Digital Anti-Corruption Typology for Public Service Delivery

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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, falsification and destruction of digital personal records and aid the fight against corruption e.g. mobile channels to report incidents of corruption, automated audits of transaction records to uncover 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 and validated using real-life examples from East Africa.

General Terms
Corruption, Typology, Mobile technology

Keywords
Corruption, Public Services, Anti-corruption, Digital anticorruption measures, Anti-Corruption Typology.

1. INTRODUCTION
The delivery of public services in an effective and efficient manner, at the right quantity and quality, at 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]. In addition to grand and petty classifications [4] identified two more classifications which cover corruption typologies based on developed and developing nations. This paper extends literature by identifying classifications of corruption in public service delivery and the corresponding corruption-enabling conditions in delivery of public health services.

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, Ghana, Malawi, Nigeria, Senegal and Uganda embarking on digital anti-corruption initiatives [5][6][7]. 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 [8] and persistence of corruption-enabling conditions [9].

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 corruption-enabling conditions. 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 theoretical framework. Section 5 describes case studies for corruption in public service delivery. Section 6 presents the digital anti-corruption typology. Section 7 discusses the findings and section 8 offers 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 [10]. 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 [11].

Proponents of using Information and Communication Technology (ICTs) in enhancing service delivery consider ICTs to have a big potential in eliminating conditions that favor corruption [6], [12]–[14] . Consequently, a lot of efforts have been invested in developing ICT-based anti-corruption measures in different countries as a means of minimizing corruption by increasing access to information [15]. Although there has been considerable success, there have also been several failed attempts to use ICTs in monitoring delivery of public services [16]–[18]. Examples of failed attempts include the Computer-aided Administration of Registration Department (CARD), a registration system in the state of Andhra Pradesh [19]; Pancha Tantra online in Karnataka, India [14]; and "Not In My Country" (NIMC) project, in Ugandan universities [20].

Technology access is one of the main barriers of using the mainstream computer-based ICTs in monitoring the delivery of public services [21]. However, given substantial growth in use of digital and mobile technologies [21], a number of researchers discern the potential of such technologies for monitoring the delivery of public services and promoting good governance, transparency and accountability [22] [23][24][25][26][27][22]–[28]. As a way of harnessing this potential, a number of countries have embarked on digital anti-corruption initiatives. Such initiatives are part of the larger digital government effort in transforming public administration and its relationships with citizens through digital technology to empower citizens to create public value by themselves, and to achieve sustainable development outcomes in the process[29].

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] and Seoul e-Procurement System (GePS)[30].In Uganda, commonly used digital tools and systems are mobile Tracking (mTrac), AKVO flow, Bespoke and Open Data Kit (ODK)[31]. 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], [33].

As a way of improving performance of such tools in fighting corruption,[6] provided a typology of technology-based corruption management which promotes government of the people. This paper contributes to [6] work 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. This paper is an extension of the earlier presented conference paper in which a digital anti-corruption typology was proposed by [31].

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, which aims at rapidly mapping the key concepts underpinning a research area and the main sources and types of evidence available [34]. The review mainly focused on corruption and anti-corruption measures in the delivery of public services of the three East African countries – Uganda, Kenya and Tanzania.

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

1. **Identifying the research question:** The research question is: What is the typology for digital anti-corruption that can be used to improve the anti-corruption performance in public service delivery?

2. **Identifying relevant studies:** The search for relevant studies was conducted in electronic research databases like Scopus, Academic Premier and ERIC, policy and legal publications by relevant organizations, and reference lists. The search 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 anti-corruption technologies used to fight corruption. The literature search resulted in 895 abstracts. Out of these, only 557 relevant full-text papers were accessed due to limitations of time and cost. Again, 99 were excluded for not being directly related to any of the search criteria; forms of corruption, conditions that enable corruption, anti-corruption measures and digital anti-corruption technologies. Finally, 458 papers were included. Of these 458 papers, 199 were papers that described forms of corruption, 26 described conditions that enable corruption and 58 for general anti-corruption measures, 8 methodology papers while 167 were digital anti-corruption technologies papers.

4. **Charting the Data:** To keep within the desired scope, the following attributes were used for identified studies: authors, publication years, study locations, study types and methodologies, problems addressed, technologies used, and the purpose of the interventions.

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 health sector in the Eastern Africa region.

Although corruption affects all public service sectors, the health sector is particularly vulnerable mainly due to uncertainty about service demands and information asymmetry among actors [35]. Thus, the public health service sector was judged as a fitting case study for examining the use of digital anti-corruption measures against rampant corruption in the delivery of public health services in East Africa.

4. THEORETICAL FRAMEWORK

This section provides a framework for classifying mobile

technologies used against corruption in delivery of public services. The framework outlines different corruption theories that explain different corruption enabling conditions and how anti-corruption mechanisms can address these conditions. These theories include: Principal-agent theory and collective action theory [36][37].

Principal-Agent Theory

The principal-agent theory highlights the role of individuals' calculations about whether or not to engage in or oppose corruption; the influence of transparency, monitoring, and sanctions on those calculations; and the technical challenges of monitoring and sanctioning corrupt behavior. This conceptualization considers citizens as the principal and government officials, political leaders, and bureaucrats alike as agents acting on their behalf [36][38]. The agents have political discretion and monopoly over the distribution of resources, hence a big potential for corruption [36][38]. Thus, strategies to fight corruption should focus on decreasing power discretion of individual government officials and on giving both their superiors and citizens means to monitor their work [36][38].

Collective action theory

This theory highlights the relevance to individuals' decisions of group dynamics, including trust in others and the behavior of others. That is, when a group of individuals perceive corruption as normal and believes everyone else is involved, they may be less willing to abstain from it or to take the first step in fighting it [38]. Strategies to fight this type of corruption aim to increase community engagement -public awareness raising and working with civil society to build trust in society through the potential benefits of mobile technologies [38].

These two theories informed the development a typology of digital anti-corruption typology in public service delivery.

5. CORRUPTION IN PUBLIC SERVICE DELIVERY

In this section, a set of categories to develop a typology of digital anti-corruption is presented in form of: forms of corruption in public service delivery in Uganda, Kenya and Tanzania (Section 5.1); corruption-enabling conditions in society, economy and politics (Section 5.2); measures against different forms of corruption (Section 5.3); and measures addressing corruption- enabling conditions (Section 5.4). Each section introduces relevant forms, measures or technologies of corruption, and illustrates them with case examples from any of the East African country.

5.1 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 [11]. 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 [39]. Petty corruption, on the other hand, is corruption in public administration, at the politics' implementation end, and involves the payment of comparatively small amounts of money to facilitate official transactions [40]. Whether grand or petty, corruption can also be classified as political, administrative or systemic [41]. Political corruption involves lawmakers [40]. Administrative corruption includes the use of bribery and favoritism to allow individual businesses to lower their taxes, escape regulations, or win low-level procurement

contracts. Systemic corruption is where bribery is routine in dealings between the public and individuals. This type of corruption affects service delivery through all levels of society [40].

Corruption has also been classified according to the perpetrators' behavior. In this classification, corruption can entail nepotism, favoritism, bribery, extortion, intimidation, abuse of office, fraud, embezzlement, insider trading, conflict of interest, illegal contributions or staff absenteeism [4]. Nepotism implies sharing of the state resources, appointments and promotions with one's family members and relatives, not based on the merits [42]. Related to nepotism is favoritism, preferential treatment by an entrusted office holder on the basis of family or friendship relationship, or ethnic, party or religious affiliation [40]. Bribery is the act of offering and receiving extra legal means to influence the performance of a constituted responsibility [4]. Extortion involves coercive means to extract financial benefits while discharging one's official duty [40]. Abuse of power refers to a situation where one's authority is unscrupulously applied to obtained preferential benefits [43]. Yet another form of corruption, among others, is the ghost worker, where the names of non-existing workers are added to the payroll to obtain undue salaries or subventions [42].

Cases of grand corruption include the estimated loss of more than USD 300 million by Government of Uganda due to corruption between 2011 and 2013 [44]. 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 [45]. Petty corruption is mostly in the form of bribes which clients pay to public officers. In Uganda, for example, patients at public health facilities pay for drugs and other free services [46]. Based on the above, Table 1 summarizes forms of corruption in public service delivery.

Table 1: Forms of corruption in public service delivery

Category	Form	References
Grand	Bribery	[40]
	Extortion	[11]
	Embezzlement	[4] [42]
	Fraud	[47]
	Political consideration	[41][45] [48]
	Kickbacks	
	Collusion	[49]
Bureaucratic/Petty	Theft	[40]
	Extortion	[4]
	Embezzlement	[42]
	Intimidation	[50]
	Fraud	[44]
	Absenteeism	[45] [47]
	Informal payments	[10]

	Nepotism	[4]
	Favoritism	[43]
	Insider trading	[50]
	Conflict of interest	
Systemic	Can take on any form of corruption like Bribery, Extortion, Embezzlement	[40] [50]

5.2 Corruption-Enabling Conditions

Studies have established a mixture of situations, attitudes and processes that create an enabling environment or facilitate corruption in public service delivery [9]. These conditions include:

Poor institutional design, in terms of political structure, legal structure, rule of law and culture amplify discretionary power of public officials thereby increasing opportunities for corrupt behavior [41].

Organizational factors like lack of moral criteria in promotions are other enablers [51]. Bad economic conditions that create a fertile ground for corruption [52].

Low levels of development which reduces education and literacy and limits the ability of citizens to serve as watchdogs over public officials' activities [53].

Low public service wages [54]. Cultural environments that condone corruption. Some cultures defend and sometimes admire corrupt practices [51]. Personal ethics and greed that lead to an unfettered desire for money or power [55].

Information barriers and asymmetry between monopoly services and service recipients-citizens [56]. Lack of transparency and accountability also create opportunities for public officials to abuse their office for private gain [55]. Based on the above, Table 2 summarizes conditions that enable corruption in public service delivery.

Table 2: Conditions that favor corruption in public service delivery

Conditions	References
Lack of transparency and accountability	[45][57][40]
Low public service wages	[58][59]
Discretionary power	
Institutional factors	[41][57][60]
Limited citizen voice	
Organizational factors	[57] [60]
Cultural conditions	
Personal ethics	
Personal greed	
Monopoly power	[52]
Low economic development	
Information asymmetry	[56]

5.3 Anti-Corruption Measures

Viewing corruption through a principal-agent lens, corruption is 'solvable' with policies that alter the degree to which principals are able to monitor and sanction their agents and the level of discretion given to agents and their individual incentive calculations [61]. Consequently, anti-corruption measures should focus on reducing the discretion of civil servants, increasing monitoring mechanisms, promoting transparency in government, supporting anti-corruption civil society groups to serve as watchdogs, and strengthening sanctions on those who engage in corruption, so as to better align the incentives of potential 'agents' with those of their respective 'principals [36][60]. These measures can be grouped into two categories, namely direct measures that aim at specific manifestations of corruption and indirect measures that aim at removing or weakening conditions that favor corruption [62].

Direct Measures Against Corruption

The direct measures aim at fighting 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 [61]. Other measures are strengthening internal control systems, asset recovery, and monitoring and enforcement [9].

Examples of direct measures against corruption in Uganda include the development of the National Anti-Corruption Strategy (NACS) in 2008, Anti-Corruption Act, Public Procurement and Disposal of public Assets Act 2003, and the anti-corruption court [63]. 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, the Medicines Monitoring Unit in the Presidents' office, and Anti-Corruption Court for prosecution of corrupt officials. However, the effectiveness of these institutions remains severely limited [46]. 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	[50][63][64][48][65][66]	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		
Monitoring	Most forms of corruption	[63]	Meant for all forms of corrupt behavior.

5.4 Measures Addressing Corruption-Enabling Conditions

Indirect measures against corruption in public service delivery aim at weakening conditions that favor corruption such as those examined in Section 5.2 [67]. The indirect measures include: monitoring of transactions to uncover opaque decision making, civil service reform to address low public service wages, stringent code of conduct or addressing low ethics issues, behavior and transaction monitoring, staff rotation, breaking the culture of secrecy, cutting the red tape, and sensitization of the public [68]. In Uganda, for example, 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 [63]. 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" [63]. Table 4 shows the different conditions favoring corruption and the corresponding indirect measures to address the

Table 4: Indirect Anti-Corruption Measures

Anti-Corruption Measures	Conditions Favoring Corruption	References	Comment
Monitoring	Lack of transparency and accountability	[63]	Reduces both grand and petty corruption
Introducing civil service reforms	Low public service wages	[54] [69]	Used against petty corruption
	Red tape	[63]	
Sensitization of the public	Cultural conditions	[68] [70] [10]	Changes attitudes and values of society
	Information barriers and asymmetry		
Stringent code of conduct	Personal ethics	[10]	Applied to both grand and petty corruption
Increasing access to information	Lack of transparency and accountability	[63] [71][72]	Applied to both grand and petty corruption
	Cultural conditions		
	Limited citizen voice		

	Information barriers and asymmetry		
Engaging service beneficiaries	Lack of transparency and accountability	[73]	Suitable for petty corruption
	Cultural conditions	[74]	
	Limited citizen voice	[55]	
	Information barriers and asymmetry	[56]	
	Personal ethics	[74]	
	Limited citizen voice		
	Discretionary power		
	Monopoly power		

6. TYPOLOGY OF DIGITAL ANTI-CORRUPTION

According to principal-agent and collective action theories presented earlier, technology is more likely to have a positive impact against corruption, if the necessary conditions within which corruption occurs are known and targeted by specific types of digital technologies. Hence, the need to align the different digital technologies capabilities with the different forms of corruption, conditions facilitating corruption and existing anti-corruption measures. The digital anti-corruption typology therefore, refers to different classifications of digital technologies according to how they are used directly or indirectly to fight corruption. The different types 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 [75].

These categories are covered in subsequent sections 6.1 to 6.4.

6.1 Digital Anti-Corruption for Gathering Information

Within this category, digital technology is used to gather data for enhancing upward transparency in public service delivery [6][75]. Information about service delivery performance such as stock outs, worker absenteeism, bribery, etc. can be collected. The commonly used technologies include SMS free 'Please Call Me' messages, Interactive Voice Response services, or ordinary telephone hotlines [6][75]. 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 [71], [76]. Other examples include "Not In My Country" project, a crowdsourcing platform used to record, report, and publicize corruption in Ugandan Universities [20], 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].

6.2 Digital Anti-Corruption for Data Aggregation and Visualization

This family of technologies is used to summarize, analyze and present information to the public for downward transparency. For example, analytics dashboards for summarizing and displaying data on government practices and crowdsourced data and interactive digital mapping of independent reports are under this classification [77]. The open source Ushahidi platform in Kenya which enables registered users to process reports and upload them to a digital map for online visualization is a typical example of an analytics dashboard used to summarize crowd sourced reports[77][75]. The platform gets its data through crowds. Crowds submit data via SMS, smartphone apps, email, twitter or online [75]. Other technologies include online data mapping tools or dashboards and digital analytics technologies such as the DHIS 2.0 software that enables processing of large amounts of data for easy visualization [75]. In Uganda, Ministry of Health uses DHIS 2.0 for data aggregation and presentation at the district level.

6.3 Digital Anti-Corruption for Mobilization

The highlighted technologies can be effective in fighting corruption in public service delivery institutions measures through increased transparency and accountability, provided citizens use them [67][45]. The technologies are heavily dependent on citizen participation and if not used, there is no content and value to fight corruption [56]. Hence, another category of digital anti-corruption technology identified from the literature is technologies for mobilization. This category is used for mobilizing citizens to take up new technologies, changing their attitudes about corruption, and generating political pressure for change. Use of blogging, SMS and social media in anti-corruption campaigns are typical examples. Other technologies used for mobilization against corruption are videos and interactive websites, and citizen-government dialogue with SMS [75]. For example, in Tanzania, the Chanjo project used blogging, SMS and social media to mobilize citizens against corruption. The use of the Internet and social media enabled the project to reach 11,000 users in three months [75], [77].

6.4 Digital Anti-Corruption for Automation

In this category, digital technologies are mainly used to automate discretionary activities with potential for abuse among public officials [75], [77]. Automation helps eliminate the discretion of public officials, cuts out intermediaries, and reduces red tape and bureaucracy in public service delivery. In turn, this reduces opportunities for corruption and favoritism by public officials [56]. Examples include the use of GPS and biometrics to detect staff absenteeism, disbursing salaries with mobile banking, checking for counterfeit medicines via SMS, and using algorithms to detect fraudulent data [31]. For example, Kenyan Government introduced the use of digital cash registers to address the problem of staff stealing user fee revenue in government hospitals [31]. Blockchain is being explored as a digital anti-corruption tool. The technology stores copies of data in different servers in a decentralized, peer-to-peer network in different locations around the world [77]. This design supports a verifiable record which cannot be changed without changing subsequent blocks, hence reducing chances for fraud to pass undetected [77]. However, developing countries like the three East African countries still have a long way to go in implementing the blockchain technology because of the lack of infrastructure[78].

In relation to the identified conditions that favor corruption in table 2, mobile technology can mainly be used to reduce too much discretion, monopoly power, lack of transparency, lack of accountability, limited citizens' voice, and enforcement. The rest of the enabling conditions like low wages, personal greed, financial problems at home, and social pressures social norms, moral beliefs, attitudes and personality may not be reduced. Therefore, effective utilization of the proposed typology also depends on other social, economic, political, infrastructural and legal anti-corruption considerations.

It should also be noted that the main logic behind use of mobile technology to reduce/eliminate corruption is to improve supply and demand sides of information exchanges and limiting the scope of public official's discretion. However, this logic may not apply for some forms of grand corruption where politicians may even legislate for corruption. Thus, while we recognize that the use of technology to fight corruption is important, it should be noted that technology alone will never be sufficient to eliminate corruption. Table 5 below summarizes the different conditions that facilitate corruption and relevant digital measures to reduce/eliminate such conditions.

Table 5: Types of Digital Anti-Corruption Measures

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

7. DISCUSSION

The main research question of this study was "what is the typology for digital anti-corruption that can be used to improve the anti-corruption performance in public service delivery?" To answer this research question, the study used scoping review methods [79] to identify and classify mobile technologies used against corruption in public service delivery. The identified categories were: digital anti-corruption technologies used for gathering information, data aggregation and visualization, mobilizing the public to demand accountability and for automation and auditing to address fraud [75]. These categories show the different ways in which digital technologies are used to fight corruption in delivery of public services. Basing on their functionalities as proposed by [80], the technologies were classified into a typology. The typology highlights that digital technology can both assist in corrupt practices e.g. theft, falsification and destruction of digital personal records much as it aid the fight against corruption. e.g. mobile channels to report incidents of corruption, automated audits of transaction records to uncover fraudulent payments, or service automation to replace discretionary decision making by public officials with rule-based automated decision-making. The typology is in agreement with principal-agent theory which states the strategies to fight corruption should focus on decreasing power discretion of individual government officials [36], [38] and the collective action theory which states that strategies to fight corruption should aim at increasing community engagement [38].

This typology 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 has implications for e-government implementation, in particular for the research area of digital anti-corruption. First, 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. Secondary, some digital anti-corruption tools like crowdsourcing tools or whistleblowing platforms constitute a huge risk for their users, if not protected. Thus, relevant authorities must introduce strong security mechanism and laws to protect the users of such platforms. Thirdly, 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. Lastly, some digital anti-corruption tools have had limited impact because their availability is not known. Therefore, relevant authorities should sensitize members of the public about availability and security of such tools.

8. CONCLUSIONS

In this study, we examined the digital technology tools being used to support direct and indirect anti-corruption measures against administrative corruption in general and public service corruption in particular. After reviewing literature using scoping review methods, it was discovered that many of these digital anti-corruption 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. 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.

Although four categories of digital anti-corruption were identified as main tools used in monitoring delivery of public services, this study used only literature review as a method of data collection. It is therefore possible that there could be other forms of undocumented corruption or conditions that are not met with by these measures. Therefore, future researchers should consider extending this typology using other research methods and use it to check whether there are forms of corruption or conditions that are not met by the identified measures.

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