Towards Digital Anti-Corruption Typology for Public Service Delivery

ABSTRACT

Digital anti-corruption refers to a family of digital technology tools that are used to fight corruption. Many such tools have not performed well in practice due to their non-alignment with forms of corruption they are supposed to fight against and persistence of corruption-enabling conditions. The aim of this paper is to contribute to filling this gap by offering a typology of digital anti-corruption in public service delivery that can be used to decide what digital measures should be applied to fight against specific forms of corruption or address specific corruption-enabling conditions. The typology also highlights that digital technology can both assist in corrupt practices e.g. theft of digital personal records, as well as aid the fight against corruption e.g. mobile channels to report incidents of corruption, automated audits of transaction records to uncover occurrence of fraudulent payments, or service automation to replace discretionary decision making by public officials with rule-based automated decision-making. The typology is grounded in research and policy literature, validated using real-life examples from East Africa, and instantiated to the public health sector. The paper concludes by presenting a range of scenarios for using the typology and offers some recommendations for public authorities.

CCS CONCEPTS

• Applied computing~E-government   • Social and professional topics~Governmental regulations

KEYWORDS

Corruption, Public Services, Anti-corruption, Digital anticorruption measures

1 Introduction

Delivery of public services in an effective and efficient manner, at the right quantity and quality, in the right place and time is the primary responsibility of any government [1]. However, this responsibility has not been fulfilled by many governments due to corruption.

Transparency International defines corruption as the abuse of public power for private gain [2]. Corruption can be classified as grand or petty, depending on the amounts of money lost [2]. Grand corruption is the abuse of high-level power that benefits the few at the expense of the many, and causes serious and widespread harm to individuals and society and pervades the highest levels of government [3]. Petty corruption is corruption at the implementation end of public administration, involving the payment of comparatively small amounts of money to facilitate official transactions [2]. This paper identifies classifications of corruption in public service delivery and corruption-enabling conditions.

Corruption in public service delivery manifests itself in form of, e.g. high rates of absenteeism among teachers and doctors; leakages of public funds intended for schools, health facilities, or social assistance benefits; shortages and stock-outs of pharmaceuticals and textbooks in many countries [4]. This has built pressure from different stakeholders to hold policy makers and service providers accountable through better governance and citizen participation. For example, African countries like Libya, Tunisia, and Egypt have faced a number of uprisings due to corruption in public service delivery [5].

Digital technology has been at the forefront of the fight against administrative corruption in general and corruption in public service delivery in particular, with many African countries such as Kenya, Tanzania, Ghana, Ethiopia, Malawi, Mali, Nigeria, Rwanda, Senegal and Uganda embarking on digital anti-corruption initiatives [6][7][8]. However, many digital tools have not been performing well in practice due to their non-alignment with forms of corruption they are supposed to fight [9] and persistence of corruption-enabling conditions [10].

The aim of this paper is to contribute to filling this gap by offering a typology of digital anti-corruption in public service delivery that can be used to decide what measures should be applied to fight against specific forms of corruption or address specific corruption-enabling conditions. The typology consists of various forms of petty corruption including, e.g. bribery, extortion, embezzlement and fraud. It also puts forward various economic, institutional or cultural conditions that enable corruption including, e.g. opaque decision-making, discretionary power, low public service wages, limited citizen voice or low personal ethics. Anticorruption measures are similarly divided into measures deployed against concrete manifestations of corruption or measures to remove or weaken corruption-enabling conditions. The former include, e.g. financial audits to detect fraud, embezzlement, theft or absenteeism; anti-corruption commissions to detect political corruption; asset recovery for theft, embezzlement or fraud; and others. The latter include, e.g. monitoring of financial transactions to address opaque decision making, civil service reform to address low public service wages, enforcing stringent code of conduct to address low personal ethics, and others. The typology also highlights that digital technology can both assist in corruption e.g. theft of digital personal records, and assist in the fight against corruption e.g. mobile channels to report incidents of corruption, automated audits of transaction records to uncover occurrence of fraudulent payments, or service automation to replace discretionary decision making by public officials with rule-based automated decision-making. The typology is grounded in research and policy literature, validated using real-life examples from East Africa, and instantiated to the public health sector.

The rest of the paper is structured as follows. Section 2 gives the background of the study. Section 3 describes the research methodology. Section 4 presents the findings on the types of corruption, conditions favoring corruption, measures against corruption and against conditions enabling corruption, and digital anti-corruption and scenarios for its use. Finally, Section 5 discusses the findings, Section 6 offers some recommendations, and Section 7 formulates some conclusions.

2 Background

A number of tools, strategies and methods have been used to fight corruption in public service delivery in different contexts, but there is a lot of evidence that corruption is still a big problem in many, especially developing countries [2]. For example, corruption in public service delivery in the three East African countries – Uganda, Kenya and Tanzania remains endemic regardless of the anti-corruption laws and institutions put in place [11]. Globally, the three countries rank among the most corrupt countries in the world. In 2015, Uganda and Kenya shared position 139 out 168 countries and Tanzania was ranked at the position 119 out of 175 countries [12].

Proponents of using Information and Communication Technology (ICTs) in enhancing service delivery like [13][14][15][8] consider ICTs to have a big potential in eliminating conditions that favor corruption like lack of accountability and transparency in service delivery. Consequently, a lot of efforts have been invested in developing ICT-based anti-corruption measures in different countries as a means of minimizing corruption in the delivery of public services by increasing access to information [16]. Although there has been considerable success, there has also been several failed attempts to use ICTs in monitoring delivery of public services [17][18][19]. Examples of failed attempts include the Computer-aided Administration of Registration Department (CARD), a registration system implemented in the state of Andhra Pradesh which goal was to increase transparency and efficiency in the land registration process and ultimately reduce corruption [20]; Pancha Tantra online in Karnataka, India meant to enable government monitoring electronically the work undertaken at the Panchayat level [15]; and "Not In My Country" (NIMC) project, a crowdsourcing platform used to record, report, and publicize corruption in Ugandan universities [21]. Other projects that have failed or remained experimental include: IPaidABribe, Bribespot, Corruption Tracker and Hatari, the latter provides means for citizens to anonymously submit reports of bribery and irregularities in public sector in Kenya [21].

Technology access and literacy face barriers of using the mainstream computer-based ICTs in monitoring the delivery of public services [22]. However, given substantial growth in the adoption of digital and mobile technologies, including in countries with low landline and Internet penetration [22], a number of researchers discern the potential of such technologies for monitoring the delivery of public services and

promoting good governance, transparency and accountability [23][24][25][26][27][28][29]. As a way of harnessing this potential, a number of countries have embarked on digital anti-corruption initiatives.

Digital anti-corruption refers to a family of digital tools that are used to fight corruption. An example is the Online Procedure Enhancement (OPEN) system for civil applications of Seoul Metropolitan Government [30], which was developed to promote transparency in city's administration by reducing unnecessary delays and preventing unjust handling of civil affairs. Another example from Seoul is Government e-Procurement System (GePS) [30], which is a portal for information on public procurement and an application service provider for e-procurement, aimed at digitalizing paper-based procurement procedures. In Uganda, commonly used digital tools and systems are mobile Tracking (mTrac), AKVO flow, Bespoke and Open Data Kit (ODK) [9][31][6]. Mobile Tracking (mTrac) works on the mobile phone already in the hands of Ugandan health professionals and the community members to collect data. Open Data Kit (ODK) is used by the Uganda National Health Consumers Organization (UNHCO) to collect and analyze data about the delivery of health services in the country. AKVO-flow is used by Village Health Teams to collect data of HIV patients to establish their satisfaction with given services. Using a smartphone and an online workspace, AKVO flow enables simple and reliable gathering of geographically referenced data that can be used straight away [31][6].

However, many such tools also have not performed well in practice due to their non-alignment with the forms of corruption they are supposed to fight against and persistence of corruption-enabling conditions [32]. This paper contributes to filling this gap by offering a typology of digital anti-corruption measures in public service delivery that can be used to decide what digital measures should be applied to fight against specific forms of corruption or address specific corruption-enabling conditions.

3 Methodology

A typology for digital anti-corruption includes classification of different types of corruption in public service delivery and their enabling conditions, measures used to fight corruption and weaken its enabling conditions, and digital technologies used to support such measures. To develop such a typology, the study adopted a scoping review methods [33], which aims at rapidly mapping the key concepts underpinning a research area and the main sources and types of evidence available [34].

According to the five stages of the scoping review methods, the adopted methodology entails:

1. **Identifying the research question.** The underlying research question for this study is: How can digital technology improve the anti-corruption performance for public service delivery?

2. **Identifying relevant studies.** The search for relevant studies was conducted in electronic research databases like Scopus, Academic Premier and ERIC, reference lists and policy and legal publications by relevant organizations. The searches applied combinations of the terms like "corruption", "anti-corruption", "measures", "public service", etc. mostly published within the last 10 years.

3. **Study Selection.** The references were imported into the Mendeley tool for easy referencing. Priority was given to the articles with abstracts referencing forms of corruption, conditions that enable corruption, anti-corruption measures, and digital technologies used to fight against corruption.

4. **Charting the Data.** To keep within the desired scope, the following attributes were used for identified studies: authors, publication year, study location, study type and methodology, problems addressed, technologies used, and the purpose of the intervention.

5. **Collating, summarizing and reporting the results.** The findings were organized according to: different forms of corruption, conditions that enable corruption, anti-corruption measures, and the use of digital technologies to support such measures. Across such themes, real-life examples were used from the Eastern Africa region, including the focus on the public health sector.

4 Findings: Corruption in Public Service Delivery

The main finding of this paper is the typology of digital anti-corruption measures for public service delivery. This section presents this typology in five stages: forms of corruption in public service delivery (Section 4.1), corruption-enabling conditions in society, economy and politics (Section 4.2), measures used directly against different forms of corruption (Section 4.3), measures used to weaken corruption-enabling conditions (Section 4.4), digital technologies supporting the direct and indirect anti-corruption measures (Section 4.5), and scenarios for the use of different anti-corruption measures (Section 4.6). Each sector introduces relevant forms, measures, technologies or scenarios, and illustrates them with three country cases of Uganda, Kenya and Tanzania, and with the case of the health sector.

4.1 Forms of Corruption

The analysis of the relevant literature revealed that corruption in the delivery of public services can be classified as grand or petty, depending on the amounts of money lost [12]. Grand corruption is the abuse of high-level power that benefits the few at the expense of the many, and causes serious and widespread harm to individuals and society [35]. Petty corruption, on the other hand, is corruption in public administration, at the implementation end of politics, and it involves the payment of comparatively small amounts of money to facilitate official transactions [36][37].

Corruption has also been classified according to the perpetrators' behavior. In this classification, corruption can entail bribery, extortion, intimidation, abuse of office, fraud, embezzlement, favoritism, insider trading, conflict of interest, illegal contributions, staff absenteeism and nepotism [38]. Nepotism implies sharing of the state resources, appointments and promotions with one's family members and relatives but not based on the merit [39]. Related to nepotism and favoritism is preferential treatment by an entrusted office holder on the basis of family or friendship relationship, or ethnic, party or religious affiliation [39]. Bribery is defined as the act of offering and receiving extra legal means to influence the performance of a constituted responsibility [38]. Extortion involves coercive means to extract financial benefits while discharging one's official duty [38]. As for the abuse of power, it refers to a situation whereby one's authority is unscrupulously applied to obtained preferential benefits [40]. Other identified types of corruption include, e.g. ghost worker syndrome, where the names of non-existing workers are added to the payroll to obtain undue salaries or subventions [39].

Uganda: In Uganda, most of the corruption cases are manifested in the form of bribery, absenteeism, extortion, diversion of public resources, influence peddling, conflict of interest, abuse of office, loss of public property, sectarianism, nepotism, embezzlement, causing financial loss, false assumption of authority, fraudulent disposal of trust property, false accounting, false claims, uttering of false certificates by public officers, and illicit enrichment [41]. For example, it is estimated that the Government of Uganda lost more than USD 300 million due to corruption between 2011 and 2013 [42]. The funds were lost through the creation of "ghost" projects and "ghost" public servants, diversion of foreign aid and local government funds to private bank accounts, bidding and selling government assets at lower costs, diverting logistics for public servants' welfare, and poorly monitored revenue sources and programs [43]. Corruption in the health service delivery in Uganda mainly manifests itself in form of: bribery and embezzlement where health service users pay bribes to public service providers to get services and health workers illegally overcharging patients [44]. The National Service Delivery Survey of 2008 showed that 15.5% of patients at public health facilities paid for drugs and that some public health workers sometimes steal the money that is supposed to buy drugs and other medical equipment [45]. Health workers also make over-claims and falsify documents, create ghost workers and ghost healthcare centers and divert patients to their private health facilities [44]. Health workers are also involved in drug-leakages, aid political influence in procurement, and absent from work [44].

Kenya: Kenya's economy is also pervaded by corruption at all levels of society. Paying bribes to the police and other public servants, extortion, nepotism and embezzlement remain routine for ordinary Kenyans [46]. According to Philip Kinisu, chairman of the Ethics and Anti-Corruption Commission (EACC), Kenya is losing a third of its state budget - the equivalent of about $6 billion - to corruption every year [47]. Like in Uganda and Tanzania, corruption in Kenya's health service delivery is also in

the form staff absenteeism, harassment, extortion, informal payments and unnecessary referral of patients to a private health provider [48].

Tanzania: Tanzania has also experienced corruption in the form of bribes, fraud especially in procurement, political consideration and extortion [49]. In 2014, it was ranked by Transparency International's East African Bribery Index as the second most corrupt country within the region [11] and 119th globally [12]. It is estimated that between 2001 and 2008, Tanzania lost USD 1 billion (TZ 1.6 trillion) to corruption [11]. In Tanzania, petty corruption is mostly in the form of bribes where clients pay bribes in almost all departments of the hospital; the outpatient, laboratory, X-ray, the labor ward and the mortuary [50]. Other forms of corruption include; absenteeism, theft of medical supplies, informal payments, nepotism, and diversion of supplies in the distribution system for private gains and embezzlement of health care funds [51]. The grand corruption involves the payment of big sums of money by rich individuals and institutions to some corrupt government officials in order to win tenders for the supply of pharmaceuticals, medical equipment and supplies [50].

Healthcare sector: Although corruption affects all public service sectors, the health sector is particularly vulnerable due to uncertainty about the demand for services, the asymmetric information among the different actors, high degree of discretion given to providers in choosing services for patients, insulation from competition or external accountability and high decentralization of service provision [52]. Thus, for this study public health service delivery was used to instantiate the described typology. The health sector corruption mainly appears in form of: bribery of health professionals, regulators and public officials; unethical research; kickbacks and political considerations as is the case in construction and rehabilitation of health facilities and purchase of equipment and supplies [53][52]. Other forms of corruption common in the health sector include: theft during distribution and use of drugs and supplies, use of public facilities and equipment to see private patients, unnecessary referrals to private practice, absenteeism of medical staff, informal payments by patients, theft of user fee revenue, and diversion of budget allocations [52].

Based on the overview above, forms of corruption in public service delivery are summarized in Table 1.

Table 1: Forms of corruption in public service delivery

Category	Form	References
Grand	Bribery	[54][12][38][39][46]
	Extortion	
	Embezzlement	
	Fraud	
	Political consideration	[37][43][49]
	Kickbacks	
	Collusion	[52]
Bureaucratic/Petty	Theft	[54][38][39][45][42][43][46]
	Extortion	
	Embezzlement	
	Intimidation	
	Fraud	
	Absenteeism	
	Informal payments	[11]
	Nepotism	[38][40][45]
	Favoritism	
	Insider trading	
	Conflict of interest	
Systemic	Can take on any form of corruption like Bribery, Extortion, Embezzlement	[36][45]

4.2 Corruption-Enabling Conditions

Reviewed literature shows that conditions that enable and facilitate corruption in public service delivery include: opaque decision-making, discretionary power, low public service wages, limited citizen voice, monopoly power, personal greed and information barriers and asymmetry [55][52][37].

Uganda: In Uganda, corruption is mainly facilitated by low economic development, a large wealth-divide, lack of transparency and accountability in all governmental and social service delivery institutions [43]. Other factors facilitating corruption include public beliefs and attitudes, lack of political leadership, moral decay in public service, limited capacity of anti-corruption agencies and the judicial system, and delays in the legislative framework [43].

Kenya: In Kenya, corruption is mainly facilitated by bad governance, political patronage, lack of political will, and breakdown of societal values and norms [56]. Other enablers of corruption include: non-enforcement of the law, tribalism, favoritism, nepotism and cronyism, weak or absence of management systems, and misuse of discretionary power [57]. In addition, weak civil society and apathy, lack of professional integrity, lack of transparency and accountability, inefficient public sector and personal greed also facilitate corruption in Kenya [56].

Tanzania: For Tanzania, the absence of transparency, wide discretion of government officials, absence of committed watchdog institutions, desire for unfair advantage, and erosion of integrity in public service due to abuse of power by individuals create conducive environment for corruption [58]. Other conditions are lack of political, red tape and ineffective regulatory frameworks, absence of rule of law, poverty and inequity, lack of exemplary ethical leadership, limited citizens' participation in decision making and unfair and undemocratic electoral system [58].

Healthcare sector: In the health sector, corruption is mainly attributed to too much discretion, monopoly power, lack of transparency, lack of accountability, limited citizens' voice, and weak enforcement [52]. [59] also identified weak rules and regulations and over-regulation as other factors enabling corruption in public health service delivery.

Based on the overview above, Table 2 summarizes conditions that enable corruption in public services.

Table 2: Conditions that favor corruption in public service delivery

Conditions	References
Lack of transparency and accountability	[52][43][60][56]
Low public service wages	[55][57]
Discretionary power	
Institutional factors	[37][56][58]
Limited citizen voice	
Organizational factors	[61][56][58]
Cultural conditions	
Personal ethics	
Personal greed	
Monopoly power	[62]
Low economic development	
Information asymmetry	[63]

4.3 Measures Against Corruption

The direct measures against corruption aim at exact manifestations of corruption. This category includes financial audits to detect fraud, embezzlement, theft or absenteeism; anti-corruption commissions to

detect political corruption; or asset recovery for theft, embezzlement or fraud [64]. Other measures are strengthening internal control systems, asset recovery, and monitoring and enforcement [10].

Uganda: In Uganda, the direct measures against corruption include: the development of the National Anti-Corruption Strategy (NACS) in 2008, the Anti-Corruption Act, the Public Procurement and Disposal of public Assets Act 2003 and a specialized anti-corruption court [65]. Ugandan Government has also put in place a number of institutions such as the Inspectorate of Government, Directorate of Ethics and Integrity, The Auditor General, Directorate of Public Prosecution, The Public Accounts Committee of Parliament, and Anti-Corruption Court for prosecution of corrupt officials. However, the effectiveness of these institutions remains severely limited [45].

Kenya: Similarly, in Kenya, a number of direct measures have been put in place to fight corruption. These include: enacting of the Anti-Corruption and Economic Crime Act 2003, the Public Officer Ethics Act 2003 and the Public Procurement and Disposal of Assets Act 2005 and the Kenya Anti-Corruption Commission (KACC) for prevention and combating corruption [65]. However, regardless of these measures, corruption in Kenya is sliding out of control [57].

Tanzania: Tanzania has also put up similar direct anti-corruption measures. It has strengthened oversight agencies for example the National Audit Office, Prevention and Combating of Corruption Bureau, and the Commission for Human Rights and Good Governance [49]. Furthermore, Tanzania has a comprehensive legal framework to fight corruption that includes the Prevention and Combating of Corruption Act which criminalizes attempted corruption, extortion, passive and active bribery, money laundering and bribery of a foreign official [66]. However, with all these direct measures in place, corruption in three East African countries still remains a challenge.

Healthcare sector: The general direct measures against corruption in the delivery of public services are also being used against corruption in the delivery of public health services [67]. Other direct anti-corruption measures specifically for health service delivery include: institutional checks and balances such as division of functions between cashiers and accountants to help control collusion [59] and establishing formal channels for complaint reporting [4].

Table 3 summarizes anti-corruption measures with the forms of corruption they are meant to address.

Table 3: Direct anti-corruption measures and corresponding forms of corruption

Anticorruption Measures	Forms of corruption	References	Comments
Anti-corruption commissions	Bribery	[45][65][64] [10][49][57] [66][4]	Mandated to combat and prevent any form of corruption.
	Embezzlement		
	Political corruption		
	Collusion		
Prosecution of corrupt officials	Bribery		Works for both grand and petty corruption.
	Embezzlement		
	Theft		
	political		
Code of conduct for public officials	Bureaucratic corruption		It is mainly for bureaucratic forms of corruption.
Assets Recovery	Theft		Meant to recover lost property or funds.
	Embezzlement		
	Fraud		
	Embezzlement		
	Fraud		
Monitoring	Most forms of corruption	[65]	Meant for all forms of corrupt behavior.

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4.4 Measures Addressing Corruption-Enabling Conditions

Indirect measures against corruption in public service delivery aim at weakening conditions that favor corruption [64] such as those examined in Section 4.2. The indirect measures include: monitoring of transactions to address opaque decision making, civil service reform to address low public service wages, enforcing stringent code of conduct or addressing ethics issues, behavior and transaction monitoring, staff rotation, breaking the culture of secrecy, cutting the red tape, and sensitization of the public [10].

Uganda: In Uganda, indirect anti-corruption measures used include: regular National Integrity Surveys, public awareness programs, preparation and submission of corruption reports to the parliament, monitoring government projects and enforcing accountability [68]. The government of Uganda has also carried out a number of public service reforms to address graft in the public sector for example decentralization of the civil servant payroll to eliminate "ghost workers" [68].

Kenya: In Kenya, indirect anti-corruption measures used include: review of systems; advisory services; promotion of standards and best practices; establishing and maintaining strategic partnerships and coalitions; public education and awareness creation through anti-corruption outreach programs; and monitoring and supervision of government projects [69][11].

Tanzania: For Tanzania, used anti-corruption measures include: regular amendment of legislation to match the changing environment, minimization of discretionary powers, introduction of computerized integrated financial management system in all public service institutions, improved monitoring, public awareness and participation, distribution of Warioba Report (a report by the Presidential Commission against Corruption) to all libraries, privatization, introduction of pay reforms and pension schemes, paying a living wage and offering retirement benefit terms to public officials [70].

Healthcare sector: In addition to general indirect measures against corruption in public service delivery, indirect measures used in public health service delivery include: use of public expenditure tracking survey (PETS), health boards, attendance registers and sector expenditure tracking surveys [59]. In Uganda, the following measures have been instituted: establishment of National Drug Authority; Drug and Medicines Delivery Monitoring Unit under State House, Health Unit Management Committees (HUMCs), creation of Village Barazas and support for civil society organizations [44]. Table 4 shows the different conditions favoring corruption and the corresponding indirect measures to address them.

Table 4: Indirect Anti-Corruption Measures

Anti-Corruption Measures	Conditions Favoring Corruption	References	Comment
Monitoring	Lack of transparency	[71]	Reduces both grand and petty corruption
	Lack of accountability		
Introducing civil service reforms	Low public service wages	[55][68]	Used against Petty corruption
	Red tape	[55]	
Sensitization of the public	Limited citizen voice	[10][69]	Changes attitudes and values of society
	Cultural conditions	[11]	
	Information barriers and asymmetry	[10][70]	
Enforcing stringent code of conduct	Personal ethics		Applied to both grand and petty corruption
Increasing access to information	Lack of transparency and accountability	[55][70] [44][59]	Applied to both grand and petty corruption
	Cultural conditions		
	Limited citizen voice		
	Information barriers and asymmetry		
Engaging service beneficiaries	Lack of transparency and accountability	[52]	Suitable for petty corruption
	Cultural conditions	[61]	
	Limited citizen voice	[37]	
	Information barriers and asymmetry	[63]	

Personal ethics	[10]	
Limited citizen voice		
Discretionary power		
Monopoly power		

4.5 Typology of Digital Anti-Corruption

Digitalization greatly improves the effectiveness and efficiency of anti-corruption measures in the delivery of public services [13][14]. Analysis of relevant research revealed different ways in which digital technologies are being used to support anti-corruption measures. The digital anti-corruption typology therefore, refers to the different classifications of digital technologies according to how they are used to support anti-corruption measures. The different categories of technologies are meant to cater for different types of corruption, which are facilitated by different conditions illustrated in the previous sections on the country and sectoral levels. Each of the categories aims at the exact forms of corruption, at conditions that favor corruption or at both. Common categories in the reviewed literature comprise: digital anti-corruption technologies used for gathering information, for data aggregation and visualization, for mobilizing the public to demand accountability and for automation and auditing to address fraud [7]. These categories are covered in subsequent sections 4.5.1 to 4.5.4.

4.5.1 Digital Anti-Corruption for Gathering Information

Within this type, digital technology is used to gather data for enhancing transparency in public service delivery [7][8]. Information about service delivery performance issues such as stock outs, worker absenteeism and bribery can be collected using these technologies. The commonly used technologies include SMS free 'Please Call Me' messages and Interactive Voice Response services or ordinary telephone hotlines [7][72]. One such example is Kenya's integrated public complaints referral mechanism, a joint effort between five government agencies and one NGO to develop a more efficient process for handling citizen complaints regarding among others corruption [73]. Other examples include "Not In My Country" project, a crowdsourcing platform used to record, report, and publicize corruption in Ugandan universities [21], and IPaidABribe, Corruption Tracker and Hatari in Kenya which provide means for citizens to anonymously submit reports of bribery and irregularities in the public sector [21].

4.5.2 Digital Anti-Corruption for Data Aggregation and Visualization

This family of technologies is used to summarize, analyze and present information to the users. For example, the open source Ushahidi platform in Kenya enables registered users to process reports and upload them on a digital map for visualization online [7]. The platform gets its data through crowds. Crowds submit data via SMS, a smartphone app, email, twitter or online [7]. Other technologies include online data mapping tools or dashboards and digital analytics technologies such as the DHIS 2.0 software that enable processing of large amounts of data for easy visualization [7]. In Uganda, the Ministry of Health uses DHIS 2.0 for data aggregation and presentation at the district level.

4.5.3 Digital Anti-Corruption for Mobilization

The highlighted types may support anti-corruption measures through increased transparency and accountability in public service delivery institutions only when citizens use them [43][60]. The technologies are heavily dependent on citizen participation and if not used, there is no content and value to fight corruption [73]. Hence another category of digital technologies for mobilization was identified from literature. This category is used for mobilizing citizens to take up new technologies, change their attitudes about corruption and generate political pressure for change. Use of blogging, SMS and social media in anti-corruption campaigns are typical examples. Other technologies used for mobilization of masses against corruption are videos and interactive websites, and citizen-government dialogue with SMS [7]. For example, in Tanzania, the Chanjo project used blogging, SMS and social media to mobilize citizens against corruption. The use of internet and social media enabled the project to reach almost 11,000 people in three months [74].

4.5.4 Digital Anti-Corruption for Automation

In this category, digital technologies are mainly used to automate discretionary activities with potential for abuse among public officials [74][7][72]. Automation helps eliminate the discretion of public officials, cuts out intermediaries, and reduces red tape and bureaucracy in public service delivery. This reduces opportunities for corruption and favoritism by public officials [73]. Examples include the use of

GPS and biometrics to detect staff absenteeism, disbursing salaries with mobile banking, checking for counterfeit medicines via SMS, USSD and using algorithms to detect fraudulent data [7][72]. For example, Kenyan Government introduced the use of digital cash registers to address the problem of staff stealing user fee revenue in government hospitals [7][72].

Following this overview, Table 5 shows different digital anti-corruption technologies and the corresponding corruption-enabling conditions that can be reduced or eliminated with these technologies.

Table 5: Types of Digital Anti-Corruption Measures

Digital measure	Corruption-enabling conditions	Description
Transparency portals	Lack of transparency and accountability	Platforms that offer timely publication of key government documents online
SMS	Limited citizen voice	Citizen-government dialogue through SMS
Crowd sourced reporting	Information barriers and asymmetry	Platforms that allow large numbers of citizens to report corruption or grievances
Service automation	Discretionary power	Automation replaces discretionary decision
Online services	Monopoly power	Allowing citizens to serve themselves, reducing interaction with public officials
Social media and blogging	Information barriers and asymmetry	Mobilizing the community to report incidents of corruption
Open data portal	Information barriers and asymmetry	Providing free access to public data
Internet services	Information barriers and asymmetry	Timely publication of information
GPS and biometrics	Poor supervision of services	Fighting public servant absenteeism
Automated audits of transactions	Lack of transparency and accountability	Removing intermediaries
Use of algorithms to detect fraud	Lack of transparency and accountability	Used to create auditable log of transactions for easy detection of fraudulent activities

4.6 Scenarios for Using Digital Anti-Corruption

According to the reviewed literature, effective digital anti-corruption should focus on reducing discretion power of individual public officials and support citizens to monitor these officials' work [73]. Their effectiveness also varies with different corruption scenarios they are deployed to contain. Based on these principles, a range of corruption scenarios for using the typology of digital anti-corruption in fighting corruption was developed. These scenarios are not exhaustive, but are simply meant to address some of the common forms of corruption in public service delivery. Table 6 summarizes these scenarios.

Table 6: Scenarios for using digital anti-corruption

Corruption scenario	Digital technology to contain this scenario
Civil servants are appointed and promoted on the basis of their connections with the responsible public authority.	Automation and digitalization of public services reduce human discretion.
Public service beneficiaries use rewards to pervert the judgment of public service providers.	Digitalization of public services to reduce direct contact points between citizens and officials. Automation of services to remove human discretion.
Civil servant, while on duty, obtains money or other property from public service beneficiaries through coercion.	Automation and digitalization of public services Use of crowdsourcing platforms to mobilize citizens against corruption Use of whistleblowing platforms.

Public payroll is inflated with names of nonexistent workers.	Use GPS and biometrics to manage work attendance. Use of whistleblowing and transparency platforms.
Civil servant comes late or are habitually absent from work.	Use GPS and biometrics to manage work attendance. Use of blogging, SMS and social media.
Civil servant misappropriates public funds put under their trust.	Automation of payment systems. Whistleblowing platforms. Transparency platforms and blockchain technology.
Civil servant intentionally alters or misrepresents information in order to manipulate or deceive government.	Use of blockchain technology, Use of algorithms to detect fraudulent activities.
Civil servant over-invoices government contract and take the difference between the actual and inflated price.	Automation of public services. Use of blockchain technology.
Management gives tips to government functionaries like ministers and members of parliament to approve their inflated budgets.	Use of blockchain technology. Transparency platforms.
Civil servant demands kickback from suppliers to secure contract or provide inside information on bidding processes.	Digitalization and automation of public services. Whistleblowing platforms. Dashboards and digital analytics technologies.
Civil servants bid and sell government assets at lower prices.	Automation of public services. Use of blockchain technology. Transparency platforms.

5 Discussion

The aims of this study was to establish forms of corruption and conditions that enable corruption in public service delivery, to determine direct and indirect anti-corruption measures, to align corruption types with anti-corruption measures, and to review opportunities for digital technology to support such measures, all illustrated with examples from East Africa and from the healthcare sector.

The results show that bribery, extortion, embezzlement, fraud, political consideration, and absenteeism are common forms of corruption in public service delivery. This is supported by the findings from Uganda, Kenya and Tanzania, where the same forms of corruption were identified [45][46][49]. It was also noted that in addition to the common forms of corruption, the healthcare sector experiences forms of corruption that are sector-specific like the use of public facilities and equipment to see private patients and unnecessary referrals to private practice [52].

Literature review also revealed that corruption practices in public service delivery is mainly facilitated by opaque decision-making, discretionary power, low public service wages, limited citizen voice, monopoly power, personal greed and information barriers and asymmetry. Again, this result was also supported by the findings from Uganda, Kenya and Tanzania and the healthcare sector in particular where similar conditions were found to facilitate corruption in public service delivery [57][52].

As far as anti-corruption measures are concerned, the findings indicate that most of the identified measures are general in nature, while others are country- or sector-specific as seen from the cases of Uganda, Kenya and Tanzania. The cases also show that digital technology supports most of these anti-corruption measures in public service in general and in public healthcare in particular.

While digital technologies can support anti-corruption measures through reporting of corruption cases, service automation and digitalization of public services, the results from East Africa, especially in the healthcare sector mainly demonstrate information collection, processing and dissemination. Hence these technologies enable reporting of corruption incidents in public healthcare. The findings concur with [15], who found out that digital technology can accelerate information dissemination, improve efficiency of public services and increase transparency and accountability of government administration to reduce corruption. On the other hand, as already noted, those technologies can support anti-corruption measures in ways not seen in Uganda, Kenya or Tanzania. The results also show that the technologies used do not

target specific sources of corruption, thus supporting the notion that most digital anti-corruption tools are not aligned with forms of corruption or corruption-enabling conditions they are supposed to fight against. Hence the proposed typology of digital anti-corruption in public service delivery could help align digital measures to specific forms of corruption and specific corruption-enabling conditions that characterize a given cultural, social, economic or institutional context.

6 Recommendations

Based on the findings and discussion above, we put forward the following recommendations for public authorities responsible for planning, maintaining and monitoring digital anticorruption measures.

Acquire custom-made solutions for different forms of corruption: It was noted that many digital tools have not been performing well in practice due to their non-alignment with the forms of corruption and corruption-enabling conditions they are supposed to address. Governments can overcome this challenge and improve their anticorruption performance by acquiring digital anti-corruption tools for monitoring the delivery of public services or tailored tools to address specific forms of corruption.

Protection of users: Some digital anti-corruption tools like whistleblowing platforms or crowdsourcing tools constitute a huge risk for their users, if not protected. Relevant authorities must introduce strong security mechanism and laws to protect the users of such platforms.

User training in digital anti-corruption tools: A number of digital anti-corruption tools have not realized their potential due to limited usage. One of the usage barriers is capacity gap, so relevant authorities should endeavor to train potential users while protecting their identity.

Government support: Digital anti-corruption tools can be only effective if supported by responsible authorities. For example, government should always act on the complaints raised by citizens considering continued availability of the platforms.

Government should promote and publicize the use of digital anti-corruption: Some digital anti-corruption tools have had limited impact because their availability is not known. Relevant authorities should sensitize members of the public about availability and security of such tools.

7 Conclusion

Corruption in public service delivery has persisted in many, especially developing countries, and various measures are being used to directly fight different forms of corruption or indirectly weaken conditions that enable corruption. Digital technology is being used to support both direct and indirect anti-corruption measures against administrative corruption in general and public service corruption in particular. However, many digital tools have not been performing well in practice due to their non-alignment with the forms of corruption or with corruption-enabling conditions they are supposed to fight against.

This paper contributed to addressing this gap by offering a typology of digital anti-corruption in public service delivery that can be used to decide which measures should be applied to fight against specific forms of corruption or address specific corruption-enabling conditions. The typology is based on the review of relevant research and policy literature, on the cases of three East African countries – Uganda, Kenya and Tanzania, and on the case of the healthcare services in general and in the region. With this typology in place, guidance is provided on deploying digital anti-corruption tools or combinations of such tools to match specific corruption threats and conditions that enable and trigger such threats.

The main limitation of this work is lack validation of the typology through in-depth cases of digital anti-corruption tools, their usage scenarios, and the resulting performance. Secondly, the typology should be better grounded in theoretical literature concerning administrative corruption and how it is addressed through technological and non-technological means in different cultural, social and institutional contexts. Third, the negative impact of digital technology in terms of aiding existing corrupt practices, creating new practices or strengthening corruption-enabling conditions was not considered in this research. The

benefits and risks of the digital technology use against corruption must be properly balanced. Fourth, while significant amount of literature was reviewed to develop the typology, the search should proceed further in terms of the rigor and extent of this review. Fifth, the typology should be made more formal, including relationships between different tables in section 4.

The limitations above point at directions of our future work. Considering this paper as the first step in developing a typology for digital anticorruption, we plan to further develop this typology into a useful tool for public authorities responsible for increasing performance of digital anticorruption efforts.

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