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Fighting Administrative Corruption With Digital Government in Sub-Saharan Africa

Yelkal Mulualem Walle[1], Tomasz Janowski[2, 3] and Elsa Estevez[4, 5]
[1]Department of Information Technology, Faculty of Informatics, University of Gondar, Ethiopia
[2]Department of Applied Informatics in Management, Gdańsk University of Technology, Poland
[3]Department for E-Governance and Administration, Danube University Krems, Austria
[4]Institute for Computer Science and Engineering (UNS–CONICET), Bahía Blanca, Argentina
[5]Department of Computer Science and Engineering, Universidad Nacional del Sur, Bahía Blanca, Argentina
yelkal.mulualem@uog.edu.et
tomasz.janowski@pg.edu.pl
ece@cs.uns.edu.ar

Abstract: Administrative corruption is a pervasive problem and a major threat to economic and social development around the world, especially in Sub-Saharan Africa which lags behind other regions in various development indicators and is seen as one of the most corrupt regions globally. This paper examines a hypothesis that digital government – the use of digital technology to transform public administration organizations and their relationships with citizens, businesses and each other – helps reduce administrative corruption in Sub-Saharan Africa. To this end, the paper relates the United Nation's e-Government Development Index (EDI) and the Transparency International's Corruption Perception Index (CPI) for 45 countries in the region in the period from 2012 to 2016, performing linear regression with EDI as an independent and CPI as a dependent variable. The estimated results show that the effects of digital government adoption on corruption reduction are statistically significant, with 37% of corruption reduction due to digital government development. The paper further explores the nature of this relationship using the case of Ethiopia, whose performance according to the EDI and CPI indexes improved slightly over the 2012-2016 period. As part of this case, the paper examines common applications such as e-procurement or e-tax that cut horizontally across ministries. Our findings suggest that the adoption of digital government has the potential for reducing administrative corruption in Sub-Saharan Africa but realizing such potential require strengthening of law enforcement and anti-corruption institutions, and political will.

Keywords: digital government, administrative corruption, Sub-Saharan Africa

1. Introduction

A major concern in the development of Sub-Saharan Africa is the damaging effect of administrative corruption on economic development of the region (d'Agostino, Dunne & Pieroni, 2016). The effect includes draining off limited economic resources, creating frustration and distrust among citizens and staff, and causing various organizational inefficiencies (Mistry & Jalal, 2012). The problem is widespread among countries in the region (WorldBank, 2011). In response, governments in Sub-Saharan Africa have been under pressure to increase transparency in their administrative and decision-making processes, and to increase the efficiency of their services to citizens and businesses. In particular, they have been applying digital technology to transform public administration units and their relationships with citizens, businesses and each other (OECD, 2003).

Underpinning such response is an assumption that digital government could help reduce administrative corruption. Adopted by many international organizations (OECD, 2005; UNDP, 2008; UNDP, 2006) and researchers (Kim, Kim, and Lee, 2009) and (Chawla and Bhatnagar, 2004), this assumption is based upon intrinsic features of digital government, such as reducing unessential human intervention in government processes (OECD, 2005; Choi, 2014), enabling more effective and responsive delivery of public services (UNDESA, 2016), increasing citizen participation in decision making, and making public institutions more transparent and accountable (Bertot, Jaeger & Grimes, 2010). The latter relies upon greater access to information about representatives, institutions, decisions, laws and projects.

However, digital government could also create new opportunities for corruption (Heeks, 1998). For instance, corrupt public officials could learn how to manipulate digital government and exploit its systems to continue or even scale up the rate of corruption (Bhatnagar, 2003). In countries suffering from systemic corruption,

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digitization could create new opportunities for bribery and rent-seeking (Sassi & Ali, 2017). Also, the negative impact of digital government on corruption could be migrated to other parts of the economy (Kim C.-K., 2013).

Current research on the effect of digital government on administrative corruption is mostly theoretical and descriptive. Empirical evidence of macro-level effect of digital government on corruption are scarce, particularly in Sub-Saharan African where most digital government initiatives only started in 2011. This paper attempts to fill this gap by empirically investigating how digital government could help reduce administrative corruption in the region. To this end, it describes a quantitative analysis of the impact of digital government on administrative corruption by relating the United Nations's e-Government Development Index (EDI) and the Transparency International's Corruption Perception Index (CPI) for 45 Sub-Saharan countries in the period from 2012 to 2016. We test this relationship by developing an empirical model that examines how changes in the level of digital government can explain changes in the levels of administrative corruption, with EDI serving as an independent and CPI as a dependent variable. We also explore qualitatively the nature of this relationship by developing the case of Ethiopia with sources of evidence on how digital government contributed to reducing corruption including e-procurement and e-tax applications.

The rest of this paper is structured as follows. Section 2 provides theoretical background. Section 3 puts forward research questions. Section 4 explains the data and methodology used. Sections 5 presents and discusses the results. The final Section 6 outlines contributions, limitations and future work.

2. Background

Corruption, the abuse of entrusted power for private gain, is a complex, multifaceted phenomena with multiple causes and effects. According to Transparency International (2016), "corruption is one of the greatest challenges of the contemporary world. It undermines good government, distorts public policy, leads to the misallocation of resources, harms the private sector, and particularly hurts the poor". Corruption is likely to reduce economic growth by depressing investment; distorting public spending and the allocation of resources; weakening public institutions, contract enforceability and property rights; increasing income inequality and poverty; allocating talented people to rent-seeking activities rather than to productive ones; and raising economic inefficiencies and unpredictability in politics and policy alike (Ali, 2017).

In public service delivery, administrative corruption is a problem of asymmetric information where one party has more or better information than the other. When a government official is unable to provide public services to citizens by herself, she can delegate the delivery of such services to another entity (Klitgaard, 1988). In such circumstances, bribery, extortion, fraud, nepotism, embezzlement, and other acts of corruption can be reduced by enhancing the accountability of the agent to the principal (Lio, Liu, & Ou, 2011; UNDP, 2008).

Digital government can be an effective tool in reducing corruption by: expanding access to information; simplifying rules and making them more transparent; providing detailed data on transactions to facilitate the tracking of actions and decisions made by agents; enhancing the questionability of unreasonable actions; reducing discretionary power by standardization; and promoting accountability (Bhatnagar, 2003). The mechanism through which digital government could reduce corruption is replacing face-to-face interactions between citizens and government officials by interactions between citizens and machines programmed to impartially perform actions on behalf of government.

According to Bhatnagar (2003) and Reffat (2006), the power of digital government to reduce corruption includes reducing opportunities for bribes, reducing brokers' powers, raising public awareness and increasing public sector transparency and accountability. Mon-Chi Lio (2011) also link corruption reduction through digital government to Internet adoption, particularly to development in telecommunication infrastructures and the quality of online public services. Internet can also create greater corruption awareness and act as a corruption deterrent (Goel, Nelson & Naretta, 2012).

Several countries adopted digital government initiatives that were reportedly successful in reducing corruption. For example in Pakistan, the Tax Department applied a new digital system with the purpose of reducing contact between tax payers and tax collectors (Bhatnagar, 2003). In the Philippines, the Department of Budget and Management established e-procurement system to allow public bidding and increase transaction transparency (ADB, 2011). In South Korea, the anti-corruption system deployed by the Seoul Metropolitan Government

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enables citizens to check online the status of their civil affairs at each step of the administration procedure, increasing transparency and reducing corruption in government (Kim et al., 2009).

However, digital technology and digital government can be used not only to fight but also to aid corruption. Sassia and Ali (2017) reveal that Information and Communication Technology (ICT) diffusion may create new opportunities for bribery, particularly in countries with weak law enforcement. According to them, the rule of law is the strongest determinant of the level of corruption in Africa and "African economies can benefit from the anti-corruption effect of ICT adoption only once a threshold of rule of law is reached". According to a study in Middle Eastern and North African countries (Saha, 2017), dynamic relationships between economic and political freedoms and government size may lead to corruption reduction. Combating corruption is improved directly through aggregate economic performance and indirectly through reduction in the negative impacts of administrative burden (d'Agostino, Dunne & Pieroni, 2016).

Few scholars investigated the empirical evidence of possible effect of digital government on corruption. Using a dataset of 149 countries with observations in 1996 and 2006, Andersen (2009) found that digital government exerts a considerable impact on corruption. He used the Control of Corruption Index ''the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture by elites and private interests" (Kaufmann et al., 2007, p. 4) and the e-government index compiled by Brown University in 2006 to investigate whether changes in e-government had a positive impact on reducing corruption (West, 2006). The study concluded that the increase of e-government index from 10% to 90% could be linked with decrease in the corruption index from 10% to 23%.

Lio et al. (2011) utilized a dataset of 70 countries covering the period from 1998 to 2005 to estimate the effect of Internet adoption on reducing corruption, based on the Gross Domestic Product, education, and internet users. The results showed that that the effect of Internet adoption on corruption reduction is statistically significant but not substantial, and the causality between internet adoption and corruption is bi-directional.

Mistry (2012) examined the relationship between digital government and corruption in developed and developing countries during the period from 2003 to 2010. The study used the Transparency International's CPI to measure corruption, the United Nation's EDI to measure e-government and the World Bank's World Development Indicators to measure economic development. The study found out that the impact of e-government on corruption reduction is higher in developing countries than in developed countries.

Concerning the situation in Africa, the African Union promotes access to ICT and its positive impact on the continent (African Union, 2016). However, modest progress is being made in fighting corruption. According to Transparency International, four out of five African countries are below the world average (AUC, 2015) although at least 70% of the Member States are implementing the African Union Convention on Preventing and Combatting Corruption (AUC, 2014). In addition, the performance of e-government websites in delivering public services in Sub-Saharan Africa is unsatisfactory, which leads to the region being lowest ranked in e-government development (Verkijika and Wet, 2015).

The question whether countries in Sub-Saharan Africa can at all advance in e-government development, despite internal barriers (legal, financial, organizational, cultural, etc.) to such development that exist in those countries, is indirectly answered by the case of Ethiopia. For instance, the Ethiopian government applies digital government to ease administrative procedures on business processes through data sharing and creating conducive environment for any new services to be implemented through opening government data. More information on this case is provided in Section 5.

3. Research questions

The literature review presented in Section 2 uncovered three quantitative studies of the relationship between digital government and administrative corruption. In particular, motivated by the finding that the impact of digital government on corruption reduction is higher in developing than in developed countries Mistry (2012), this study examines the promise of digital government on reducing administrative corruption in one of the most corrupt regions globally – Sub-Saharan Africa. This regional focus sets this study apart from other quantitative studies. The second distinguishing feature is that the current study complements quantitative analysis with

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qualitative analysis to determine the exact nature of this relationship, i.e. how different forms of digital government act to reduce different forms of administrative corruption, based on the case of Ethiopia.

Based on the rationale above, the study in this paper is guided by two research questions: 1) what was the impact of digital government on reducing administrative corruption in Sub-Saharan African in the period from 2012 to 2016? 2) How did different forms of digital government prove to be effective in reducing administrative corruption in Ethiopia over the same period?

4. Data and methodology

To answer the first question, we examined the effect of digital government on reducing administrative corruption for 45 Sub-Saharan countries between 2012 and 2016, using the CPI published by Transparency International and the EDI published by the United Nations. CPI measures how corrupt the public sector of a country is perceived to be (TI, 2012–2016). The values vary from 0 representing the highest level of corruption to 100 representing the lowest level. The CPI is produced based on expert assessments and opinion surveys, with countries ranked annually. EDI measures and ranks the readiness and capacity of national governments to use ICT to deliver public services. Its values range from 0 (low) to 1 (high). The index is a composite measure of: 1) the provision of online public services, 2) telecommunication infrastructure and 3) human capital. The index is produced biannually by UNDESA (UNDESA, 2012-2016).

This research analyses whether changes in the values of EDI can explain changes in the values of CPI for all 45 Sub-Saharan countries between 2012 and 2016. The variables and formulas that formally express this problem are as follows. For a given country *i*, let $CPI_{i,2012}$ and $CPI_{i,2016}$ represent the values of CPI for this country taken in 2012 and 2016 respectively, let $EDI_{i,2012}$ and $EDI_{i,2016}$ represent the values of EDI for this country taken in 2012 and 2016, and let ΔCPI_i and ΔEDI_i represent differences between values of the corresponding indices taken in 2016 and 2012, i.e. $\Delta CPI_i = CPI_{i,2016} - CPI_{i,2012}$ and $\Delta EDI_i = EDI_{i,2016} - EDI_{i,2012}$. Furthermore, let CPI_{2012} and CPI_{2016} represent the vectors of 45 values $CPI_{i,2012}$ and $CPI_{i,2016}$ for every i=1,…,45; let EDI_{2012} and EDI_{2016} represent vectors of values $EDI_{i,2012}$ and $EDI_{i,2016}$ for every i=1,…,45; let the vector ΔEDI contain differences between the values of the vectors EDI_{2016} and EDI_{2012}; and let ΔCPI define the Ordinary Linear Square (OLS) regression model to calculate the values of ΔCPI (dependent variable) on the basis of the values of ΔEDI (independent variable) - $\Delta CPI=\alpha+\beta*\Delta EDI$. The explanations of the variables and the corresponding formulates are provided in Table 1.

Table 1: Variable symbols, calculations and descriptions

VARIABLE	CALCULATION	DESCRIPTION
$EDI_{i,2012}$		value of the EDI index for country i, taken in 2012
$EDI_{i,2016}$		value of the EDI index for country i, taken in 2016
$CPI_{i,2012}$		value of the CPI index for country i, taken in 2012
$CPI_{i,2016}$		value of the CPI index for country i, taken in 2016
ΔEDI_i	$EDI_{i,2016} - EDI_{i,2012}$	difference between 2016 and 2012 values for EDI for country i
ΔCPI_i	$CPI_{i,2016} - CPI_{i,2012}$	difference between 2016 and 2012 values for CPI for country i
ΔEDI	$(\Delta EDI_1, \Delta EDI_2, \ldots \Delta EDI_{45})$	vector of ΔEDI_i *values* for all i=1,…,45
ΔCPI	$(\alpha+\beta*\Delta EDI_1, \ldots \alpha+\beta*\Delta EDI_{45})$	vector of $\alpha+\beta*\Delta EDI_i$ values for all i=1,…,45

To answer the second research question, we analysed how Ethiopian digital government initiatives contribute to improving transparency and accountability, and thereafter, to reducing corruption. The case study is based upon two systems identified by Ethiopian Government as key to addressing the main sources of administrative corruption (Desalegn, 2012): e-procurement and e-tax. The case study relies on secondary data such as project and policy reports and web pages to identify and map e-government measures and their anti-corruption effects. It also relies upon the survey of 50 civil servants at federal- or regional-level government organizations, to assess the number of features related to information systems and transactional services. Respondents were selected using purposive stratified random sampling technique considering gender and organization level.

5. Results and discussion

Concerning the first research question, Table 2 presents the summary statistics for the EDI-CPI correlation model. Table 3 present the correlation matrix of the variables. As shown in table, the correlation coefficient between the EDI and CPI variables was 0.557889877 in 2012, increasing to 0.61458852 in 2016.

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Table 2: Summary statistics for the EDI-CPI correlation model for 45 Sub-Saharan countries

VARIABLES	MEAN	STD.DEV	VARIANCE	MIN	MAX
EDI_{2012}	0.2627533	0.1101295	0.0121285	0	0.5066
EDI_{2016}	0.2629556	0.1256003	0.01577542	0.02699	0.62306
CPI_{2012}	32.377778	12.619049	159.240404	0	65
CPI_{2016}	31.444444	12.454564	155.116162	10	60
ΔEDI	0.0002022	0.0550512	0.00303064	-0.11414	0.1226
ΔCPI	-0.933333	4.3243497	18.7	-9	11

Table 3: Correlation matrix for the EDI-CPI correlation model for 45 Sub-Saharan countries

	CPI_{2016}	EDI_{2016}	EDI_{2012}	CPI_{2012}	ΔCPI	ΔEDI
CPI_{2016}	1					
EDI_{2016}	0.61458852	1				
EDI_{2012}	0.54856119	0.899102332	1			
CPI_{2012}	0.94059436	0.593905366	0.557889877	1		
ΔCPI	0.13531683	0.036979176	-0.048088037	-0.209131252	1	
ΔEGOV	0.30480214	0.482870409	0.050825883	0.238951238	0.180568	1

The basic regression model is a linear regression of digital government development measured through EDI as an independent variable and perception of corruption measured through CPI as a dependent variable. The observations using EDI and CPI indices comprise 45 Sub-Saharan countries. If a country does not have the CPI value provided for both years, then it was excluded from the analysis.

Table 4 provides the OLS results for the formula presented in Table 1. In particular, it shows the results of the Unstandardized Coefficient and the Standardized Coefficient, both associated with OLS regressions with robust standard errors. The regressions include a constant and standard errors, reported in parenthesis. The Unstandardized Coefficient, which is based on the full sample, shows that the change in EDI is a significant predictor of the change in CPI once the initial level of corruption is accounted for. Generally, the Standardized Coefficient of e-government has the positive sign and is significant at conventional levels. This indicates that there is a positive relationship between EDI and CPI among the analysed Sub-Saharan countries. According to Table 4, if a country's EDI score increases by one unit, its transparency score increases by 14.18 units.

Table 4: Ordinary Least Squares for the EDI-CPI correlation model for 45 Sub-Saharan countries

	Dependent variable ΔCPI	
	Unstandardized Coefficient(B)	Standardized Coefficient(Beta)
CONSTANT	-0.936201631	-
ΔEGDI	14.18 (11.78)	0.1803
OBSERVATIONS	49	49
R-SQUARE	0.032604898	--

Figure 1 depicts 45 country points plotted on the two-dimensional graph with EDI plotted vertically and CPI plotted vertically. The left graph depicts correlations taken in 2012 and the right correlations taken in 2016. Even though the correlation when comparing the values of CPI and EDI in 2012 is high – the R-squared value is 0.3112, the value increases to 0.377 when comparing CPI and EDI in 2016.

Concerning the second research question, according to the 2014 EDI, Ethiopia has been the best performing least developed countries in online service delivery. The country also registered significant improvements in EDI over the period 2003-2016 as a result of recognising digital government as a key factor in promoting national prosperity and sustainable development. In particular, it jumped from the position 122 (2014) to the position 91 (2016) in the E-Participation Index but remained at the 157th position in the 2016 edition of EDI.

Over the past years, the Ethiopian ICT sector experienced exponential growth with 62.6 million mobile subscribers (EthioTelecom, 2018) representing 65% of the population. Also broadband access has been steadily increasing, reaching 16 million Internet data user in 2018 (EthioTelecom, 2018; ITU, 2017). In the government

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domain, the national e-government strategy is used to automate and transform processes, aimed at creating networked, integrated and SMART (Simple, Moral, Accountable, Responsive and Transparent) government (MCIT, 2011). The government's digitization efforts also include five open datasets related to education, health, government spending, social welfare, labour and environment; 219 electronic public services developed since 2011, along with common cross-cutting applications such as e-procurement or e-tax; and a customer-centric strategy to conveniently deliver services and information to citizens. According to (MCIT, 2011), by improving service delivery and data sharing, Ethiopian digital government contributes to increasing efficiency, transparency and accountability of government, and increasing citizen satisfaction. It also improves the engagement between government and citizens (Pathak et al., 2007).

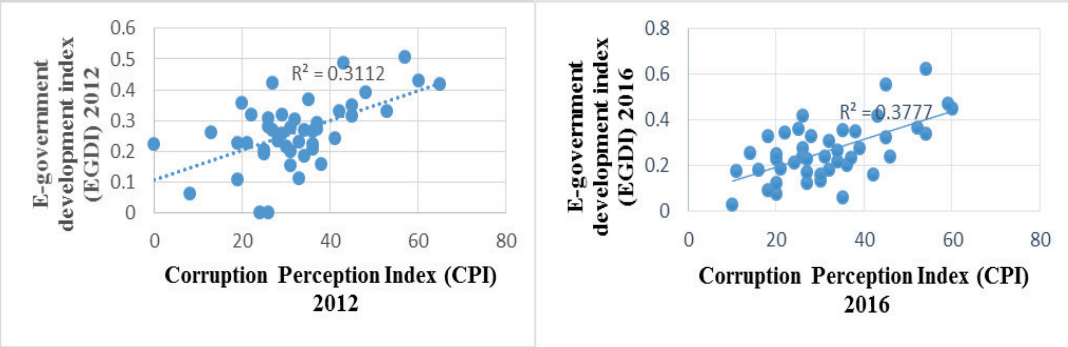

Figure 1: Correlation of EDI and CPI values for 2012 (left) and 2016 (right) for 45 Sub-Saharan countries

Table 5 describes how Ethiopia is using digital government to reduce corruption in two most affected sectors: public procurement and tax administration (Desalegn, 2012). The table maps two corresponding digital government systems implemented and their associated anti-corruption effects.

Table 5: Analysis of anti-corruption effect of Ethiopian e-tax and e-procurement systems

	E-GOVERNMENT MEASURES	ANTICORRUPTION EFFECTS
e-Tax system	Development of informational services: Custom and Revenue Authority and national web portal https://etax.revenue.gov.et/	Removes asymmetries in access to information Raises public awareness and increases transparency and accountability Real-time, online status of customer compliance
	Developing national payment gateway with transactional services	Reduces contact between tax payers and tax collectors
	Development of tax management and information system	Simplifies administration of taxes and provides better control over compliance Timely tracking of late-files and late-payers Transparent and accountable public authority
e-Procurement System	Development of e-procurement portal containing informational services related to public-private partnerships and government tenders https://www.eprocurement.gov.et/	Allows public bidding for supplies, and increases transaction transparency Reduces procurement cost due to increased competition and demand aggregation Increases procurement transparency and accountability Reduces opportunities for bribes and brokers' power, raises public awareness, and increases transparency and accountability Reduces bidding costs by 50% Improves turnaround times for payments

Even though digital government is developed in Ethiopia since 2011 (MCIT, 2011), only slight anti-corruption improvements has been observed, with CPI values increasing from 33 to 34 and 35 in 2012, 2016 and 2017 respectively. According to (Ahmed, 2018), limited impact on reducing corruption in Ethiopia is due to poor implementation and consolidation, low political will to fight corruption, deficiencies of existing anti-corruption institutions, and weaknesses of the country's political system, culture and institutions. Strengthening law enforcement must be undertaken when implementing digital government in Sub-Saharan Africa. Also the negative effect of digital government on achieving economic and political goals, which in turn can lead to more corruption, should be accounted for (Schuppan, 2009; Aladwani, 2016).

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6. Conclusions

In this paper, we analysed whether improvements in digital government were accompanied by reductions in administrative corruption in Sub-Saharan Africa in the period from 2012 to 2016. Based on the quantitative analysis of the United Nation's E-Government Development Index and Transparency International's Corruption Perception Index, a positive relationship was uncovered between both variables, which was confirmed by studies that demonstrate a significant role of digital government in corruption control and poverty reduction (Bhuiyan, 2011). A possible mechanism at play is that digital government enhances accountability and contributes to better governance. It also helps rationalize government reform by facilitating innovative forms of cooperation between public and private actors, strengthening legitimacy through sustainable public services, and enlarging and deepening citizen participation (WorldBank, 2007).

We complemented quantitative analysis of the region with qualitative analysis of one country in the region – Ethiopia, and how it has been using digital government for corruption reduction. Although Ethiopia has been developing digital government since 2011 and such developments contributed to improving government transparency and accountability, the country achieved only modest improvements in the levels of corruption over the period of 2012 to 2016. A possible reason is that the corruption reduction depends on various external factors. Key among them is strengthening the rule of law, which is also a powerful predictor of clean government (Kim C.-K., 2013), anti-corruption stance and safeguarding human rights, and government effectiveness, size and gender ratio (Zhao & Xu, 2015). Generally, the potential of developing digital government to realize its anti-corruption effect in Sub-Africa is immense.

We are aware of several limitations of this research. First, this study does not account for differences in political, economic and cultural conditions that exist in different countries of the region, with direct impact on the effectiveness of digital government for corruption reduction (Nam, 2018). Second, the study relies on two selected indices that measure digital government and the level of corruption in two specific points in time. For more accurate analysis, the study could use a range of indices for measuring digital government and levels of corruption, both perceived and actual, over a time series. Third, the qualitative analysis of the case of Ethiopia is largely informal and not linking micro-level (organizational) initiatives to macro-level (policy) effect of such initiatives. Fourth, the study does not indicate at what level of digital government development we should observe improvements in corruption reduction in line with other sustainable development goals and targets (Estevez and Janowski, 2013) (Janowski, 2016). These limitations will be addressed in our future work.

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