrated E-procurement system KONEPS in Korea

The digitalisation of procurement processes reinforces internal anti-corruption controls and detection of integrity breaches, and it provides audit services trails that may facilitate investigation activities. In Korea, the implementation of a national e-procurement system has resulted in a significant improvement in the transparency and integrity of the public procurement. In 2002, the central procurement agency of Korea, the Public Procurement Service (PPS), introduced a fully integrated, "end-to-end e-procurement system" called KONEPS, which provides for all aspects of the procurement cycle such as one-time registration, tendering, contracts, inspections, payments, as well as electronic exchange of documents. KONEPS links a multitude of external systems to share and retrieve information, and runs a one-stop service, including "automatic collection of bidder's qualification data, delivery report, e-invoicing and e-payment" [16]. According to PPS, the system has boosted efficiency, considerably reduced transaction costs, resulted in increased participation in public tenders and has considerably improved transparency. In addition, the Korean Fair-Trade Commission makes use of an automated KONEPS system for detecting suspicious bid strategies (named BRIAS), which has sharply decreased instances of corruption by preventing illegal practices and collusive acts. So-called 'Cover quoting', during which a tenderer submits more than one tender is illegal and to prevent this from happening, the government of Korea introduced "Fingerprint Recognition e-Bidding", limiting a tender to only one per company. The government also eased market accessibility through the use of smartphones during the bidding process [16].

4.2.4 Zambia's public E-procurement

E-procurement has not been widely used in by governments in Africa to date. According to the World Bank the three main reasons for the slow adoption of e-procurement in Africa have firstly been a low level of capacity building by African governments, secondly a lack of ICT infrastructure as well as limited internet access bandwidth challenges; and lastly, archaic administrative processes and restrictive cultures in African governments [44].

Policy makers in the Zambian government published the Public Procurement Regulations in 2011, under the strict provisions of the 2008 Public Procurement Act, under the auspices of the Zambia Public Procurement Authority (ZPPA), an autonomous regulator mandated to regulate procurement of services, goods and works in Zambia. Since the publication, research indicates that public entities and local authorities have been in support of a move to e-procurement as it is expected to yield several advantages, such as reduced opportunities for corrupt practices, access for prospective bidders to tender opportunities whether residing within the country or abroad, and compliance to public sector procurement legislation, thereby preventing service providers or procuring entities from deviating from the procedures set out by ZPPA [46]. E-procurement is also less expensive in terms of “hardcopy bid filing” which was required for the previous centralised traditional filing system, as well as saving money for participants in terms of lodgings in and transport to Lusaka. However, there are some concerns regarding non-availability of internet facilities or as a result of connectivity issues preventing possible participants in deep rural areas from submitting their electronic bids [47].

5. Advantages of E-procurement

It has been noted that implementing e-procurement is potentially valuable in guaranteeing a more efficient public procurement process which results in reduced costs for goods or services, a decrease in procurement cycle time periods, administrative cost and improving communication. The active involvement of bidders during a real-time procurement, being continuously informed of their competitors' bids and what their prospects of success are, further increases transparency and may even reduce corruption within the process [44].

The use of e-procurement may also reduce administration costs, the number of procurement staff required, and improve communication through swifter access to information the online availability of tender documents and information which can be updated regularly and promptly. Governments will further be able to publicly identify its regular suppliers thereby promoting transparency whilst at the same time promoting value for money in contracting with reliable suppliers. At the same time, competition can still be maintained by using various suppliers. The main benefit of introducing e-procurement recorded by the World Bank has been a marked upturn in transparency and competition [44].

6. Disadvantages of E-procurement

With e-procurement being a relatively new form of procuring goods and services, it has been up against a number of challenges, notwithstanding the proven benefits of using electronic means in procurement. In a 2004 UK wide study, Wong and Sloan in [48] found that only 48% of respondents indicated that they were able to conduct e-procurement effectively. The complete list of barriers ranked by this study was:

- Uncertain about the legal status of e-procurement;
- Organisational culture;
- Senior / executive management support;
- Lack of sufficient ICT infrastructure;

- ICT systems too expensive;
- Lack of technical skills and knowledge;
- Lack of qualified and proficient e-procurement personnel;
- Relationship challenges with suppliers when providing e-procurement;
- Possible security challenges during transactions;
- Interoperability issues; and
- No value for money [48].

Progress within the traditional procurement function has been slow and many governments have battled to gain traction, with varying levels of resistance to change [48] and an unwillingness to transfer to e-procurement systems, especially when structural change in business processes are necessary. In addition, the level of technological awareness of e-procurement system users to be, so-called “tech-savvy”, is still lacking, requiring increased efforts to raise awareness of procurement-enabling technologies, and opportunities raised by these disruptive innovations [40]. In addition, ICT failure (whether that be a failure in the infrastructure or a failure in the equipment) during the procurement process is a reality; a lack of technical expertise knowledge and access to information technology are limitations to upcoming contractors. A lack of legal certainty underpinning e-procurement; and a failure by management to provide adequate infrastructure, are some disadvantages of e-procurement. The benefits of e-procurement can only be realised if the processes are properly improved and not simply by automating the existing methods of working [44].

A further possible threat is an increase in collusion where there are only a small number of suppliers of the required product or service. A lack of legal certainty underpinning e-procurement may be a further barrier to the successful implementation of e-procurement [48]. The benefits of e-procurement can only be realised through, amongst others, in-depth training of all stakeholders and adoption of an “electronic attitude” by suppliers. The use of mathematical formula’s during evaluation can be problematic when public procurement is used as a tool to also achieve secondary objectives such as quality and socio-economic considerations. Different mathematical formulas must be developed for all types of procurement [44].

7. Conclusion

Although there are successes to be found where e-procurement has provided governments with the opportunity to improve their public procurement processes in terms of value for money, transparency, and integrity. Globally governments are only slowly starting to embrace the fourth industrial revolution, with technological advances being incorporated in order to survive in today’s uncertainties. Public sector procurement entities are hard-pressed to accept the technology innovations to curb unnecessary costs and strengthen transparency measures to ensure that ethics are upheld throughout all the business processes [47]. In order to maximise the benefits of e-procurement, preparatory actions such as increased awareness of all stakeholders is essential as well as migration of all information pertaining to tender processes in order to successfully implement and maintain trust in an electronic

procurement system. More importantly, senior public management support will be crucial in establishing and maintaining a trustworthy, transparent, and well-governed e-procurement system, supported by the necessary infrastructure and well-trained staff [44]. Faced with ever-increasing pressures on state funds to be spent for the greater good of all, the benefits of e-procurement will prove to outshine the disadvantages associated with a movement to technology. Less corruption, undue influence of tender awarding processes, and the reduction of other unethical behavioural risks are the advantages which will outweigh the disadvantages of the initial expenditure on technology, training of staff, and migration of all processes to an e-procurement environment. E-procurement provides the strategic foundation towards, transparent and cost-effective collaboration throughout the entire public procurement lifecycle [48].

Conflict of interest

The authors declare no conflict of interest.

Author details


David Fourie^{1*} and Cornel Malan²

1 School of Public Management and Administration, Faculty of Economics and Management Sciences, University of Pretoria, Pretoria, South Africa

2 Independent Industry Advisor, Lyttelton, South Africa

*Address all correspondence to: prof.djfourie@up.ac.za

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