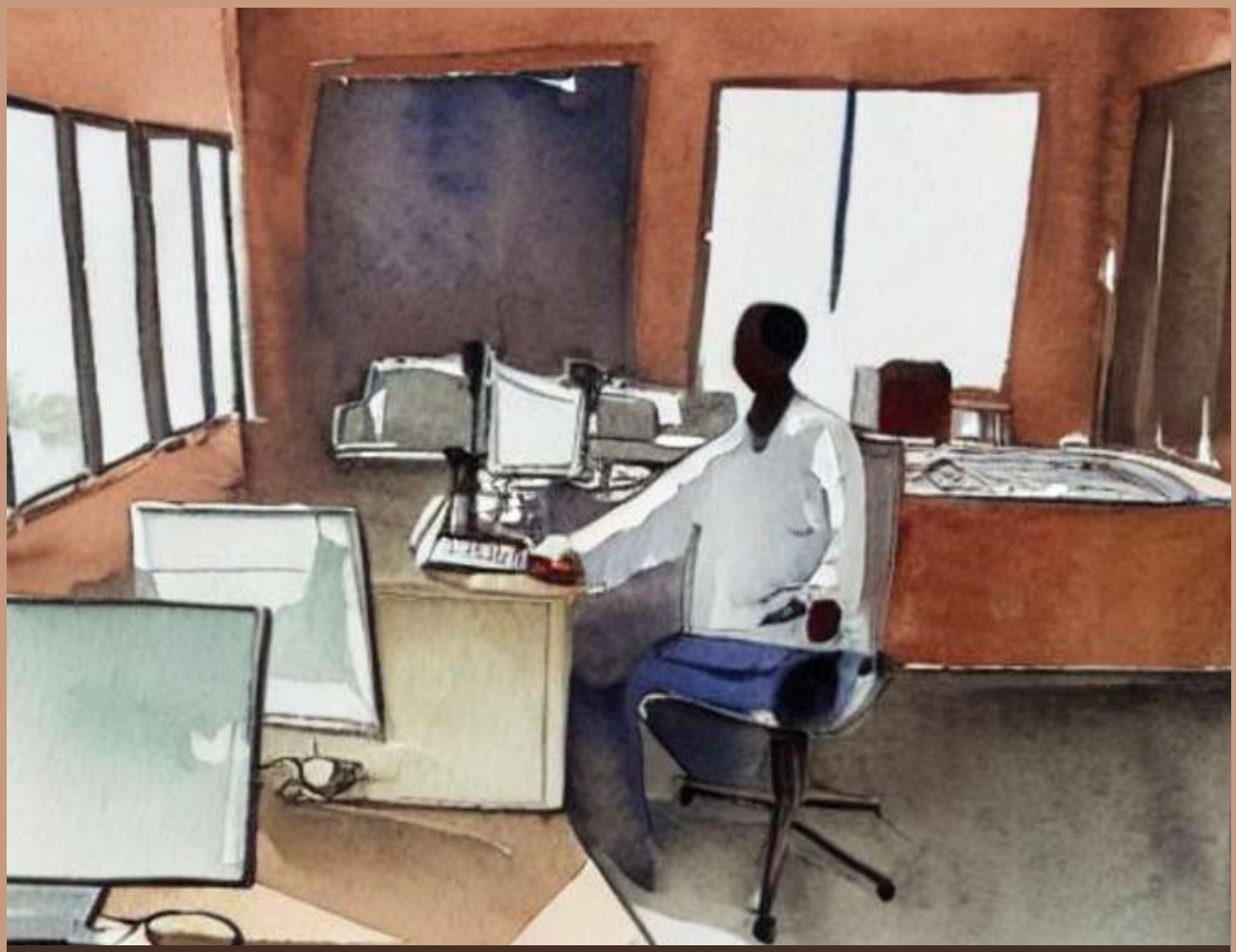
E-GOVERNMENT PROCUREMENT

HALFTIME FOR THE SUSTAINABLE DEVELOPMENT GOALS



BEST INVESTMENTS FOR THE SDGs

EXCELLENT BENEFIT COST RATIO: 125

Investment

IT systems to manage procurement activities of works, goods, and services required by the public sector resulting in for example more transparent and less corruption-prone project budgeting, submission of bids, bid evaluation, auctions, publication of contract award results, and vendor payments.

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The investment case for e-Government Procurement:

a cost-benefit analysis[1]

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Summary

In almost every country, government is the largest buyer of works, goods, and services from the private sector. Through the laws and practice of public procurement, governments create competition among firms, thus optimizing public expenditure. However, public procurement is often associated with inefficient allocation of resources and corruption.

One method to reduce inefficiencies and abuse in public procurement is the use of e-government procurement platforms. Yet nearly 40% of countries—mostly low- and lower-middle income countries—do not have functioning e-government procurement platforms.

Cost-benefit analysis is used to make the investment case for the development and integration of e-procurement systems in low- and lower-middle income countries. The costs of setting up an e-government procurement (e-GP) system include an initial investment of $9.03 million, on average, for the planning, design, and build phases spread over a five-year period. Annual operating and maintenance expenses during pilot and deployment phases are estimated at $1.1 million annually. In total, it is estimated that the net present value of costs to design, build, test, deploy, and operate a robust e-GP system is $16.7 million for a typical low- and middle-income country (at an 8% discount rate).

While there are many tangible benefits of e-GP, the benefit assessed here is the reduction in the prices of goods, works, and services paid by government buyers. Using the average percentage reduction in procurement prices of 6.75%, the savings from an e-procurement system are valued at $637.9 million and $5.2 billion for low- and lower-middle income countries, respectively.

The benefit-cost ratio of implementing an e-GP system in the average low-income country ranges from 8 to 58, and is 142 to 473 for a lower middle-income country. The size of the procurement market, the reduction in procurement prices, the duration of the implementation process, and the penetration rate of e-GP throughout government are principal determinants in the return on investment.

Introduction

The role of government as an influential economic agent is overlooked often. Yet in most countries, the government is by far the largest buyer of works, goods, and services from the private sector. Done well, procurement can level the playing field among firms, stimulate production and innovation, and make more efficient use of public resources by making transactions more transparent, lowering the compliance and accessibility costs for suppliers, and setting up accountability mechanisms.

Total public procurement amounted to $11 trillion in 2019, or approximately 12% of global GDP (Bosio et al., 2020). COVID-19 associated expenditures aside, the annual percentage growth in government consumption has been steadily increasing since 2011, from 0.68% to 2.41% in 2019 (World Bank Open Data, 2022). If GDP in low- and lower-middle income countries in 2020 was just over $8 trillion (constant 2015 USD), public procurement amounted to approximately $961 billion (12%).

However, public procurement is also a government's number one corruption risk: bribes, kickbacks, and collusion among bidders and with the procuring entity can occur at any phase in a procurement process.

Enforcement data from 427 cases of foreign bribery by the Organization for Economic Co-operation and Development (OECD, 2014) showed that in the majority of cases (57%) involved bribery for a public procurement contract.

Increased spending by governments implies that corruption and inefficiency may cost a considerable sum. The International Monetary Fund's analysis for infrastructure spending "suggests that, on average, over one-third of the resources spent on public investment are lost due to inefficiencies in its public investment management processes" and that losses are higher in less developed economies (International Monetary Fund, 2020).

Public procurement of goods and services is characteristically divided into three phases: (1) the *tender preparation and advertising phase*, in which the procuring entity identifies its needs, budget, application and submission procedures, and evaluation criteria for bidders, and publishes

the tender; (2) the *bid evaluation and contract award phase,* which includes the reception, handling, and processing of bids according to pre-specified procedures and the negotiation and signing of the contract; and (3) the *contract execution phase*, which includes a calendar of payments and delivery of service as well as any contract amendments (Bosio et al., 2020).

All three phases have opportunities for misconduct, and corruption in public procurement is particularly costly to society, especially when investment decisions are driven by opportunistic, rent-seeking motives rather than the principles of needs and efficiency (Open Contracting Partnership, 2018). Corruption has been found to be common in procurement (Collier and Kirchberger, 2016; Colonnelli and Prem, 2020; Olken, 2007), particularly when contracts are renegotiated (Campos et al., 2019; Decarolis, 2014; Decarolis and Palumbo, 2015). Public agencies often lack the incentives and administrative capacity to handle these challenges. A lack of transparency and accountability results in inferior quality of service provision, barriers for small firms to bid, avoidance of environmental regulations, low innovation uptake, and state capture by large companies who can influence legislation and processes in their favor. It also undermines wider public trust, which may have knock-on effects on other programs and government interventions. Since most governments are politically devolved, transparency and accountability also become harder to trace at local government levels (Bosio et al., 2020; Fazekas and Blum, 2021).

A recent study on the impact of cronyism on the awarding of public contacts in Hungary exemplifies this issue. When the President's son-in-law was on the Board of a company, its probability of winning a tender was three times higher than that of the average bidder. When he moved off the board, this probability fell to less than half of that of the average bidder (Makszimov, 2022). These discrepancies suggest collusive behavior between public officials and companies. In another study (Kochanova et al., 2020), the effects of adopting e-procurement on public procurement competitiveness for a large sample of low- and middle-income countries was analyzed. The authors found that e-procurement improves competitiveness only in countries

with relatively high levels of development. The expected decline in the likelihood of bribes is material.

In the World Bank's 2020 Enterprise Surveys, the East Asia and Pacific and South Asia regions registered the highest percentage of firms that expect to give a gift to secure a government contract: 40.1 and 45.5%, respectively (see Table 1) (World Bank, 2020d). However, developing countries do not have a monopoly on corruption. The OECD (2010) estimated that bribery in government procurement in OECD countries increases contract costs by at least 10%, suggesting that US$400 billion is lost to bribery every year. Further, the World Bank's 2020 Enterprise Survey revealed that, across all countries, 23.7% of firms expected to give gifts to secure government contracts.

Table 1: Suggestive Evidence for Corruption in Public Procurement

Regions	% of firms expected to give gifts to secure government contracts
All countries	23.7
East Asia and Pacific	40.1
Europe and Central Asia	8.6
Latin America and the Caribbean	14.3
Middle East and North Africa	26.3
South Asia	45.5
Sub-Saharan Africa	33.6

Source: World Bank (2020d) Enterprise Surveys (http://www.enterprisesurveys.org).

Government responses to natural disasters and other emergencies are even more vulnerable to corruption (Bandiera et al., 2021). The allocation of contracts at inflated prices and to known associates, the practice of 'adding on' to contract prices as an incentive payment, and reduced quality requirements have been repeatedly observed. In a study of five disasters in Italy between 2009 and 2020, Fazekas et al. (2021) uncovered statistically significant increases in the share of contracts awarded through non-open procedures, limited advertisements, and overly short advertisement periods. They also found a positive but insignificant increase in the share of

contracts with a single bidder. Gallego et al. (2021) also documented the increase in prices paid by Latin American public health institutions of medical supplies, which were some 7 to 12 times higher than the market value. They also noted that countries with an existing e-procurement system had to introduce less drastic changes to adapt to the new circumstances resulting from the COVID-19 pandemic, and indeed, they were able to adjust their public procurement functions more promptly. In a survey of procurement specialists covering 103 countries in 2020, the World Bank found that the lack of an e-procurement system was reported as a critical constraint for 59% of countries surveyed (in Cocciolo et al., 2021).

There are ways that corruption in public procurement can be reduced. Using data from the World Bank's Enterprise Survey and Public Expenditure Financial Accountability Assessments across 88 countries, Knack et al. (2019) found that in countries with more transparent procurement systems, independent complaints mechanisms, and external auditing, firms reported paying fewer and smaller kickbacks to officials. Furthermore, they found that the more transparent and accountable the procurement process, the more likely firms were to participate in bidding for tenders. This is supported by an earlier study by Bauhr et al. (2017) who found, after analysis of more than 3.5 million government contracts across Europe, that publishing more information about contracts decreases the risk of single bid tenders. This matters because single bid contracts are both a governance risk and are, on average, 7% more expensive.

The obligations of quality public service provision, transparency, and accountability in public administration and the use of public resources are enshrined in the Sustainable Development Goals, with several indicators making reference to it. SDG 16 makes specific reference to reducing corruption in public procurement.

Target	Indicator
SDG 16	*16.5.1* Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months *16.5.2* Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months *16.6.1* Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar) *16.6.2* Proportion of population satisfied with their last experience of public services

It is worth emphasizing that better public procurement will have a positive impact on every other Sustainable Development Goal. For example, of the World Health Organization's ten leading causes of inefficiency in the health sector, four are procurement-related (Chisholm and Evans, 2010).

What is e-Government Procurement (e-GP)?

e-GP is the use of a transactional information system by government institutions and other public sector organizations in conducting and managing their procurement activities and relationships with suppliers for the procurement of works, goods, and services required by the public sector (Wu Chebili et al., 2022). e-GP can be considered an umbrella term for a range of functionalities that span the whole public procurement life cycle (World Bank, 2007a). These commonly include:

- Planning pipelines and project budgeting
- Distribution (downloading) of bidding documents
- Notification
- Supplier and buyer registration
- Online Question & Answer sessions
- Supplier vetting
- Submission of bids
- Bid evaluation
- Auctions
- Publication of contract award results
- Vendor payments
- Data sharing, analysis, and business intelligence

The definition of e-GP used for the current cost-benefit analysis is that of a comprehensive end-to-end implementation system covering at least some features of planning, award, and

implementation of public contracts. The simple electronic availability of bid documents, or parties just emailing documents to each other, for example, would not be considered an e-GP system for the purposes of this study (Hayman, 2019).

Not all these elements of a comprehensive e-GP approach are implemented together. For example, the bid submission may be electronic, but vendor payment may be manual. Generally, however, the vision of e-GP for this paper is that of a comprehensive end-to-end implementation of e-GP with respect to the planning, award, and implementation of public contracts, and that digitization of procurement can involve fundamentally redesigning how public contracts are planned and delivered. It involves reimagining the business flow for a purely digital environment like e-auctions and leveraging data with business intelligence and risk monitoring tools as opposed to simply replicating paper-based transactions with, say, parties just emailing documents to each other (Hayman, 2019). The more digitized the process is, the greater the likelihood of efficiency gains.

Fazekas and Blum (2021) identify four functionalities as being the most commonly digitized: e-notification, e-access, e-attestations, and e-submission. This is supported by market research of e-GP developers, which also include e-reverse auctions (at the pre-awarding phase) and monitoring and reporting (Wu Chebili et al., 2022). Less commonly digitized functionalities include e-invoicing, e-payment, e-complaints and e-signatures (Fazekas and Blum, 2021; World Bank, 2007a; Wu Chebili et al., 2022). According to the United Nations' 2020 e-Government Survey, even among OECD countries, these latter functionalities are only at 30-40% implementation (United Nations, 2020).

Of the 193 countries surveyed by the UN e-Government Survey, 125 have invested in a functional e-procurement platform, leaving the remaining 70 countries without one, as of 2020. The share reverses if one takes into account the full-functionality of the existing e-procurement systems: two-thirds of the world are still developing their systems (Open Contracting Partnership 2021a). The majority of these countries are classified as low- and lower-middle income. Hence

the motivation to undertake a cost-benefit analysis of integrating an end-to-end e-procurement system in these regions.

The Costs and Benefits of e-Government Procurement (e-GP)

As the largest purchasing agent in most economies, it is critical that governments seek to increase efficiency and reduce waste and leakages, that is, seek to achieve agreed upon policy objectives at the least cost (Santiso et al., 2014). This is why countries are increasingly turning towards digital technology to reduce transaction irregularities, limit buyer discretion, and improve workflow processes.

To ascertain the timing and magnitude of the costs and benefits, the implementation of an e-procurement system has been conceptualized in four phases based on an eleven-country sample (see Table 2):

(1) The *Planning* phase includes, in most cases, the search for appropriate partners to finance the implementation of e-GP and consultations and negotiations to identify the appropriate service provider. The *Planning* phase lasts, on average, 11 months.
(2) The *Design and Build* phase is characterized by a needs and readiness assessment, which includes an examination of existing processes and the legal and regulatory framework and human resource constraints, development of the implementation plan, and acquisitions pertaining to hardware, software, data security, and the sensitization and training of stakeholders. The *Design and Build* lasts for 18 months. Some countries, like Tunisia and Ukraine, complete both the Planning and Design and Build phases in as little as 12 to 18 months, whereas in the Indian state of Karnataka and in Uganda, this phase was completed in 36 months (OECD, 2020a; Ojha and Pandey, 2014; Results for Development, 2017; Wu Chebili et al., 2022).
(3) The *Pilot* phase allows a government to slowly introduce the new system to its user community, both government buyers and suppliers, giving them an opportunity to adapt, during which a subset of a country's procuring bodies are selected to test the system and the business model (Asian Development Bank, 2013). In this phase, acceptance and usage issues are identified, like the user-friendliness of the system, supplier challenges, management and bureaucratic tensions, the robustness of IT and data security, and the adequacy of human resources, among others (Mohungoo et al., 2020). The *Pilot* phase lasts, on average, 29.3 months, but it can be as short as 10 to 16 months, for example, Ukraine, South Korea, and Italy, and as long as 60 months for the Philippines and Tunisia (Bombay, 2011; Cho and Byeon, 2004; Results for Development, 2017; World Bank, 2007a; Wu Chebili et al., 2022).

Table 2 e-GP implementation phase by country case, months

Country/Name of e-GP platform	Planning	Design and Build	Pilot
UKRAINE/PROZORRO	0	12	10
Karnataka, INDIA/KTPP	24	12	24
Sao Paulo, BRAZIL/BINPS	n/a	n/a	n/a
SOUTH KOREA/KONEPS	16	16	16
PHILIPPINES/PhilGEPS	6	24	60
RWANDA/UMUCYO	12	18	18
ITALY/CONSIP	16	16	16
TUNISIA/TUNEPS	6	12	60
UGANDA/e-GP	8	28	24
BANGLADESH/DIMAPPP	n/a	n/a	n/a
MAURITIUS/e-PS	12	24	36

Note: 'n/a' implies that the duration of the phases was not distinguishable in the readings.

(4) The *Operations* phase marks the end of the transition period during which adjustments are made and actions taken to remedy implementation hiccups and the system is fully deployed. It is typical at this juncture to mandate the use of the e-GP by all procuring entities. For the purposes of this model, this phase lasts until replacement and/or upgrades become necessary, and hence additional capital investment, which is assumed to be a period of seven additional years after the end of the pilot.

Table 3 presents the duration of all four phases, in months, which is used to determine the timing of costs and benefits, a total of 12 years.

Table 3 Timing and duration of e-GP implementation phases

e-GP Implementation phase	Year in model (months)
Planning	Year 1 (11 months)
Design and Build	Years 1 - 3 (18 months)
Pilot	Years 3 - 5 (29 months)
Operations	Years 6 - 12

Benefits of e-GP

There are multiple, tangible benefits associated with e-government procurement:

- *An improvement in workflow efficiency of procurement agencies*. A reduction of 55 days in the tender cycle time was observed in India (Asian Development Bank, 2013). In

South Korea, the duration of the processing of bids, from the receipt to the validation to the selection of the winning bid, was brought down from an average of 30 hours to 2 hours (Luijken and Martini, 2014). The adoption of the COMPR.AR system in Argentina led to strong efficiency gains: on average, the duration of the public procurement process fell by over 11 days (De Michele and Pierri, 2020). BAObras, a public transparency platform for the procurement of over 1100 public works projects for a planned US$3.5bn facelift for the city of Buenos Aires in Argentina, reduced the time taken to share data by the city's authorities by 93% (Open Contracting Partnership, 2021b).

- *A decrease in advertising costs*. In the Philippines, there was P564 million savings in advertising; likewise in India, a decrease in advertising costs of $0.56 million (Asian Development Bank, 2013; Bombay, 2011).
- *An increase in the number of bidders*. Because information and transaction costs in traditional paper-based procurement processes are more onerous for smaller firms, electronic procurement systems, which reduce such costs, attract greater participation. In Bangladesh, the rate of contracts awarded on a tender with only one bidder practically halved, dropping from 33%to 17 percent (World Bank, 2020a). In Karnataka State, India, the number of suppliers increased from 130 to 4800 in the first three years of operation (Ojha and Pandey, 2014). In South Korea, the number of bidders doubled from 70,000 to 147,000 in the first three years (Cho and Byeon, 2004). An analysis of the open data from Ukraine's Prozorro e-GP reforms from 2021 shows that a remarkable 97.7% of businesses (some 64,801 by number) bidding in Prozorro are SMEs. In 2021, they won 39,5271 contracts for $16.6 billion, while large companies (some 1524 entities) won 20,249 contracts for $5.99 billion.
- *Better oversight of suppliers and improvement in service delivery*. In Indonesia, 15% more construction projects were completed on time (Lewis-Faupel et al., 2016). In India, there was a 12% increase in road quality grade (Lewis-Faupel et al., 2016). e-GP reforms in Paraguay from 2015 reduced amendments to contracting processes from 19% in 2013 to just 3% in 2016. Improved monitoring meant that more than 80% of the schools most in need now receive funding, compared to fewer than 20% in 2015 (Open Contracting Partnership, 2017).
- *Increased transparency*. Bauhr et al. (2017) found that publishing five more pieces of information about each tender would save Europe up to 3.6 billion Euros. Furthermore, disclosing the information proactively rather than retroactively was important and had a bigger effect.
- *Better preparedness for emergencies, especially in coordinating a response to sudden marker shocks.* A World Bank Survey covering 103 countries between April and August 2020, found that countries with comprehensive e-procurement systems were able to more promptly adjust their public procurement functions to respond to the Covid-19 emergency (Cocciolo et al., 2021). The Open Contracting Partnership (2022) detailed how availability of good quality open data on who was buying from whom improved emergency coordination, training, and monitoring in countries such as Chile, Colombia, Ecuador, Lithuania, Moldova, Paraguay, and Ukraine.
- *Implementation of red flags to detect and act on corruption and other risks.* Availability of standardized, structured, machine-readable data in e-GP systems allows for proactive monitoring and identification of corruption, collusion, or other risks in contract planning, tender, and award processes, as well as automatically flags such

concerns for action by the procurement authorities and control authorities. Ukraine's Prozorro open procurement reforms are a best practice example of this with a sophisticated business intelligence engine using the data and resulting in hundreds of investigations and actions.

e-GP is an anti-corruption strategy. The direct costs of corruption include the misallocation or inefficient use of public funds, delayed projects, and/or lower quality infrastructure. The European Parliamentary Research Service (2016) found that a one-unit increase of the Corruption Risk Index (CRI) raises prices (or reduces cost savings) on average by about 15%. They predict that the implementation of a full e-procurement system could reduce the costs of corruption risk in public procurement by around €924m annually, which corresponds to a reduction of almost 20% of the current costs

e-GP reduces corruption in procurement through several channels:

- It lowers the bidding and transaction costs for firms, thus attracting more firms to the market, which stimulates competition and mitigates the high prices associated with single bidders.
- The automation of certain functions reduces the potential for bribery and graft that exists with human interaction.
- The digital fingerprint that is left from operating the system increases accountability in decision-making.
- The transparent nature of the technology facilitates audit and monitoring functions and significantly lowers the cost of doing so. Importantly, red flags can be automated given the authorities (and sometimes even companies and citizens') advance warning of a problem that can be investigated and fixed before things go seriously wrong.

An immediate and well-documented consequence of these channels is the lower prices paid by procuring entities. For example, Open data e-GP reforms in Moldova resulted in 15.4% savings on medical procurement transactions worth US$60 million and 19% savings on the HIV/AIDS program procurement budget, including 95% savings on key antiretroviral drugs when switching to a low-cost alternative dose (Open Contracting Partnership, 2021c).

Not all reforms result in a measurable cost impact, but other important factors, such as the quality of works and services may still improve or delays may be reduced (Lewis-Faupel et al., 2016).

The multiple benefits mentioned above notwithstanding, the only benefit used in this cost-benefit analysis is the average percentage decrease in procurement prices, a benefit for which information was obtainable and comparable across several countries. Table 4 lists country cases of cost savings realized as a result of e-GP implementation.

Table 4 Effect sizes

Country	% reduction in procurement prices	Source
ARGENTINA	4%	de Michele and Pierri (2020)
BANGLADESH	7%	Turkewitz, Fazekas, and Islam in Bajpai and Myers (2020)
BRAZIL (São Paulo)	25%	World Bank (2007a)
CHILE	3%	Singer et al. (2009)
INDIA (Andhra Pradesh)	8%	Bikshapathi and Raghuveer (2006)
INDIA (Bangalore)	4 - 12%	Ojha and Pandey (2014)
MAURITIUS	20%	Wu Chebili et al. (2022)
MEXICO	5 - 25%	OECD (2018)
PHILIPPINES	10 - 25%	Bombay (2011)
SOUTH KOREA	12.5%	Public Procurement Service of South Korea
UKRAINE	3.5 - 5.8%	Kovalchuk et al. (2019)

Note: Based partly on literature review by World Bank (2007a) and Fazekas and Blum (2020). Effects are national in scope, unless otherwise indicated.

Ukraine is an example of how much money can be saved from e-procurement. The country's Prozorro reforms mean that its open architecture e-GP uses a reverse auction method for awarding contracts with open bidding as well as a real time, open-data dashboard on the award data. This means that it is possible to calculate savings on awards as well as on the budgeted price that that government was willing to pay to award the contract. Over the life of the reforms from 2015 to date (2022), savings have been at least US$1 billion a year. Furthermore, as expected, as agencies have become better at setting the prices for awards from the start, savings have come down from almost 15% in 2015 to about 3% for 2021.

After eliminating the extreme (highest and lowest) estimates from the sample above, the average percentage decrease in procurement price is 6.75%. This effect size is used to calculate a

moderate estimate of the average decrease in procurement prices. The conservative effect size of 3%, the lower bound of the evidence reviewed, is also used in the scenario analysis.

The percentage of GDP spent on public procurement was 11.3% and 14.1% in low- and lower middle-income countries (Wu Chebili et al., 2022). Using the Copenhagen Consensus Center's GDP projections for 2022 and onwards, the average low-income country has a GDP of approximately $22.1 billion, whereas that of a lower middle-income country is $155.9 billion at the start of the intervention (see Table 5). The significant disparity in economy size and procurement volumes between the two income groups will prove to be one of the determining factors of the price reduction benefit from the e-procurement system.

The size of public procurement is $2.5 billion in low-income countries and $22 billion in lower-middle income countries, on average. Working with the assumption that only half of the awarded contracts go through the e-GP system in countries that have them[2], the respective market sizes are reduced to $1.25 billion and $11 billion, respectively. However, the average of the income groups masks the variance in procurement market sizes that exist within the income groups: the bottom quintile of low-income countries as measured by GDP has an average procurement market of $500 million; its counterpart in lower middle-income countries is valued at $4.4 billion. This variance and its impact on the benefit-cost ratio is addressed in the scenario analysis below.

Table 5 GDP and procurement market projections

	Low-income		Lower middle-income	
Year in model	GDP, USD billions	Procurement market value, USD billions	GDP	Procurement market
1	22.1	2.5	155.9	22
2	23.8	2.7	167.1	23.6
3	25.7	2.9	178.3	25.2
4	27.7	3.1	190.3	26.9

[2] According to the Global Public Procurement Database, a low- or lower-middle income country has an average of 85,900 tenders based on 2019 figures, of which only 45,900—or about half—were awarded through their procurement systems.

5	29.8	3.4	203.1	28.7
6	32.1	3.6	216.7	30.6
7	34.5	3.9	229.7	32.4
8	37	4.2	241.7	34.1
9	39.7	4.5	254.5	35.9
10	42.6	4.8	267.8	37.8
11	45.6	5.1	281.8	39.8
12	48.6	5.5	294.9	41.6

Procurement agency uptake and integration into the e-procurement platform is not instantaneous. Uptake at the start of the *Operations* phase (Year 5), based on the sample of countries, is 25.3%, on average. Hence, it is assumed some benefits do accrue during the *Pilot* phase, or Years 3 to 5. Therefore, there is gradual phasing of benefits beginning in Year 3 through to Year 12 (see Table 6).

Table 6 Schedule of benefits, with average effect size 6.75%

		Low-income	Lower middle-income
Year in model	% public procurement through e-GP	USD, million	
1	-		
2	-		
3	3	5.97	51.9
4	11	23.9	205.9
5	26	58.6	499.4
6	50	122.3	1,032.7
7	50	131.4	1,094.5
8	50	141	1,152.1
9	50	151.1	1,212.7
10	50	161.9	1,276.3
11	50	173.5	1,343.1
12	50	185.0	1,405.6

Total benefits, unadjusted		1,154	9,274

Costs of e-GP

Generally, the implementation of e-GP involves (World Bank, 2007a):

- A comprehensive review of the whole public procurement system, procurement processes, procurement regulations, procurement market evolution, and whole-of-government reform processes. An evaluation of readiness must be undertaken for at least five elements: leadership, functionality, technical design and standards, private sector activation, infrastructure, and web services.
- Legal and regulatory reform. For example, under Egyptian procurement law, tender announcements had to be published in two widespread newspapers. It had to be amended to include the internet. Likewise, supplier bids were identified by supplier stamps and can now be identified by e-signature.
- User-centered research and design both of the procurement system and of the 'business logic' of how to plan, award, and implement contracts effectively in a digital environment.
- Mapping of the data, data standards, and decision-making across the procurement process, a publication policy of what data to share, with whom, and when, and the performance indicators to be tracked internally and externally.
- A reorganization of back-office functions to deliver an improved, digitized business process: ordering, payments, catalog maintenance, among other functions to ensure clarity of the procedure and responsibilities.
- The acquisition and configuration of the specific technological and the data support skills needed for e-GP implementation.
- User engagement, training, and outreach across the e-GP implementation process.

There are costs associated with each of the implementation phases. The *Planning* and *Design and Build* phases incur investment costs. These costs are modeled over a 29-month period; 11.1 for the former, 18 for the latter, running into Year 3 (see Table 7).

Often overlooked is the fact that e-procurement tools may also increase transaction costs by introducing new types of costs such as system design rigidity (i.e., not being able to accommodate certain atypical cases) and IT system maintenance, data storage, and vendor lock-in from specific technical solutions. This constitutes what is referred to as a one-off transition cost for users that can be substantial in many developing countries (Fazekas and Blum, 2021).

Also in Year 3 is the start of the *Pilot*, lasting 29.3 months, on average, and which is assumed to incur annual *operations and maintenance* costs. Ongoing maintenance includes data

security and management and training, including both relevant government personnel and firms. Annual operations and maintenance costs are also assigned to Years 6 through 12, with a 2% annual cost increase (Table 7).[3]

The value of the training component should not be underestimated nor underbudgeted. According to the Asian Development Bank (2013), the true value a government receives from e-GP is in the size of its online marketplace and the level of competition generated by its user base. Building the user base does not happen overnight. It requires a great deal of effort in the promotion, marketing, and delivery of an e-GP system and procurement reforms that encourage vendors to participate. Therefore, external training, outreach, and IT support to suppliers is also required (Asian Development Bank, 2013; Fazekas and Blum, 2021; World Bank, 2007a) and has been a key component in successful e-GP reforms (see, for example, Open Contracting Partnership, 2016). These costs form part of the operations and maintenance costs.

Maintaining the security of an e-GP system is also expensive and often demanding. In a custom e-GP platform, the government usually manages the infrastructure alone, in addition to training users and internal developers, which represents a major investment. Functionalities requiring specific attention where it relates to data security include e-tendering, e-reverse auctions, e-evaluation/awarding, contract management, e-purchasing, and e-registration (Wu Chebili et al., 2022).

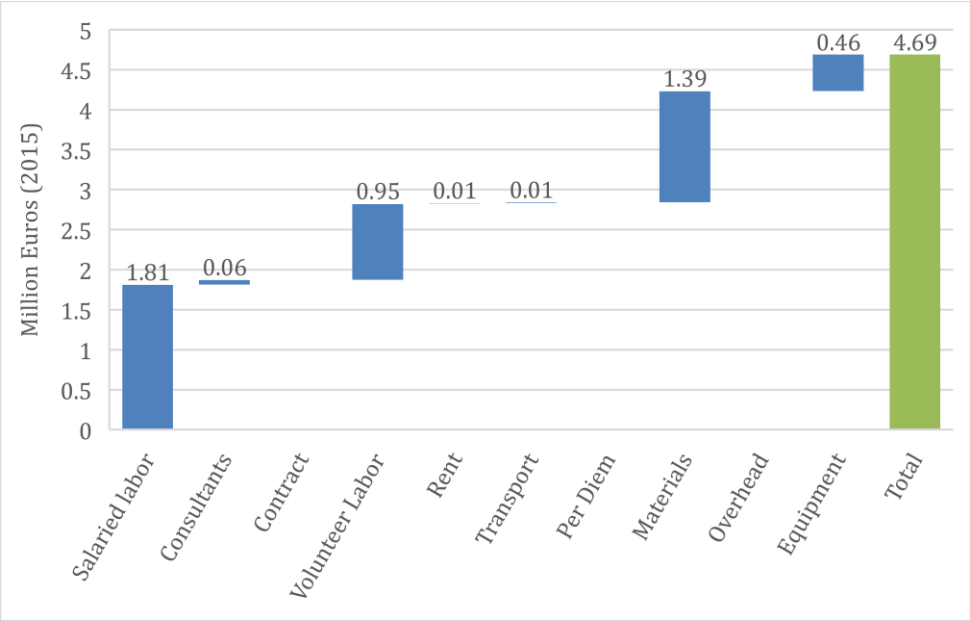
According to an evaluation report of Vietnam's e-GP system, a full-fledged off-the-shelf e-GP System developed using open source programming platform and database as well as with open standard architecture with required customization can be bought for between $1.2 - $1.5 million, depending on the scope of customization (Shakya, 2016). However, this estimate does not include the other costs referred to above, which include implementation costs; content aggregation, rationalization, and maintenance; catalog/search engine; transactions; end-user

[3] Published in various currencies, all cost estimates were converted to USD at the appropriate exchange rate. Based on World Bank Open Data, the five-year average (2017-2021) of the US consumer inflation rate was used as a proxy for future cost increases.

training; process re-engineering; associated licensing—for example, additional DBMS fees, integration-ware licensing, and marketplace participation (World Bank, 2007a). With these costs taken into consideration, the World Bank (2007a) estimates that Italy's e-GP system cost 10.4 M Euros in 2002, and it was 4 years before the system reached full operability.

Ukraine's Prozorro reforms provide a robust recent costing of an open-source reform effort including a full estimate of each category as it was subjected to a detailed review specifically to cost out the reforms using independent experts by the World Bank in 2017. The more costly activities of the implementation process appear to be related to human resources (60%), whereas the hardware costs were only 10% of total implementation costs (see Figure 1).

Figure 1 Breakdown of ProZorro Program Costs by Cost Input Category



Source: Results for Development (2017).

Wu Chebili et al. (2022) undertook a survey of software developers in order to develop costing scenarios for implementation of e-GP in African countries. For a full-service e-GP platform (including e-Procurement planning, e-Publication/Notification, e-Tendering, e-Evaluation/e-Awarding, e-Registration, Vendor Management, and Procurement Monitoring and Reporting), the highest cost scenario, as customized for the country, was $4.2 million. The medium cost scenario of a commercial off-the-shelf system was priced at $3.4 million. The lowest cost scenario is an off-the-shelf system called SaaS, a shared service, made available over the Web with no hosting or installation required and customization is limited to software capabilities. This option is

considered the most relevant for e-GP by software developers, and the total cost is $2.6 million. Five years is considered the average implementation period.

Table 7 e-GP Costing by Country Case

Country/Name of e-GP platform	Investment costs, USD millions	Operations and maintenance, USD million	Implementation period, total months	Source
UKRAINE/PROZORRO	2.2	1.6	22	Kovalchek et al. (2019)
Karnataka, INDIA/KTPP	4.6	0.87	60	Ojha and Pandey (2014)
Sao Paulo, BRAZIL/BINPS	1.4	0.45	n/a	World Bank (2007a)
SOUTH KOREA/KONEPS	37.5	3.5	48	Cho and Byeon (2004)
PHILIPPINES/PhilGEPS	2.6	1.5	90	Bombay (2011)
RWANDA/UMUCYO	8.4	0.80	48	World Bank (2020e)
ITALY/CONSIP	14.2	?	48	World Bank (2007a)
TUNISIA/TUNEPS	5.6	0.16	78	Wu Chebili et al. (2022)
UGANDA/e-GP	1.6	0.88	60	Wu Chebili et al. (2022)
BANGLADESH/DIMAPP P	13.9	1.1	n/a	World Bank (2007b)
MAURITIUS/e-PS	1.6	0.31	72	Wu Chebili et al. (2022)

Note: Costs are inflation-adjusted to 2020 depending on year of occurrence. "n/a" implies that the phases were not readily distinguishable.

Investment costs are, on average, $8.5 million and are incurred during the *Planning* and *Design and Build Phases,* Years 1 to 3 (see Table 8). The development and implementation of South Korea's KONEPS is one of the highest cost estimates found in the literature. KONEPS is fully integrated and deployed across all procurement agencies as well as procurement-related external agencies like the Ministry of Finance. Furthermore, it was an end-to-end system in which higher functionalities like encryption technology and digital certification were integrated from the start. Finally, KONEPS is internally operated and maintained by the Public Procurement Service, requiring the acquisition of hardware, software development, and human resources capacity development, rather than the outsourcing option chosen by other countries (Cho and Byeon, 2004; OECD, 2016).

Average annual maintenance costs are $1.1 million and are incurred throughout the *Pilot* and *Operations* phases, beginning in Year 3 through to Year 12. They are driven up by estimates from the Philippines and the government of Karnataka, India. Facing human resource capacity constraints, the former opted for a hybrid approach in which the Procurement Service outsourced the back-end system to a third party. It was a whole of government conversion, including national government agencies and state universities and colleges. Other maintenance costs include procurement staff and management training (Bombay, 2011). Likewise, in the latter, the government selected a state-wide, end-to-end system (including supplier registration, e-tendering, contract management, catalog management, e-auction, e-payments, among others), covering more than 70 departments, with the potential to scale horizontally, and chose to outsource all aspects of implementation, operations, and maintenance to a private sector partner for five years. Their maintenance costs also included a help-desk service for system users, two training facilities for procurement officers, which operated for 6 years, and a 'Expert Cell' which managed the PPP arrangement (Ojha and Pandey, 2014). It is worth recognizing that governments already have a cost with respect to maintaining whatever current system and regime exists, even if it is on paper, and it is not clear that the maintenance costs, as opposed to the conversion costs, of a more digitized system are more. Nonetheless, we have budgeted for additional costs.

Table 8 Schedule of Costs, USD Million

Year in model	Planning, Build + Design	Pilot	Operations
1	3.5		
2	3.5		
3	1.5	0.65	
4		1.1	
5		0.93	0.18
6			1.1
7			1.1
8			1.1

9			1.1
10			1.1
11			1.1
12			1.1
Total, unadjusted	9.03	2.7	7.9

The total unadjusted cost of e-GP, over 12 years, is $22.3 million, which includes anticipated annual cost increases of 2%. When discounted by 8%[4], the net present value of costs is $16.7 million.

Since implementation and maintenance costs depend largely on the choice of software and the degree of customization, as well as the business model chosen to manage the system, it is assumed that both low- and lower-income countries will face the same options and will make choices based on their local context and needs, which do not necessarily vary by size of the economy.

Cost-benefit analysis of e-GP

The central estimates for return on investment in typical low- and lower middle-income countries are 38 and 309, respectively (see Table 9).

Table 9 Cost-Benefit Ratios, USD Millions

	Benefits	Costs	Benefit-cost ratio
Low-income	$637.9	$16.7	38
Lower middle-income	$5,158.4	$16.7	309

Note: Monetary values are discounted at 8%.

Results are highly sensitive to parameters relating to effect size, the percentage of procurement that goes through the e-GP system, the length of the implementation phases, and the size of the country's economy. Tables 10–14 show the benefit-cost ratio of various scenarios.

Table 10 Sensitivity Analysis on Effect Size

[4] This paper forms part of a larger suite of papers within the SDG Halftime Project of the Copenhagen Consensus Center. The project has as its objective to evaluate the interventions with the highest socio-economic returns and which contribute directly to the realization of the Sustainable Development Goals. Papers have broad economic parameters in common, one of which is the discount rate of 8%.

			Low-income			Lower middle-income		
Effect size		NPV cost	NPV benefit	BCR	Δ	NPV benefit	BCR	Δ
Conservative	3.0%	$16,164,812	$283,504,920	18	-56%	$2,292,642,317	142	-56%
Moderate	6.8%	$16,164,812	$637,886,070	39		$5,158,445,212	319	
Optimistic	10.0%	$16,164,812	$945,016,400	58	48%	$7,642,141,055	473	48%

Of the 11 country cases, the savings in procurement prices documented ranged from 3 to 25%. The average is considered to be the moderate estimate, a 6.7% reduction in procurement prices, was found in half; the conservative estimate of 3% was the minimum estimate found in 2 cases, Ukraine and Chile. Finally, the optimistic estimate of 10% could be found in 10 studies.

Table 11 Sensitivity Analysis on Duration of Implementation Phases

			Low-income			Lower middle-income		
Time		NPV cost	NPV benefit	BCR	Δ	NPV benefit	BCR	Δ
Rapid	24 months	$18,060,257	$842,770,376	47	18%	$6,930,217,103	384	20%
Average	58 months	$16,164,812	$637,886,070	39		$5,158,445,212	319	
Slow	96 months	$14,241,261	$406,189,480	29	-28%	$3,213,280,949	226	-29%

For two countries, the phases were not distinguishable, leaving a sample of nine. The time from inception to launch (Planning, Design and Build and Pilot) spanned from 22 (Ukraine) to 90 (Philippines) months. Four of the countries completed the process in less than 58 months (South Korea, Italy, Rwanda, and Ukraine).

Table 12 Sensitivity Analysis on e-GP Penetration

			Low-income			Lower middle-income		
% procurement via e-GP		NPV cost	NPV benefit	BCR	Δ	NPV benefit	BCR	Δ
Conservative	25%	$16,164,812	$345,565,406	21	-46%	$2,807,477,629	174	-46%
Moderate	50%	$16,164,812	$637,886,070	39		$5,158,445,212	319	
Optimistic	75%	$16,164,812	$930,206,734	58	46%	$7,509,412,796	465	46%

Of the six countries for which we were able to obtain the percentage of public procurement that goes through the e-GP system, the average was 75%. However, examination of the Global Public Procurement Database revealed that the indicator was more likely to be around 50%, which is treated as the moderate estimate.

Table 13 Sensitivity Analysis on Size of Economy

Size of economy			Low-income	Lower middle-income

		NPV cost	NPV benefit	BCR	Δ	NPV benefit	BCR	Δ
small GDP, Low income	20% of average	$16,164,812	$127,577,214	8	-80%			
Low income	average	$16,164,812	$637,886,070	39				
small GDP, Lower-middle income	20% of average	$16,164,812				$1,031,689,042	64	-80%
Lower middle income	average	$16,164,812				$5,158,445,212	319	

The size of the economy, and hence the size of the procurement market, greatly limits the benefits of this intervention. The lowest quintile of low-income countries includes Somalia, Sierra Leone, Burundi, and Liberia. These countries can expect a benefit-cost ratio of 8 versus the average of 39. The lowest quintile of lower middle-income countries includes Cambodia, Senegal, El Salvador, and Honduras, and these countries can expect a benefit-cost ratio of 64 against the average of 319, all other things being equal.

Finally, there is also the scenario in which rollout of the e-GP platform fails after the pilot and a second investment is needed to re-launch it, which typically includes an upgrade of the system if several years have lapsed since the pilot. There are also observed cases in which an e-procurement system is replaced/upgraded before widespread adoption across procuring entities. The example of this is Moldova, which is about to launch its 3rd e-procurement platform in less than 10 years with gaps between implementation of 2 systems, while not yet achieving full-implementation.

Table 14 Sensitivity Analysis of Failed Rollout

			Low-income			Lower middle-income		
		NPV cost	NPV benefit	BCR	Δ	NPV benefit	BCR	Δ
Pilot stage fails		$22,754,278	$608,513,432	27	-32%	$4,508,570,722	198	-38%
Operational		$16,164,812	$637,886,070	39		$5,158,445,212	319	

Table 14 shows the benefit-cost ratios for the scenario in which there is a re-investment after month 59. The benefit-cost ratios of 27 and 198 represent the returns after a failed initial roll-out.

The costs and benefits of the private sector, namely bidding firms, have not been included in the analysis. These refer to technology and hardware acquisition and adjustment costs and the opportunity costs of sending personnel to training sessions, among other costs. Benefits include workflow efficiencies like reduced time and travel when interacting with government officials, lower marketing and business development costs, improved cash flow, and a greater number of government contracts.

Furthermore, there are other tangible benefits of e-GP that have been documented in the literature. These include the reduction in the amount and frequency of bribes paid per government contract, as well as the reduction in advertising costs. The reduction in expenditure in one segment of the economy represents a savings in another. Essentially social transfers, they would have limited effect on the cost-benefit analysis.

The Copenhagen Consensus Center has in the past undertaken cost-benefit analyses of digitization of functions that alter the nature and form of the private sector's interaction with public officials. The benefits far outweigh the firms' costs of adjusting to new regulations. E-filing coupled with tax nudges in Malawi had a benefit-cost ratio of 7; digitization of property and business fees functions in Ghana, 9; the automation of VAT collection in Bangladesh, 6; and digitizing the whole of government in Haiti, 5.

Finally, the excellent benefit-cost ratios are ultimately contingent on the successful implementation and compliance to the system. Sometimes, government IT projects do fail,; in such cases, the benefit-cost ratio would be less than 1.

These results give plentiful motivation for governments wishing to optimize public expenditure and reduce the likelihood of corruption at the same time. There are, however, a number of critical success factors to maximize the anticipated benefits of the intervention.

Critical success factors

An e-GP system is challenging to implement because it requires a change in the management culture and practices of public administration. Barriers to successful implementation include the resistance of managers and the culture of paper-based

documentation and the gap in absorption of ICT, digital technology, and data use within and across countries and the private sector, among others. Successful cases of e-GP implementation appear to have several factors in common.

(1) *A strong legal and regulatory framework*. Bosio et al. (2020) find that laws do predict practice. The correlation between transparency laws and practice is 0.67; that is, laws improve outcomes when public sector capacity is low, and regulation of procurement helps, particularly in poor countries. Supporting the development and ratification of such laws requires, in addition to the financial resources, a significant time commitment as well as negotiation skills.

(2) *Investment in staff and management training.* A dynamic change at the managerial level is a necessary and preliminary condition for success of e-GP operability (World Bank, 2007a). In Ghana, Osei-Tutu et al. (2011) attributed low compliance with procedures such as notifying successful bidders, publicizing contract awards, notifying unsuccessful bidders, using internal notice boards to display procurement information and the use of standard tender documents to inadequate capacity of procurement personnel.

(3) *Independent oversight/audit of government expenditures*. Knack et al. (2019) found that an independent complaints mechanism can deter procurement officials from requesting kickbacks as a condition for awarding contracts. Further, the increased likelihood of an external audit resulted in a decrease in informal payments of about 0.4 percentage points. Similar results were found by Zamboni and Litschig (2016), where a 20 percentage point increase in the probability of auditing local government health services in Brazil decreased resources involved in corruption by 10 percentage points, and by Olken (2007) in which increasing government audits of small-scale infrastructure grants to Indonesian villages decreased expenditure discrepancies by 8 percentage points. Randomized control trials of community monitoring of road building in Afghanistan found that new roads were of significantly higher quality and more durable in neighborhoods where the community had training and support to monitor the implementation of the project and where there were channels for the community to engage with the contractors and local government.

(4) *Development assistance channeled through national procurement systems*. A sizable portion of development programs are externally funded, and development partners often require specialized procedures, placing additional pressure on the existing government capacity (Wittig, 2002). Furthermore, OECD (2010) revealed that country systems are underused by donors: only 45% of aid to the 54 developing countries surveyed in 2008 used those countries' PFM systems. This had fallen to 37% in a 2016 review (OECD and UNDP, 2016). Knack et al. (2019) found that higher aid levels are associated with larger kickbacks.

(5) *Technology-ready and receptive private sector, accompanied by supportive infrastructure.* The countries planning to adopt e-government systems need to have appropriate energy and telecommunication infrastructure in place for population-wide access. The training of bidding firms on the particular e-GP system is complementary to a private sector for which electricity and communication are not constant challenges to production. Otherwise, governments will be met by low uptake. A test of the general receptiveness of firms and an indication of country readiness to e-GP would be the launch of e-filing and e-payment of taxes systems.

Introducing e-procurement in developing countries can significantly reduce the opportunities for rent-seeking and corruption and increase competition among bidders, which can facilitate the efficiency of resource allocation and promote economic growth and development. Nevertheless, the proposed intervention is not without political economy considerations. e-GP is essentially a political decision, and the refusal or delay in e-GP adoption is linked to vested interests in keeping manual, paper-based systems and their connections to political representatives. Furthermore, the longer the implementation period, the lower the political benefits (and hence incentive) for public officials.

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