



Are emerging technologies helping win the fight against corruption in developing countries?

Background Paper

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This paper is part of a series of background papers on technological change and inclusive development, bringing together evidence, ideas and research to feed into the commission's thinking. The views and positions expressed in this paper are those of the author and do not represent the commission.

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Abstract

This paper systematically takes stock of the latest academic and policy literature that sheds light on Information and Communication Technology (ICT) tools and their impact on corruption. The tools reviewed include digital public services, crowdsourcing platforms, whistleblowing tools, transparency portals, big data, distributed ledger technology (DLT), and artificial intelligence (AI). We scrutinise the evidence on various technologies' effectiveness, drawbacks, and even potential misuse that enables corruption. Drawing on the commonalities across the different technologies, it appears that ICT can genuinely support anti-corruption by impacting on public scrutiny in numerous ways. For example, by digitising public services and enabling corruption reporting, it can promote transparency and accountability, and facilitate advocacy and citizen participation as well as closer interaction between government and citizens. However, ICT can also provide new corruption opportunities related to the dark web, cryptocurrencies, or simply through the misuse of well-intended technologies such as digital public services and centralised databases. Our findings underline that ICT is not *per se* a panacea against corruption, and it can also play into the hands of corrupt officials. Importantly, the existence of ICT tools does not automatically translate into anti-corruption outcomes. Rather, impact hinges on the suitability of ICT for local contexts and needs, cultural backgrounds, local support and skills in using technology.

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Executive Summary

ICT has affected the work of all actors involved in or working against corruption, including public institutions, civil society organisations, the private sector and the media. While many see great promise in this development, the effectiveness of ICT tools – as well as their drawbacks and potential misuse – vary widely. Some technologies may even enable corruption. To understand the state of play, this paper systematically reviews the evidence on the use of ICT *for* as well as *against* corruption across the globe, with a particular focus on developing countries.

We define 'corruption' as the abuse of entrusted authority for illicit gain, recognising that corruption in particularistic societies essentially reproduces the existing structures of unequal distribution of power. We consider different kinds of corruption, happening on grand as well as bureaucratic and petty levels. We address both sides of corruption – as a principal-agent and as a collective action problem. We look at how ICT can help or harm oversight, accountability, civic action and norm change. In terms of the ways ICT affects corruption, we distinguish between the supply side of information (from governments to society) and the demand side of information (from society to governments), recognising that some technologies' impact might fall into both or none of these.

We systematically take stock of the academic and policy literature available to shed light on the detailed characteristics of ICT tools for anti-corruption efforts. We sort them into the following, not mutually exclusive, categories: digital public services and e-government, crowdsourcing platforms, whistleblowing tools, transparency portals and big data, distributed ledger technology (DLT) and blockchain, and artificial intelligence (AI).

The literature on **e-government** is extensive, frequently finding that e-government is important as a useful tool to strengthen the supply side of information. It also finds a clear statistical relationship between different measures of e-government adoption and reduced corruption. However, case study evidence indicates that, depending on a number of factors concerning the design of e-government interventions, digital public services are not effective. They can even provide new corruption opportunities. Therefore, to be effective, their implementation needs to be embedded in broader administrative reform.

The evidence base for the impact of anti-corruption **crowdsourcing** platforms on corruption is quite thin. However, there are a number of case study investigations into success factors such as ease of use, guaranteed anonymity, and existence of follow-up action. From these examples it appears that crowdsourcing platforms can affect the demand side of information and foster upward transparency when implemented well. But they possibly also enable corruption or have no impact at all due to the low numbers of users.

There is limited statistical and anecdotal evidence to show that ICT-enabled **whistleblowing** tools can facilitate detailed reporting on cases of grand corruption that can be followed up with legal action. The protection of whistleblowers' identities and appropriate follow-up action is crucial in the design of such tools. Otherwise, potential whistleblowers might be deterred from, or could be endangered by, reporting corruption.

Concerning **transparency portals**, impactful examples that provide big and open data used by civil society or the business community are still relatively rare, particularly in developing countries. The scant literature indicates that the mismatch of supply and demand of data, a lack of resources, sanctions, and logistical challenges commonly appear to hinder effective implementation of such portals. There is an urgent need for further evidence on the impact of such portals on the supply side of information and on enhancing downward transparency.

The newly emerging **DLT and blockchain technologies** are anticipated to have great potential for enhancing downward transparency and accountability in the public sector. However, they also raise concerns about data security – for instance, enabling untraceable flows of money. The impact and added value of blockchain is yet to be determined as its implementation in the public sector is still experimental.

Similarly, while the application of **AI technologies** carries great promise, the current state of development and lack of scientific evidence means it is difficult to assess the impact of AI on corruption, especially for developing countries. Future growth should be accompanied by rigorous assessment and build on existing evidence from other areas of application.

Drawing on the commonalities across different technologies, it appears that ICT can support anti-corruption in a variety of ways. It can promote transparency and accountability while facilitating advocacy and citizen participation. It is also proven to enable a closer interaction between government and citizens – for example, by enhancing access to public information. ICT can genuinely impact on public discretion and scrutiny – for instance, by digitising and monitoring officials' activities and public services, and enabling corruption reporting.

However, ICT can also facilitate corruption. Emerging technologies can provide new corruption opportunities related to the dark web, cryptocurrencies, or simply through the misuse of well-intended technologies such as digital public services. ICT can also contribute to the centralisation of corruption opportunities, such as a central database for all financial transactions, something which may have previously been highly decentralised. These instances underline the fact that ICT is not *per se* a panacea against corruption; it can also be used by corrupt officials.

The existence and availability of ICT tools does not automatically translate into use. Nor does it guarantee any desirable anti-corruption impact. This is because the tools crucially depend on the specific content provided, and require connectivity and a certain level of ICT proficiency. And this is something that cannot be taken for granted in developing countries.

Similarly, the application of ICT tools for anti-corruption needs to acknowledge the digital divide between different social groups. The success of ICT interventions against corruption hinges on their suitability for local contexts and needs, cultural backgrounds and technology experience. Finally, for ICT to be effective in controlling corruption, it still very much depends on political parties, public administrations and civil society groups; on its own, it is likely to remain ineffectual.

1. Introduction

The rapid spread of ICT and digitalisation as one of the forces shaping the 21st century gives an impression of great promise for revolutionising societal relations and public service delivery. In the field of anti-corruption, ICT has become increasingly influential in opening new doors for the prevention, detection and prosecution of corruption. As numerous studies assert, ICT can promote transparency, accountability and citizen participation. It can also facilitate advocacy and closer interaction of government and citizens. The relevant tools include websites and mobile phone applications as well as the newly emerging DLT, big data analysis or AI. These tools serve the fight against corruption by enhancing access to public information, monitoring officials' activities, digitalising public services and enabling corruption reporting (for example, see Bertot, Jaeger, and Grimes, 2010; Davies and Fumega, 2014; Kuriyan, Bailur, Gigler, and Park, 2011; Subhajyoti, 2012).

However, the existence and availability of these tools does not automatically translate into their use, which crucially depends on the content provided, connectivity and a level of ICT proficiency (Torero and von Braun, 2006). This cannot be taken for granted in developing countries as only 15% of households in least developed countries (LDCs) have internet access at home (International Telecommunications Union, 2017). Similarly, the application of ICT tools for anti-corruption needs to acknowledge the digital divide¹ between different social groups (Bimber, 2000; Gillwald, Milek, and Stork, 2010). For example, the proportion of women in Africa using the internet is 25% lower than the proportion of men (International Telecommunications Union, 2017). The differences in technology use between men and women appears to be partly gender-related but are strongly complemented by socio-economic and cultural factors (Antonio and Tuffley, 2014; Gillwald et al., 2010; Hilbert, 2011). **The success of ICT interventions against corruption hinges on their suitability for local contexts and needs, cultural backgrounds and technology experience** (Helbig, Ramón Gil-García, and Ferro, 2009).

Although ICT is commonly studied as an anti-corruption instrument, we should also consider the potential opposite effect of such tools being used *for* instead of *against* corruption. Emerging technologies can potentially provide new corruption opportunities, related to the dark web, cryptocurrencies, or simply through the misuse of well-intended technologies such as digital public services (Heeks, 1998; World Bank, 2014). While relevant research is more scant in this area, some literature points to the potentially adverse use of ICT for corruption (for example, Kenya Anti Corruption Commission, 2008). A few studies also find negative effects of ICT use. For example, overinvestment in ICT tends to be associated with increased corruption (Charoensukmongkol and Moqbel, 2014). Numerous examples from Western Balkan countries also show that there are corruption risks associated with the manipulation of digital records and public service systems. For instance, €2 million (ca. £1.8 million) disappear every year from Croatian tollbooths due to officials entering false data into the digital information system (ReSPA, 2013). Such examples underline the fact that **ICT is not *per se* a panacea against corruption, and it can also play into the hands of corrupt officials.**

¹ The term 'digital divide' refers to diverging paces of ICT adoption, leading to inequality in the power to communicate and process information digitally. This is also related to other determinants of inequality, such as income, education, gender, age, geography, and ethnicity (Hilbert, 2011).

ICT has affected the work of all actors involved in the fight against corruption, including public institutions, civil society organisations, the private sector and the media. While there are many approaches for taking advantage of ICT in the fight against corruption, the success of these tools – as well as their drawbacks and potential misuse – varies widely. The individual characteristics of the technologies used may make them more or less effective anti-corruption tools, or even corruption enablers in a given context, depending on actors' skills and their capacity to take collective action. To understand the state of play, the aim of this paper is to systematically review the evidence and the broader literature on the use of ICT for and against corruption across the globe, with a particular focus on developing countries. Consequently, the guiding research questions of this review are:

- What are the applications of ICT as a tool against corruption in developing countries?
- What impact and limitations have these shown?
- In what ways could they also facilitate corruption?

To answer these questions, we will systematically take stock of the academic and policy literature on six types of ICT-based anti-corruption interventions:

- Digital public services and e-government
- Crowdsourcing platforms
- Whistleblowing tools
- Transparency portals and big data
- DLT and blockchain
- AI

Naturally, these types overlap – for example, some transparency portals or DLT-based tools can also be considered e-government interventions. Therefore, these types are not mutually exclusive categories. Rather, they distinguish between different ICT-enabled tools according to how they impact on corruption.

Based on a broad literature search, a synthesis of key arguments and findings is provided per ICT type. The focus of the search lies predominantly on empirical papers using solid theoretical frameworks, where available. Throughout the review, the study quality and knowledge gaps in the existing evidence are thoroughly assessed.

The review is structured as follows: Section 2 sets the stage by defining corruption and technology types; Section 3 outlines the frameworks for the impact of ICT-based anti-corruption interventions and reviews the literature on the main technology types; Section 4 includes our concluding remarks on the overall impact of ICT on corruption, and recommendations on the conditions under which ICT-based interventions contribute to the fight against corruption.

2. Setting the stage

To provide the backdrop for reviewing the use of emerging technologies in the fight against corruption, we first need to explain the concept of corruption with its drivers and effects. We can then define the types of ICT applied as anti-corruption tools, as well as understand the impacts.

The concept of corruption

The definition of 'corruption' commonly used by anti-corruption organisations is: "the abuse of entrusted authority for illicit gain" (Transparency International, n.d.). Also, as Mungiu-Pippidi (2006) says, it is important to recognise that corruption is not always a sporadic deviation from the assumed universal norm of equal treatment for everyone, regardless of their position in society. In reality, many societies, especially in developing countries, are characterised by particularism, meaning that people's treatment by the state depends on their position in society. Therefore, corruption in particularistic societies essentially reproduces the existing structures of inequality and uneven distribution of power (Mungiu-Pippidi, 2006).

Corruption can take many shapes. In this review, we consider different kinds, including bribery, fraud, extortion, embezzlement and nepotism (Elbahnasawy, 2014). These can happen at the elite level (grand corruption) with politicians or high-level authorities distorting government expenditures, or at a lower level (petty or bureaucratic corruption) involving street-level bureaucrats being corrupted during public service delivery (Bardhan, 2006; Charoensukmongkol and Moqbel, 2014). Corruption commonly reduces public trust in governments. It diverts funds from goods and services supposed to benefit citizens, and it weakens the functioning of public institutions and the rule of law (Chêne, 2014). It is also likely to hinder economic growth (Aidt, 2010) by discouraging investment (Mauro, 1995), creating economic inefficiencies and contributing to income inequality (Gupta, Davoodi, and Alonso-Terme, 1998).

The root cause of corruption can be understood in two principal ways (for example, as distinguished by Kossow and Dykes, 2018). First, corruption is a principal-agent problem, with citizens usually being principals and government officials or bureaucrats being agents that act on citizens' behalf. The officials possess asymmetric information and political discretion on the distribution of resources, which potentially allows room for corruption. Consequently, strategies to fight corruption in the sense of the principal-agent problem commonly focus on decreasing discretionary power of government officials and establishing better oversight and accountability (Klitgaard, 1988).

Second, corruption can be understood as a collective action problem – for example, where government officials', businesses' and citizens' behaviour is influenced by social norms alongside the perceived strength of deterrents and the probable behaviour of others, such as whether peers also pay or accept bribes. Strategies to fight this type of corruption require a more comprehensive approach that focuses on fostering anti-corruption norms and bringing citizens together against corruption – for example, by providing information and educating people or creating transparency and accountability initiatives. These can lead to a long-term shift towards more universalistic norms (Bertot et al., 2010). In this review, we address both natures of corruption, looking at how ICT can help or harm oversight, accountability, civic action and norm change.

The main technology types

Here we examine the functions of the main technology types under consideration in this review. ICT generally facilitates the processing, transmission and display of information through **digital devices**. This includes radio, television, mobile phones and computers, as well as **network technology** – the most important example being the internet (Charoensukmongkol and Moqbel, 2014). In recent years, a form of network technology called DLT has emerged, with one well-known type called blockchain. DLT provides a database of financial, legal, physical or electronic assets, recorded and shared across sites in a geographically spread network, where all participants have a synchronised duplicate of the ledger. There is no central data storage, rather it is a peer-to-peer network, requiring consensus algorithms which can be used, for example, for cryptocurrencies, smart contracts, or file storage (Natarajan, Krause, and Gradstein, 2017; Walport, 2015).

Another important concept related to the rise of new technologies is **big data**. 'Big data' is a blanket term for very large amounts of data generated by sources such as the internet, credit card systems, surveillance cameras or social media. Big data are distinguished by high frequency (that is, real time), massive size, heterogeneity and complexity of data, requiring special data-processing and analytical tools (Gandomi and Haider, 2015). Big data can be used for predictive analytics – for example, by employing machine learning, which is a subset of AI. AI technologies are often distinguished by their ability to demonstrate intelligence in the form of learning or problem-solving, being programmed to maximise their chances to achieve pre-set goals (Legg and Hutter, 2007).

ICT and corruption

ICT facilitates the information flow between government and citizens, across government institutions, and among citizens. Potentially this fosters transparency, accountability and citizen participation (Chêne, 2012). The impact of ICT against corruption is influenced by the reduction of information asymmetries, the automation of processes, the limitation of public officials' discretion, and the reduction of intermediaries and red tape (Grönlund et al., 2010). Conversely, ICT can also have a corruption-enhancing effect as the use of digital technologies introduces new opportunities for committing and concealing corrupt behaviour. This is generated by easier and broader access to databases that can be hacked or manipulated, and reduced information asymmetries for those seeking details about relevant officials to bribe.

Since ICT's overarching purpose relates to the communication of information, one way to distinguish the ways ICT influences corruption is to look at whether it affects the supply side of information by governments or the demand side of citizens' information gathering and interactions (Kossow and Dykes, 2018). Naturally, not all uses of ICT in anti-corruption can be clearly distinguished according to these impacts. Some might affect both the supply and demand side of information, or none, if they do not concern the provision or demand of information but directly affect other areas shaping corruption such as the scope of officials' discretion.

With regards to **the supply side of information from governments to society**, the digitalisation of public services reduces direct contact points between citizens and public officials. It automates processes, therefore removing opportunities for public officials to misuse their discretionary powers. It can also facilitate the detection and prevention of corruption through providing 'downward'

transparency, where government activities are made public and accessible to citizens, civil society organisations, journalists and researchers – that is, facilitating vertical accountability. Consequently, the power over information within society becomes decentralised and thus corruption riskier to commit (Castells, 2000; Soper, 2007). Information on citizens' rights and on cases of corruption can be provided more quickly and easily. The digitalisation of donor-beneficiary payments can remove opportunities for corruption by middlemen such as distributing agencies (Kshetri, 2017).

Nevertheless, digitalisation can also create new vulnerabilities for hacking and manipulation at a scale simply not possible in a paper-based government. Instead of eliminating corruption opportunities, digitalisation may shift them to other areas of government activities that are not yet digitalised. ICT may concentrate new, system-wide corruption opportunities in the hands of those few who have the right ICT skills, as examples given by the Regional School of Public Administration (ReSPA, 2013) show (see next chapter). Converse to commonly expected benefits, increased transparency can be argued to facilitate corruption in public procurement, for example, because it potentially enables bidders to identify the relevant officials to bribe (Bac, 2001).

Concerning **the demand side of information from citizens**, emerging technologies can foster forms of 'upward' transparency. This includes where supervisors receive citizen feedback on public officials' performance, for example, through digitalised public service delivery. Such feedback loops create complaint channels that can lead to prevention, detection and punishment of corruption. Also, platforms for information sharing, such as news websites, crowdsourcing platforms, and social media, can foster civil mobilisation (Grönlund et al., 2010; Kossow and Dykes, 2018).

Nevertheless, false information might be spread. Online activism might give people the impression that they are active against corruption while the virtual activity does not translate to real impact. Digital means of interaction among citizens and businesses may also render corruption easier to organise and maintain by lowering transaction costs and allowing for more efficient monitoring within criminal groups.

In summary, both frameworks could lead to positive and negative impacts of emerging technologies on corruption, depending on a range of contextual factors and enablers. For example, in a study on the effect of ICT diffusion on corruption in Africa, the authors found that anti-corruption effects of ICT adoption only materialise once a threshold of rule of law is reached. This emphasises the importance of comprehensive reforms of law enforcement (Sassi and Ben Ali, 2017). Similarly, Charoensukmongkol and Moqbel (2014) find a u-shaped relationship between ICT investment and corruption. This implies that, while increased investment in ICT can lead to reduced corruption, overinvestment in ICT tends to result in increased corruption, as the distortion of such funds through a non-transparent procurement process easily create corruption opportunities. Particularly in developing countries, the implementation of ICT is prone to the "conception-reality gap" (Heeks and Bhatnagar, 1999), describing the difficulties of transferring successful interventions from developed countries. As this illustrates, ICT's potential anti-corruption use depends on political, infrastructural, social and economic factors. The risk of misuse needs to be carefully considered.

3. Assessment of individual technologies and 'interventions'

a. Digital public services and e-government

One of the main applications of new technologies in the fight against corruption is digital public services. This is a sub-form of electronic government (e-government), that involves the use of ICT, particularly the internet, web-enabled devices, and electronic data management systems, for the provision of public services to citizens (UN Department of Economic and Social Affairs, 2014). By digitalising public service delivery, governments aim to improve their effectiveness and efficiency, often achieved by automating services and simplifying recurrent bureaucratic processes. The wide-ranging implementation of digital public services is pioneered by countries like Estonia, for example, which has built digital systems for almost all public services, including voting, land registry, court processes, taxation or health records (e-Estonia, n.d.).

Similar developments have been picked up by numerous developing countries, such as India. For example, the Karnataka District government has launched e-government software that allows farmers to apply for and receive compensation for crop damage without having to spend resources visiting the relevant offices. (Bhoomi, 2018). The same government has established an electronic land record system estimated to have saved 7 million farmers 1.32 million working days in waiting time and Rs.806 million (ca. £8.9 million) in bribes to local officials in its first several years. Before the system, the average land transfer required Rs.100 (ca. £1.10) in bribes, while the electronic system requires a fee of Rs.2 (ca. £0.02) (Chawla & Bhatnagar, 2014).

It is suggested that digital public services reduce corrupt behaviours rooted in the principle-agent problem by internally enabling supervisors to more effectively monitor officials' activities. They also externally increase transparency to enhance relationships with citizens, thereby impacting on the supply side of information (Pathak, Singh, Belwal, and Smith, 2007; Shim and Eom, 2008). Digital public services also reduce face-to-face contact between public officials and citizens. They remove human discretion from some bureaucratic processes, which is expected to reduce corruption opportunities (Charoensukmongkol and Moqbel, 2014).

Nevertheless, Barata (2001) stresses that the use of ICT to digitalise public services does not in itself ensure improved transparency and accountability. It is also true that the accomplishments of effective e-government are controversial. E-government projects in developing countries often fail due to state failure and low capacity, as well as inappropriate designs which do not match on-the-ground realities (Heeks, 2003; Schuppan, 2009). For e-government initiatives to be successful in developing countries, the different initial institutional, cultural, and in particular, the different administrative contexts and rationalities must be considered. Furthermore, government employees may require persuasion and training to use new digital systems, which need to be kept updated and safe from undue interference (Schuppan, 2009). At the same time, a major impediment for the intended widespread use of digital public services in developing countries is the digital divide – that is, the inequality in public access to ICT (and basic requirements of electricity and internet connection) and the capability and motivation to use them as intended. To accommodate these problems, e-government reforms need to shift from the supply-side to the demand-side of digital services, with consideration for the digital divide (Helbig et al., 2009).

Instead of enhancing oversight, digital public services may introduce new opportunities for systematic misuse of electronic systems. They could enable the concealment of corrupt actions by individual tech-literate officials, as well as potentially shift corruption towards remaining paper-based areas (Pacific Council on International Policy, 2002). A report by ReSPA (2013) provides examples of how new digital public service systems are abused for corruption. For instance, the case of police and public administration employees in Bosnia-Herzegovina who, following the introduction of an electronic citizen registration system, misused their access and forged data to sell false ID cards and passports. As this illustrates, instead of automatically being a tool to curb corruption, digital public services may also allow corruption to be concealed or open up new and potentially more concentrated 'rent-seeking' opportunities, particularly for those who are ICT literate.

Evidence

There is a diverse body of literature on the relationship between e-government and corruption, most of which does not exclusively focus on digital public services (government-to-citizens) but also includes digitalised government-to-government or government-to-business systems. There are a number of medium-quality empirical studies that lend support to the suggested effect of e-government mitigating corruption.

In an empirical study, Shim and Eom (2008) examine the correlation for 127 countries between three e-government measures (including West's (2006) e-government maturity index, the UN e-participation index, and the levels of internet penetration) and corruption levels as indicated by Transparency International's Corruption Perception Index (CPI) 2004.² The results suggest that the three e-government measures account for 77% of the total variation of corruption perception levels. They appear to be more influential on its reduction than the tested conventional anti-corruption factors, including bureaucratic professionalism, bureaucratic quality and law enforcement.

Similarly, Andersen (2009) conducted an empirical study applying multiple regression analysis to analyse the impact of West's (2006) e-government index (based on an assessment of national government websites) on the World Bank's Control of Corruption Index.³ He analysed a panel data set of 149 countries with two time observations from 1996 and 2006. The findings indicate that, in non-OECD countries, increases in e-government maturity resulted in reductions in corruption levels over the decade 1996–2006. Even when controlling for real gross domestic product (GDP) per capita and press freedom, the two time-varying factors often related to corruption. In terms of impact, the most conservative estimate is that moving from the 10th percentile to the 90th percentile of the e-government measure reduces corruption by 13 per cent. Andersen also argues that internet use is possibly more important than e-government for reducing corruption. However, there is no conclusive evidence for this claim due to data limitations.

² CPI is a composite index with a range from 0 (highly corrupt) to 10 (highly clean) that assesses the perceived level of public sector corruption in 180 countries, based on various expert and business surveys.

³ Control of Corruption is an aggregate index that combines up to 23 different assessments and surveys to record perceptions of the extent to which public power is exercised for private gain, including petty and grand forms of corruption as well as state capture.

Analogous to this, in a later study, Mistry and Jalal (2012) analyse changes over time in the relationship between e-government (using the UN e-government readiness index) and CPI in a sample of 108 developed and developing countries for the period 2003–2010 using different ordinary least squares regression models. The results confirm that, as the use of e-government technologies increases, corruption perception decreases, with a greater impact in developing countries than in developed countries.

A study by Garcia-Murillo (2013) adds telecommunications infrastructure to the equation. The research uses data from a six-year panel for 208 countries to analyse the correlation between the implementation of e-government innovations (measured by combining UN e-government readiness index and the UN telecommunications infrastructure index) and national Worldwide Governance Indicators (WGI) Control of Corruption Indices. The findings indicate a negative relationship, leading the authors to conclude that an increased online government presence – through e-government and telecommunications infrastructure – reduces the perception of corruption around the world.

In summary, a number of empirical studies using different combinations of various measures of e-government and of corruption at country level all conclude that increasing provision of digital public services is likely to have a dampening effect on levels of (perceived) corruption.

A number of research papers examine the effects of specific digital public services on corrupt behaviours. For example, Kleven et al. (2011) and Pomeranz (2013) suggest that electronic tax reporting systems for double reporting of taxes significantly reduces tax evasion. At the micro-economic level, Kim, Kim and Lee (2009) studied the development of an electronic service system in the Seoul Metropolitan Government that enables citizens to monitor the progress of their applications in 54 common procedures. The study found that corruption was reduced significantly. In a case study of Tanzania, Krolkowski (2014) examined the use of mobile payment methods for public water bills. They found that this reduced opportunities for petty corruption, increased revenue collection per customer, and improved the quality of data generated in the payment process.

To the best of our knowledge, no quantitative studies have been published about the adverse effects of digital public services enabling corruption. Regarding qualitative evidence, Heeks (1998) uses five case studies to argue that digitalising public service systems may have no effect on, or may even create new opportunities for corruption by public officials. For example, a government-owned railway firm introduced seat reservation software designed to undermine corruption by booking staff. However, clerks found new ways to outwit the system by pre-booking seats using common names, and selling them at the last minute or as emergency VIP seats. Consequently, Heeks argues that digital public services are merely a tool that can affect symptoms of a corrupt system rather than causes, which need to be addressed by broader reform of organisational and environment factors.

In Kenya, an online citizen complaints system – designed to enhance co-operation between five government bodies and one non-governmental organisation (NGO) by re-routing complaints to the appropriate body – was first hailed as a success, with 184 out of 199 cases referred in the year following its introduction. In the year after, this dropped to only 12 cases, and staff reportedly perceived the new technology as an additional burden (Kossow & Dykes, 2018). Complaints also

emerged that the platform was sometimes not accessible or very slow, that there was a high staff turnover without knowledge on the system being passed on, lack of feedback from partner organisations, and too little outreach (Huter, 2018). (Elbahnasawy, 2014) also points out that, in many countries, some e-government services may be offered online but the full processes to obtain certain services may still require citizens to meet with government officials in person. So, where the administrative procedures might not have changed, the benefits of e-government would be undermined.

Similarly, the case studies cases presented by ReSPA (2013) illustrate the ingenuity with which public officials adapt to new digital systems – such as the case of officials manipulating data in a new electronic road toll system re-registering trucks as cars to keep the price margin for themselves, leading to an annual loss of €2 million (ca. £1.8 million) from Croatian tollbooths. They conclude that, while digitalising the public sector can enhance transparency, it can also enable much wider abuse than is possible without ICT. This is because officials find ways to circumvent or use the new systems for their own benefit by falsifying, illegally obtaining or destroying data. Recognising such risks, Asogwa (2012) investigates the challenges of e-records management as a component of efficient digital public services in Africa. The research finds that the benefits of digitalisation can only be realised if appropriate infrastructures, regulations, finance and ICT-trained staff are available. Without these preconditions, public records become more vulnerable and public services could be jeopardised.

The empirical findings using different combinations of e-government and corruption measures consistently highlight the importance of digital public services and e-government as a useful tool in anti-corruption efforts. They also illustrate a clear statistical relationship between different measures of e-government adoption and reduced corruption. This supports the theory that digital government impacts on the supply side of information, and that it expands information access, transparency and accountability by raising the risk of detection and undermining corruption opportunities.

Nevertheless, as the qualitative evidence reviewed indicates, digital public services can also enhance corruption, depending on a range of factors linked to the quality of design and implementation of such interventions. Further studies are needed on different kinds of digital public services to help us understand which areas are most cost effective to digitalise, what types of corruption are mitigated or enabled, and in what kind of public administration context. Future research could also provide better insight into the relationship between e-government and corruption reduction. That is, how is it that increased e-government use lowers corruption indices?

Furthermore, Singh et al. (2010) note that e-government's prime goals are often efficiency and effectiveness. This can cause the objective to reduce corruption to be lost, unless transparency and accountability priorities are explicitly built in to new digital public service systems from the planning and design phase. Therefore, where the administrative procedures of public administration have undergone little change, the benefits of e-government are likely to be limited. Instead, e-government is more likely to be effective when a number of factors linked to corruption mitigation are explicitly considered in the design of digital public services. This can include appropriate legal frameworks ensuring transparency, free access to information, and the ability to track actions and decisions back to the individual public officers, as well as context and needs suitability, ICT access and capabilities, and cybersecurity.

b. Crowdsourcing platforms

Crowdsourcing platforms are similar to the better-known crowdfunding platforms, the only difference being that, instead of money, information is collected. Crowdsourcing platforms allow citizens to report corruption incidences and publicly share individual experiences via the internet or telephone. In contrast to whistleblowing tools (discussed below), these platforms are primarily intended for reporting incidences of petty corruption in the public sector, as experienced by citizens in a lot of countries on a regular basis (Charoensukmongkol & Moqbel, 2014). They are therefore a potential tool for upward transparency, affecting the demand side of information from citizens to governments.

A famous example of a widely used anti-corruption crowdsourcing platform is I Paid A Bribe which was first introduced in India and adopted in more than 10 other countries. It allows users to anonymously share their corruption experience, including the nature, location and value of a corrupt act, as well as cases where they declined to pay a bribe or interacted with honest officials. Similar platforms have emerged around the world, such as Yosoborno in Colombia, Toidihoilo in Vietnam, or Ushahidi in Kenya. Also, some anti-corruption crowdsourcing platforms focus on a specific issue, such as the Nigerian Trade Route Incident Management System (TRIMS) for reporting trade route incidents, or the Check My School project in the Philippines where citizens monitor and report on the use of public funds by schools (Kossow & Dykes, 2018).

When used extensively, crowdsourcing platforms can reap the benefits of upward transparency and collective knowledge. The data gathered can paint a detailed picture of how and where corruption happens, and what amounts are involved. Watchdog organisations or government authorities can then follow up on this information by tightening legal regulations in critical areas and prosecuting corrupt public officials. Crowdsourcing platforms can be used to tackle corruption by tightening oversight and tracking effectiveness of reforms on the basis of crowdsourced information. For example, the transport commissioner for the state of Karnataka in India used data collected from I Paid A Bribe to push through reforms in the motor vehicle department, including online applications and video monitoring to reduce corruption and increase transparency. The widespread use of a crowdsourcing platform increases the threat of exposure which can deter corruption (Kossow and Dykes, 2018).

Crowdsourcing platforms can also raise public awareness, educating them about their rights and the illegality of corruption. Bundling of isolated cases demonstrates the pervasiveness of corruption, and potentially fosters solidarity, connects citizens and creates an anti-corruption community. It can therefore impact on the demand side of information from citizens and help overcome collective action problems through the strengthening of anti-corruption norms among victims of corruption, typically ordinary citizens.

Crucially, the value of crowdsourcing platforms depends on user access, knowledge, and participation. There are a number of factors that influence the success of crowdsourcing platforms: the accessibility, reliability and quality of ICT infrastructure; the skills and abilities of the crowd; the links, mutual expectations and trust among individuals; perceptions of the other users; the vision and strategy of the crowdsourcing initiative to incentivise participation; and the external environment

in terms of governance support and socio-economic circumstances (Bott & Young, 2012; Sharma, 2010). All of these variables impact on the main reason for crowdsourcing success: aligning the motive of the crowd – that is, the extent of crowd association and participation with the long-term goal of a crowdsourcing initiative. A weak alignment, due to flaws in user access, capabilities and trust, or shortcomings in platform design and organisational and technical support, can easily result in reduced value or failure of crowdsourcing initiatives.

Additional concerns revolve around the fact that crowdsourced data are often submitted anonymously. Consequently, information is hard to verify, opening up possibilities for false allegations and complicating follow-up action. The risk of security loopholes in the protection of users' data can cause their mistrust, put them at risk, and compromise their participation (Asiimwe, Wairagala, & Grönlund, 2013). Also, crowdsourcing platforms intended to counter corruption might have the involuntary effect of actually enabling corruption as they provide information for people seeking to bribe officials, for example, to speed up a procedure, or to find out who can be corrupted where and at what price.

To summarise, crowdsourcing can be especially useful for upward transparency through reporting widespread petty corruption, increasing visibility of corruption and generating data to research trends, indicating the need for anti-corruption action. We need a public body that is willing and able to follow up on crowdsourced information to generate actual results. However, successful crowdsourcing requires a critical number of people with sufficient motive alignment, and this is not easily attained. There might be gaps in users' privacy protection, potentially leading to abuse. Information accuracy is difficult to ensure, especially if denunciations are submitted anonymously. Involuntarily, crowdsourcing platforms could potentially enable corruption by providing information on the possibilities of bribing.

Evidence

There are numerous examples of anti-corruption crowdsourcing platforms. However, the evidence regarding their impact on corruption is mostly limited to indications of their success or failure in terms of participation, data generated and follow-up actions (for example, see GISWatch, 2012).

A handful of qualitative case studies also shed light on explanations for platforms' success or failure. The Phones against Corruption project by the United Nations Development Program in Papua New Guinea is an example of an anti-corruption crowdsourcing initiative that was considered to be successful. The initiative was tested within the Department of Finance: instead of targeting citizens who experience corruption, the Department's 1,200 staff members were encouraged to report when they witnessed incidences of corruption. Almost half of them participated and provided information in a total of 22,000 text messages. The corruption reporting system was designed in a simple but effective way that considers the local context of low ICT literacy and lack of widespread internet access. It provides an interactive, free, and anonymous SMS system asking where, when and how corruption occurred. Since its implementation, two public officials have been arrested for mismanaging funds totalling more than US\$2 million (ca. £1.58 million), and around 250 other cases of alleged corruption are being investigated. User experience research with 41 participants established that they found the SMS service easy and quick to use, and 90% of respondents suggested that

they would be willing to use it again. Three-quarters of respondents expressed confidence that action would be taken by the relevant authorities. Based on this success, the initiative has been rolled out to nearly 84,000 public servants, but the impact is yet to be determined (Phones Against Corruption, n.d.).

Kossow and Dykes (2018) examine the well-known anti-corruption crowdsourcing example, I Paid A Bribe, in India, which generated large numbers of reports – 162,130 reports since 2010, from more than 1,000 Indian cities with an average of 25-50 reports per day (I Paid A Bribe, n.d.). It aims to change the system that breeds corruption and has achieved some high-profile success stories. In one example, the Transport Commissioner in Bangalore found that his department had the highest instances of bribe-taking in the state. He consequently worked with the Janaagraha Centre, the NGO responsible for the platform, to re-engineer the process for issuing drivers' licences to reduce loopholes for rent-seeking activity.

Kossow and Dykes (2018) highlight the mediating role of the Janaagraha Centre as a crucial feature for the platform's success. While it was initially designed for anonymous reporting only, the option to provide one's name was added later to enable follow-up actions for possible prosecution. Officials called 'Janayuktas' mediate between users and the government, following up on reports by initiating prosecution of corrupt officials but protecting users' identities or analysing anonymous reports to identify and advocate for future reform. The existence of the Janayuktas is argued to be central to the success of I Paid A Bribe in India. Also, citizens have access to detailed information about their rights and advice on how to act on situations of corruption (Kossow and Dykes, 2018).

Ang (2014) contrasts the success of I Paid A Bribe in India with the failure of similar initiatives in China, which many attribute exclusively to the repression of free speech in the Chinese state. The author argues that the initiatives were plagued by internal organisational problems. These included mismanagement, opportunism to use the platform for personal vengeance, and a narrow understanding of anti-corruption as a principal-agent problem; the focus was on exposing and arresting corrupt individuals, rather than addressing structural and collective action issues. In India, such problems were comparatively absent as the Janaagraha Centre offered the autonomy and professionalism necessary to channel crowdsourced information into constructive policy engagement and public education. In the absence of such a body in China, the author points to the limits of crowdsourcing activism in authoritarian states, not only due to external constraints but also limited by a weak civil society.

Asiimwe et al. (2013) provide a case study on two projects in Uganda that aim to fight corruption in low-resource communities by enabling citizens to report incidents by phone, radio, SMS or e-mail when corruption occurs or is suspected in the delivery of public services. The authors use interviews, focus group discussions and observations to investigate whether the projects' channels are trusted by citizens. They also examine what factors enable or challenge citizens in reporting petty corruption via ICT. Their results indicate that the reporting methods are sound enough to serve the purposes of transparency and accountability. The track record exhibits real change achieved as the project providers and voluntary action committees follow up on and verify reports on the ground and open dialogue with administrators or supervisors and the relevant public service

bodies. For example, one case deals with health centres where the reports improved the availability of drugs and reduced staff absenteeism. The authors find that enabling factors for this kind of reporting include efficient and effective reporting processes, convenience, direct links to service delivery outcomes, privacy and affordability. The challenges were poor infrastructure facilities (low connectivity or electricity), mistrust towards project officials, misuse (prank calls, lack of ICT skills), gender issues (as ICT tools are viewed as male artefacts and women lack access to phones or computers and ICT skills), and general issues of economic sustainability and finding the most effective scope for operations (Asiimwe et al., 2013).

In contrast to these optimistic reports, Hellström and Bocast (2013) compare a number of anti-corruption crowdsourcing platforms implemented in East Africa. They find that five out of six have such small numbers of reports (less than 100) that their utility seems limited. Only the I Paid A Bribe initiative in Kenya successfully generated more than 3,500 bribe reports between 2011 and 2013. These were used by civil society organisations to argue for improved governance procedures and tighter law regulation (Hellström & Bocast, 2013). However, not much is known about the initiative's impact and it ceased operations in 2015 without a public explanation.

Hellström & Bocast (2013) subsequently conducted a detailed qualitative investigation into the Ugandan anti-corruption crowdsourcing platform, Not In My Country, designed specifically for recording and publicising corruption at universities. The platform received broad support on social media and had more than 15,000 unique visitors. However, only 10 corruption reports were submitted at the time of research. Probing the concept of motive alignment, the authors used surveys and focus group discussions with students to investigate why, despite the apparent anti-corruption sentiment and interest, the number of reports was this small. They found that peripheral factors such as limited internet access, a non-intuitive website, and fears of government surveillance inhibited students from reporting corruption. It appeared that, while most respondents shared the long-term goal of reducing corruption and have experienced repeated incidences of corruption, they also recognised some benefits of corrupt practices and favouritism such as buying exam questions in advance. They also indicated that engaging with anti-corruption initiatives that accord with local communication customs would be preferable – for example, through radio call-in shows, anti-corruption petitions, or using peers to file a report. In other words, students' more immediate interests subverted long-term goals. This points to the issue that motive alignment should not just include ideological orientation, but also modes of action and communication between participants and the crowdsourcing project (Grönlund et al., 2010).

The evidence base for the impact of anti-corruption crowdsourcing platforms on corruption is quite thin, with a number of success stories and qualitative investigations into success factors. From the available literature it appears that crowdsourcing platforms can help tackle corruption when implemented well, but possibly also enable corruption or have no impact whatsoever. As some of the examples indicate, many platforms remain experimental and seem to have limited added value as the number of reports remain low with no attested impact. This points to the fact that crowdsourcing platforms are merely a tool for strengthening upward transparency. They need to be embedded in a broader initiative where success strongly depends on the public's participation, determined by factors such as ICT infrastructure, user abilities, trust, vision and strategy, all of which

affect alignment of public motives. It appears that it is important to ensure long-term ideological alignment of the public with the platform (that is, the shared goal that corruption should be eradicated), and also consider the short-term needs and modes of action and communication for target participants. The ease of use, guarantee of anonymity, and follow-up action (for example, by non-governmental watchdog organisations) appear to be crucial for the success or failure of anti-corruption crowdsourcing platforms. They should be tailored to the context (considering the aforementioned factors) to reap the benefits of collective knowledge and collective action.

c. Whistleblowing tools

Whistleblowing tools using ICT are similar to crowdsourcing platforms in their ability to enable people to report wrongdoing by public officials. The difference is that crowdsourcing aims at a large number of cases of petty corruption; whistleblowing tools are usually designed for gathering detailed reports of individual cases of grand corruption with the aim of producing a legal case leading to criminal prosecution. In other words, they aim for lower numbers but greater depth and reliability of reports, thus seeking impact through the demand side of information and upward transparency.

Examples of ICT-enabled whistleblowing systems include: GlobalLeaks, an open-source software that can be adopted to different settings; and the BKMS® compliance system, mostly for internal whistleblowing, which encrypts and forwards reports to an internal examiner.

Whistleblowing tools can provide invaluable information on corruption cases that would likely otherwise remain secret. This is because it allows public employees who witness wrongdoing at their workplace to anonymously blow the whistle on personnel, including their superiors. The issue of anonymity and protection are central to the discussion around ICT-enabled whistleblowing platforms (Salbu, 2001). Their technological design needs to provide protection, for example, by disguising whistleblowers' IP addresses and safeguarding data transfer, and should consider the legal frameworks which, in many countries, do not comprehensively protect anonymous whistleblowers.

At the same time, a major concern is that these platforms should enable follow-up communication between officials and whistleblowers. In some cases, officials try to encourage whistleblowers to reveal their identity – for example, in order to act as witnesses in a trial. The platform providers should carefully consider this option, realistically assessing the risks involved for whistleblowers (Kossow & Dykes, 2018). Another challenge for whistleblowing platforms is finding the right balance between broadly raising awareness of the service and limiting the volume of reports to ensure quality and maintain the capacity for handling them promptly and professionally.

When a whistleblowing report results in legal prosecution and cases become publicised, the increasing visibility of the risk involved could reduce levels of corruption. Alternatively, this could also lead to corrupt officials finding more intricate ways to hide misdemeanours. Platforms have the responsibility to protect the whistleblower, as the possibility of a breach of protection could strongly discourage potential whistleblowers.

Evidence

Given the unique nature of high-profile and often complex cases resulting from whistleblowing reports, there is a general paucity of evidence on effectiveness. With regards to general insights on enabling factors for whistleblowing in the workplace environment, Zipparo (1998) conducted a survey of more than 800 public sector employees in New Zealand to investigate what deters them from reporting workplace corruption. The survey asked whether they would submit a whistleblowing report in the absence of specific factors. The most common concerns were not having enough proof, or the absence of legal protection. The least-detering factors included the absence of role responsibility and not being directly affected by the corruption. The author also found that respondents from lower-income groups were significantly more likely to be deterred from reporting corruption in the absence of encouraging factors.

On the same topic, Carr and Lewis (2010) analyse the extent to which employment law has the potential to fight corruption by imposing rights and duties on employers and workers. The research also looked at the level of protection provided by the UN Convention against Corruption for those who speak out about malpractices in an organisation. It finds the existing legislation to be inadequate in many cases with a high threat posed by disclosure via the internet. Therefore, it is argued that organisations should devise effective policies on internal and external reporting that do not inhibit the exposure of corruption or unnecessarily curtail freedom of speech.

With regards to the use of ICT-enabled whistleblowing platforms, Kossow and Dykes (2018) offer some qualitative insights based on interviews with key informants working on whistleblowing platforms from developing countries. One is Kenya's anonymous whistleblowing platform which became operational in 2005 – at a time when whistleblowers were scarce due to fear of retaliation and absence of a well-functioning whistleblowing system. The platform guarantees anonymity and was designed to record all the information necessary for officials to follow up on a report. It also facilitates case management and anonymous interaction with a whistleblower. According to an interview with a project advisor, the platform was embraced by the public in the first years and thousands of reports were submitted. The numbers have dropped in recent years, supposedly due to insufficient publicity (Kossow & Dykes, 2018). A similar platform Indonesia supports the argument that publicity is an important factor to success. The providers established a special marketing department for conducting awareness campaigns on a regular basis. Since its inception, the platform consistently receives around 2,000 whistleblowing reports per year.

In summary, ICT-enabled whistleblowing tools can facilitate reporting on cases of grand corruption with sufficient detail to facilitate follow-up legal action. This facilitates impact through the demand side of information and upward transparency. The design of these tools, particularly regarding the protection of whistleblowers' identities, is crucial to their success. If security measures are not properly implemented, hacking or leaking of identity information can endanger users and deter others from reporting. If a whistleblower faces repercussions, it could greatly discourage other potential whistleblowers and thus weaken anti-corruption efforts. At the same time, platform providers need to follow up on reports, evaluate their accuracy and act – otherwise, potential whistleblowers might lack the motivation to report corruption.

If we are to understand the direct impact of upward transparency from whistleblowing platforms on corruption through scientific evidence, much more research is needed, going beyond simple statistics of use and anecdotal evidence. What clearly appear to be key success factors for ICT-enabled whistleblowing platforms are the guarantee of anonymity, appropriate follow-up action, and publicity for the platform.

d. Transparency portals and big data

Transparency portals are online platforms usually run by governments or NGOs that publish information on government operations. They include open data portals where government data sets are compiled, and freedom of information portals which facilitate citizens' information requests. Examples of transparency portals include: the Argentinean *Dinero y Política* which presents data on political party finances, enabling people to scrutinise political and campaign financing; *OpenSpending.org* which provides data on government budgets by mapping money flows; or DIGIWHIST's *OpenTender.eu*.

Transparency portals ideally provide government information as open data, meaning that data are freely and easily accessible, machine-readable, and explicitly unrestricted in use (Gurin, 2014). Open data may be, but are not necessarily, big data – that is, very large amounts of data distinguished by their massive size, heterogeneity and complexity, requiring special data-processing and analytical tools (Gandomi & Haider, 2015). For example, open government data on transparency portals can provide important information on population, public budgets, education, public health, weather and trade. They can serve to improve public administration, for example in the field of public procurement, where publishing information on past contracts can improve efficiency of public contracting and allow public scrutiny (Elbahnasawy, 2014).

While not directly being anti-corruption tools, transparency portals can still open new opportunities for citizen oversight. For example, when information on public budgeting is published on government websites, citizens can more easily hold officials to account for their spending decisions (Wickberg, 2013). Transparency portals can help to tackle corruption by enhancing the supply side of information from governments to citizens, which fosters downward transparency and accountability. The mere existence of such platforms can deter acts of corruption and generally create disincentives for public officials to engage in corrupt behaviour as the risk of exposure increases.

A number of steps leading from data to impact have been identified. First, appropriate legal frameworks, technical knowledge and skills are requirements for turning data into relevant information. Second, this may generate outputs such as web applications, reports and newly derived data sets. Third, depending on the context, the outputs' use could result in better accountability, more media coverage and public awareness which could have the impact of curbing corruption (Conference for e-Democracy and Open Government, n.d.).

On the other hand, critics argue that supply-side governmental online transparency is generally a dubious concept since it is provided by governments themselves – meaning that 'inconvenient' information can remain undisclosed or removed from public scrutiny (Suleiman, 2017). Governments can 'whitewash' themselves – for example, by joining initiatives such as the Open Government Partnership – without actually making the substantive changes that would increase transparency and accountability.

Furthermore, transparency portals are only as good as the data they use, which depends on government willingness to be rigorous about transparency. If government agencies release incomplete or inaccurate data, the information most valued by the public could remain undisclosed – or there could be too much so-called "zombie data" published (Kaufmann, 2013) which is unimportant and has no purpose or value in the public interest. Also, even with government willingness, putting open data to work on transparency portals remains difficult, especially in developing countries. And the mere existence of data sets with government information does not ensure an impact on corruption. Limited resources and numerous logistical issues obstruct the effective use of transparency portals. Many countries lack key data on important topics. They face gaps in technology and skills, have patchy legal frameworks, and lack access to finance for open data initiatives.

Evidence

Empirical evidence has been ample, pointing out that often what is claimed to be open data is, in fact, not or only partially open. For example, Brito (2007) reviews the US government's transparency portals analysing the data that is technically publicly available online and finds that it is often difficult to access. This is usually because it is not available in useful formats, for example, when documents are only uploaded as scans and so are not machine-readable and searchable. *The State of Open Government Data in 2017 report* (Lämmerhirt, Rubinstein, and Montiel, 2017) demonstrates that the challenges to open data use have remained since Brito's study. They identify the three critical obstacles preventing open data use, including that data is hard to find, not user-friendly, and not openly licensed.

Gurin's (2014) comparison of open data use supports this point. It stresses that, even though the international open data movement is having an impact on government policy – about 60 countries committed to principles that include releasing government data under the Open Government Partnership – most of this activity has taken place in developed countries, while the use of open data in developing countries faces more obstacles. The World Wide Web Foundation has implemented and evaluated a number of programmes on open data in developing countries. A report by Davies and Fumega (2014) draws on the findings from these programmes across 13 countries, looking at factors affecting efforts to supply, access and use open data in different settings across the developing world. They find that, although there is evidence that open data is being used in some settings, leading to new applications or analysis, in general, examples of the direct use of open data and its outcomes are limited. This is due to frequent mismatch between the supply and demand of open data in developing countries.

Cuillier and Piotrowski (2009) empirically examine the relationship between people's use of the internet to find information and their support for public access to government records. They find that, as more people use the internet for gathering information about their governments and communities, such online information-seeking is related to increased support for government transparency and the right to request public records. Reliance on the internet for information is positively associated with support for access to public records. This implies that, in countries with less internet use for information-seeking, there is less demand for public access to government records. Nevertheless, Davies and Fumega (2014) underline that developing countries show clear interest in using open data approaches to address governance challenges. They also highlight that transparency portals can create new spaces for civil society to pursue government accountability. Intermediaries are vital for the successful supply and use of open data.

Another important aspect to consider is the subject matter of data sets available on transparency portals. The Open Data Barometer study found that, despite an increasing number of countries providing open data, politically sensitive information and other data sets that would be key to accountability efforts are among the least likely to be published. In various developing countries, crucial data sets, such as company or land registers, are simply not available digitally due to the administration's lack of capacity or digital management systems. At the same time, the study recommends that governments should consult citizens and intermediaries when prioritising which data to publish first (Open Data Barometer: Global Report Fourth Edition, 2017).

As a country-specific study, Srimarga's (2010) research seeks to understand the transparency portal for national budget data in the Ministry of Finance of Indonesia. The study explores the governance context that influences the creation of the initiative as well as its impact on budget advocacy work. The results draw on interviews with individuals on the data supply side (within the Ministry of Finance) and those who are potential users and intermediaries of the data, particularly from NGOs working on budget issues in Indonesia. The results suggest that the initiative allows NGOs to participate more in public decision-making as more opportunities to have input arise from the improved budget transparency. It enables NGOs to conduct evidence-based advocacy. It also reinforces the position of organisations that are able to conduct budget analysis on the quality of data and its ease of use. Nevertheless, the NGOs criticised that the data provided are sometimes inconsistent, deficient or not provided in useful formats and so can not be used for investigative purposes.

At the same time, the notion that greater transparency enables citizen action against corruption is brought into question. Bauhr and Grimes (2014) find that an increase in transparency in highly corrupt countries tends to breed resignation and reduce political interest and institutional trust, rather than fostering indignation, oversight and collective action. If citizens lack institutional avenues to hold office holders accountable with the information gained through increased transparency, their civic engagement may be deterred (Bauhr & Grimes, 2014).

In summary, impactful examples of big and open data on transparency portals in developing countries are still relatively rare. The impact of transparency portals on the supply side of information and enabling downward transparency appears to hinge on a variety of factors connected to its context and implementation. The main concerns appear to be the characteristics of data provided (open,

accessible, usable, relevant) and the ways they are used by intermediaries to arrive at intelligible analysis that can be used for advocacy. Transparency portals are only as good as the data they provide and the engagement of an active civil society or business community to be able to use the data as effective remedies for corruption. As a result of an effectively implemented transparency portal, governments may change the documentation of public data, enabling oversight and curbing corruption. On the other hand, the mismatch of supply and demand of data, a lack of resources, means of sanctions, and logistical challenges all appear to hinder effective implementation of such portals. Overall, we need a more nuanced and detailed understanding of how transparency portals providing open and big data can have an impact on corruption.

e. Distributed ledger technology (DLT) and blockchain

Blockchain, as one type of DLT, is a decentralised and synchronised database maintained by a peer-to-peer network where each user holds a copy of the blockchain. All information (such as transactions) are transmitted, verified and saved in the distributed ledger as blocks of information that cannot be changed or deleted. Therefore, permanent and secure records are created which can be used for cryptocurrencies, smart contracts, or file storage (Natarajan et al., 2017; Walport, 2015).

In this way, blockchain can be used to manage the supply chain of information, offering full transparency. It could be applied by governments for public transactions and documents, for example, for tracking budget spending, saving land records and company registries, or reshaping contracting and payment systems. This would mitigate some of the risks associated with central government databases that could be hacked or manipulated. Hence, using blockchain technology can increase transparency and prevent fraud, enhancing possible oversight and accountability (Kshetri, 2017).

Therefore, the application of blockchain-based technologies in developing countries is being seen as a carrier of great promises. However, it is not a panacea and, without well-planned policy and a holistic and the co-ordinated effort of all stakeholders, it appears unlikely to “be realized on a large scale anytime soon due to the resistance of the existing leadership and lack of infrastructure” (Kim & Kang, 2017). At a most basic level, blockchain technologies are as good as the data entered into them. Where people record transactions improperly, enter inaccurate data or deliberately falsify records, no significant positive impact can be expected. On top of that, blockchain technology may even pose a threat to anti-corruption efforts as it enables fully anonymous and encrypted cryptocurrency transactions that may be used for embezzlement or fraudulent deals.

Evidence

Unfortunately, a lot of potential interventions are still being developed and piloted. In Ghana, for example, two start-ups, Bitland and Benben, aim to introduce blockchain-based land registries and real estate transactions. The Swedish and Georgian governments experiment with blockchain technology for land registries. In the Ukraine, the government plans to move its farmland registry and state property and land registers to a blockchain-based system (Huter, 2018).

In international development co-operation, blockchain technologies can bring about innovative ways of establishing a direct link between donors and recipients. This can circumvent the allocation of funds to organisations or administrators where corruption could happen. For instance, a South African start-up has established a platform where donors can fund utility costs for South African schools using bitcoin. Another example is the African TruBudget platform where international donors can see what spending decisions have been made by a given government ministry. The platform uses the immutability of the blockchain as a way to build trust that money is actually being spent according to what was announced and agreed on.

Nevertheless, examples of blockchain applications that are already mature and applied by governments are scarce. Therefore, it is too early to say what effects such innovations may have and their use for increasing accountability or facilitating corrupt acts. Besides, it needs to be determined to what extent blockchain-based innovations add value compared to earlier interventions (Huter, 2018). In other words, to what extent does the introduction of blockchain-based technologies itself have an impact on corruption, on top of the effects brought about by the earlier digitalisation of government processes?

Additional research is required to establish if cryptocurrencies may facilitate corruption and money laundering because, unlike banking transactions, they are not subject to regulation and government oversight. While cryptocurrencies allow for highly secure payments, their transactions are publicly visible. The parties to the transaction, however, can remain anonymous, and the technology could be used to move, launder and protect illegitimate funds.

To sum up, on the one hand, blockchain technology can impact on the supply side of information as it offers increased levels of transparency and accountability to the public sector, cutting out 'middlemen' with discretion over resources, and thus reducing corruption opportunities. On the other hand, it is largely untested and this deviation from traditional ICT solutions requires government willingness and training. It also poses a challenge to data security and regulation, and could possibly even enable the transfer of corrupted money.

It is too early to assess the impact of blockchain-powered applications as an anti-corruption tool; more experimentation and innovative cases should be developed and rigorously tested. It is crucial that governments continue to turn paper-based processes into digital ones. The digital processes could later be moved to a blockchain application, if blockchain is found to add value and further improve transparency.

f. Artificial Intelligence (AI)

AI technologies, distinguished by their ability to demonstrate intelligence in the form of learning or problem solving, are increasingly arousing attention from policy-makers due to their potential predictive power. Applying neural networks that have the ability to learn data structures can potentially uncover hidden relationships such as corruption, and can be used for more precise prediction models. One such neural network tool is a self-organising map that can extract patterns from large data sets and visualise them without an explicit understanding of the underlying

relationships. It is argued that this type of map could become a powerful tool to predict corruption (López-Iturriaga and Sanz, 2017). In this way, AI could increase the effectiveness and efficiency of predicting, detecting and pursuing corruption. However, such technologies are only as good as the data they are based on. They may replicate past biases and miss new developments. Criminal groups can also use AI tools to increase their own efficiency and better predict threats to their organisations and business models.

Evidence

The literature on AI and corruption is scant, but previous research used data-mining techniques and neural networks to predict patterns in related fields such as crime (Li and Juhola, 2014), credit risk evaluation (Swiderski, Kurek and Osowski, 2012), and fraud detection (Olszewski, 2014).

One notable application in the AI literature for predicting corruption was developed in Spain at the University of Valladolid as an early warning system based on a neural network approach creating self-organising maps (López-Iturriaga and Sanz, 2017). The researchers used data of corruption cases reported by media or dealt with in court from the various Spanish provinces between 2000 and 2012. Their findings indicate that the taxation of real estate, economic growth, the increase in real estate prices, the growing number of deposit institutions and non-financial firms, and the same political party remaining in power for long periods appear to stimulate public corruption. They argue that their computer model can calculate the probability of corruption in different provinces and the conditions that favour it, providing time frames to predict corruption up to three years in advance (López-Iturriaga and Sanz, 2017).

At the current state of development, and with the lack of scientific evidence, the impact of AI on corruption and its potential – especially for developing countries – is difficult to assess. Future developments should be accompanied by rigorous assessment and build on existing evidence from other areas of application.

4. Conclusions and recommendations

ICT has affected the work of all actors involved in or against corruption, including public institutions, civil society organisations, the private sector and the media. While many see great promise in this development, the effectiveness of ICT tools, as well as their drawbacks and potential misuse, vary widely. Some technologies may even enable corruption. To understand the state of play, this paper systematically reviewed the evidence on the use of ICT *for* as well as *against* corruption across the globe, with a particular focus on developing countries.

We defined corruption as the abuse of entrusted authority for illicit gain, recognising that corruption in particularistic societies essentially reproduces the existing structures of unequal distribution of power. We consider different kinds of corruption – on a grand as well as bureaucratic and petty level. We understand both natures of corruption as a principal-agent as well as a collective action problem, looking at how ICT can help or harm oversight, accountability, civic action and norm change.

ICT affects corruption in two main ways. First, it changes the supply side of information from governments to society: ICT removes opportunities for public officials to misuse their discretionary powers and increases oversight and downward transparency. However, instead of mitigating corruption, introducing ICT-based systems on the supply side of information may shift corruption opportunities to other areas of government activities as well as create new vulnerabilities for hacking and manipulation. Second, ICT affects the demand side of information from society to governments, creating forms of upward transparency where citizens can report cases of corruption and find platforms to exchange information and organise collective action. At the same time, such platforms can be used to spread false information or facilitate the organisation of criminal activity. The twofold nature of ICT – how it potentially cuts both ways in anti-corruption efforts – underlines the importance of considering the political, infrastructural, social and economic context of such interventions, as well as the risk of misuse.

Having taken stock of the available academic and policy literature, we have been able to shed light on the detailed characteristics of ICT tools for anti-corruption efforts. The broad search focused on empirical papers with solid theoretical framework, where available. The review was organised by sorting the different ICT-based anti-corruption interventions into the following (not mutually exclusive) six categories:

- Digital public services and e-government
- Crowdsourcing platforms
- Whistleblowing tools
- Transparency portals and big data
- DLT and blockchain
- AI

The literature on **e-government** is extensive as the concept encompasses various dimensions with a lot of research on the impact of the digitalisation of public services on corruption. Overall, the findings frequently highlight the importance of e-government as a useful tool for strengthening

the supply side of information. There is a clear statistical relationship between different measures of e-government adoption and reduced corruption. However, case study evidence indicates that, depending on a number of factors concerning the design of e-government interventions, digital public services are not effective and can even provide new corruption opportunities – for example, as public officials have access to digital databases. Therefore, to be effective, their implementation needs to be embedded in broader administrative reform.

The evidence base for the impact of anti-corruption **crowdsourcing** platforms on corruption is quite thin. A number of case study investigations look at success factors for crucial broad participation, such as ease of use, guarantee of anonymity, and existence of follow-up action. From these examples it appears that crowdsourcing platforms can affect the demand side of information and foster upward transparency when implemented well, but possibly also enable corruption or have no impact at all due to the low number of users.

With regards to ICT-enabled **whistleblowing** tools, there is limited statistical and anecdotal evidence to show that they can facilitate detailed reporting on cases of grand corruption, which can be followed up with legal action. The protection of whistleblowers' identities and appropriate follow-up action is crucial in the design of such tools, as otherwise potential whistleblowers might be deterred from, or could even be endangered by, reporting corruption.

Concerning **transparency portals**, impactful examples that provide big and open data used by civil society or the business community are still relatively rare, particularly in developing countries. The scant literature indicates that the mismatch of supply and demand of data, a lack of resources, means of sanctions, and logistical challenges commonly appear to hinder effective implementation of such portals. Further evidence is greatly needed on the impact of such portals on the supply side of information and enhancing downward transparency.

The newly emerging **DLT/blockchain technology** is anticipated to have great potential for enhancing downward transparency and accountability in the public sector. However, it also raises concerns about data security and, for instance, enabling untraceable flows of money. Its impact and added value is yet to be determined as the implementation of blockchain technologies in the public sector is still experimental.

Similarly, while the application of **AI technologies** carries great promise – for example, the use of self-organising maps to detect underlying patterns in big data – at the current state of development, and with the lack of scientific evidence, the impact of AI on corruption and its potential – especially for developing countries – is difficult to assess. Future developments should be accompanied by rigorous assessment and build on existing evidence from other areas of application.

Drawing on the commonalities across different technologies, ICT can support anti-corruption in a variety of ways. It can enable the promotion of transparency, accountability, while also facilitating advocacy and citizen participation. It has also proven to enable a closer interaction between government and citizens – for example, by enhancing access to public information. ICT can genuinely impact on public discretion and scrutiny – for example, digitising and monitoring officials' activities and public services, and enabling corruption reporting.

However, ICT can also facilitate corruption. Emerging technologies can provide new corruption opportunities related to the dark web, cryptocurrencies, or simply through the misuse of well-intended technologies such as digital public services. ICT can also contribute to the centralisation of corruption opportunities such as a central database holding all records for financial transactions in situations where previously transactions were highly decentralised. These underline the fact that ICT is not *per se* a panacea against corruption, and it can also play into the hands of corrupt officials.

The existence and availability of these tools does not automatically translate into their use. Nor does it guarantee any desirable anti-corruption impact. This is because the tools crucially depend on the specific content provided, and require connectivity and a certain level of ICT proficiency. And this is something that cannot be taken for granted in developing countries. Similarly, the application of ICT tools for anti-corruption needs to acknowledge the digital divide between different social groups. The success of ICT interventions against corruption hinges on their suitability for local contexts and needs, cultural backgrounds and technology experience. Finally, for ICT to be effective in controlling corruption, it still very much depends on political parties, public administrations and civil society groups; on its own, it is likely to remain ineffectual.

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