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Viewpoint, Policy Forum or Opinion

## Digital contact-tracing and pandemics: Institutional and technological preparedness in Africa



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### ABSTRACT

Several countries in Africa have either deployed or considering using digital contact-tracing (DCT) as part of their Covid-19 containment strategy, amidst calls for the use of technology to improve the efficiency of traditional contact-tracing. We discuss some of the complexities entailed in using DCT in Africa. Adopting a socio-technical perspective, we argue that if DCT design and deployment are not well thought out, it can lead to unintended consequences, particularly in a continent like Africa with disproportionate levels of digital divides and other structural inequalities. We suggest that any adoption of DCT by African countries must take account of their compatibility with local resources, values, social structure, and domestic political factors. Accordingly, we propose a process of *translation* whereby DCT adaptation is made to accommodate the unique institutional and technological characteristics of African countries by leveraging local practices learned from previous pandemics like Ebola to develop a *blended epidemiological approach* to (digital) contact-tracing.

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### 1. Introduction

Contact-tracing- the identification and follow up of persons who may have had contact with someone exposed to an infectious disease- is an important part of any epidemiological investigation and active surveillance. The [Africa CDC \(2020, p. 2\)](#) guidelines on Covid-19 contact tracing have advised member states to use “the characteristics of the epidemic in their country to decide when and how to do contact tracing”. Some African countries have learned best practices for contact-tracing from previous infectious diseases such as the Ebola virus (“EVD”) ([Largent, 2016](#)). These experiences have made it clear that there are logistical and governance challenges in the implementation of traditional/manual contact-tracing ([Greiner et al., 2015](#)). The recognition of these challenges has resulted in calls for the use of digital contact-tracing (DCT) to improve the efficiency of traditional contact-tracing.

Thus far, our African country analysis indicates Rwanda and Egypt have implemented GSP enabled DCT with the use of mobile app and cellphone tower data respectively. The South African government has partnered with the University of Cape Town to develop GSP enabled DCT with a mobile app. WHO AFRO is piloting

a project with the Republic of Congo to repurpose the Polio GIS platform previously developed for EVD, into Covid-19 DCT. Furthermore, WHO is also developing a global app for checking symptoms and tracing contacts, that should support African and other developing countries in their fight against Covid-19 ([Dave, 2020](#)).

Until now the discourse on the suitability and effectiveness of DCT has primarily focused on privacy issues ([Ferretti et al., 2020](#)). This discourse often takes a techno-centric perspective with a focus on how to address data security and privacy concerns through technical solutions ([Yasaka, Lehrich, & Sahyouni, 2020](#)). While privacy issues are important, we argue that if DCT design and deployment are not well thought out, it can lead to unintended consequences, particularly in a continent like Africa with disproportionate levels of digital divides<sup>1</sup> and other structural inequalities ([Arakpogun, Wanjiru, & Whalley, 2017](#)).

Adopting a socio-technical perspective, we argue that inscribed in DCT design is a certain “vision of (or prediction about) the world” ([Akrich, 1992, p. 208](#)) – that is, assumptions about the world of the users and how they are going to use the technology. We suggest that any adoption of DCT by African countries must take account of the compatibility of these design assumptions with local resources, values, social structures, domestic political factors and the reality of users in the African context. Accordingly, we

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<sup>1</sup> Digital divides here include the lack of access to telecoms network, affordability of mobile devices and digital literacy.

argue that the unproblematic *transfer* of DCT to African countries can result in the marginalisation of people who suffer a varying degree of digital divides and other structural inequalities. Instead, we propose a process of *translation* whereby DCT adaptation is made to accommodate the unique institutional and technological characteristics of African countries by leveraging local practices learned from previous pandemics like EVD to develop a *blended epidemiological approach* to (digital) contact-tracing.

## 2. Techno-centric vs socio-technical perspectives

A technocentric view of DCT would conceptualise it as “isolated technical artefacts, the collection of hardware and software” (Heeks, 2005, p. 25) which entails using a smartphone app to identify and trace contact persons. This techno-centric view is often criticized for its relative neglect of the interplay between technology and its societal context of deployment by focusing on the techno-economic benefits of a given technology (Walsham, 2017). The limit of such view is that it portrays technological artefacts as neutral material objects, and thus conceals “how institutions influence the design, use, and consequences of technologies” (Orlikowski & Barley, 2001: 153). In contrast, socio-technical perspectives emphasise the interplay between technology and its context of design, implementation and use (Avgerou, 2008; Hatakka, Thapa, & Sæbø, 2019). According to this perspective, technologies are inherently political since they involve decisions about their designs that cater to certain users' interests and exclude others (Spicer, 2005).

Technologies inscribe the social beliefs and assumptions of the creators and stakeholders involved in its design (Akrich, 1992). The concept of inscription from actor network theory (Joerges & Czamiawska, 1998; Latour, 1992) is central in this view to capture the idea that technology producers inscribe into a technology “a series of technical norms that specify the standard uses of that technology and how the technology itself is to behave” (Spicer, 2005, p. 869). These inscriptions reflect the designers' assumptions about the potential user, their skills, and the contexts in which the technology will be used (Linderoth & Pellegrino, 2005).

The realisation of the social embeddedness of technology design, implementation and use, have led scholars to bring attention to the difficulties involved in transferring technologies across contexts (Heeks, 2005). In particular, scholars in the field of ICT4D have challenged the idea that ICT can be deployed unproblematically in developing countries to achieve socioeconomic development goals, rather they pointed out that such endeavours often fail due to differences between the design and implementation contexts (De', Pal, Sethi, Reddy, & Chitre, 2018), which leads to unintended consequences by marginalising vulnerable groups whose circumstances are already precarious and not considered by technology producers (De' & Ratan, 2009).

## 3. Transferring technologies across contexts

Prior studies on the diffusion and adoption of e-government systems and applications in the public sector can provide us with important insights into the use of DCT in developing countries. As the literature on e-government has shown, the diffusion and adoption of these systems are uneven globally with developing countries lagging behind (Cavalheiro & Joia, 2014; Zhang, Xu, & Xiao, 2014).

A unifying theme across these studies is the idea of a “contextual mismatch” (Heeks, 2005) between the original context in which the technology was designed and the context to which it is transferred. The cultural, institutional and technological differences across countries complexify the technology transfer process

and its successful deployment. Heeks (2005) points out this is especially the case when a certain technology is developed by designers from a developed country for developed country users and then subsequently transferred and adopted by a developing country.

Of relevance to our discussion are the unintended consequences on vulnerable people's circumstances that might result from the unproblematic transfer of technologies across contexts. For example, Prakash and De' (2007) show how introducing a computerized land records system in India has marginalised small and landless farmers. As Heeks (2005) points out, in these situations, this mismatch is a result of a design-reality gap as designers fail to take into consideration the local conditions of the context in which the technology is deployed. As pointed out earlier, a technology contains inscriptions (Latour, 1992) which are assumptions or expectations about the user's context and how they will use the technology. These assumptions are “perceptions of the designer about the world of the user, so they are drawn from the world of the designer” (Heeks, 2005, p. 56), and shaped by the cultural and institutional environments in which the technology emerged.

Therefore, it is vital to uncover the assumptions inscribed into the architecture and design of DCT. Prior studies have identified different design dimensions that capture the contextual elements inscribed in a design (Heeks, Mundy, & Salazar, 1999; Heeks, 2005). These inscriptions involve assumptions about: the *information* to be handled by the application; the *technology* needed by the application; *processes* through which the application will function; implicit *cultural values* that the users hold; the *skills* needed by both the staff managing the application and the users; *management systems and structures* needed to deploy and manage the application; and finally *other resources* needed to deploy and maintain the application (Heeks et al., 1999).

We apply the framework proposed by Heeks et al. (1999) to uncover the inherent assumptions in DCT design and examine their suitability in the African context. As shown in Table 1 in the online appendix, some dimensions like information and technology requirements are explicit. For example, for DCT to be successful, it requires users to possess smartphones and that individuals' information is easily retrieved through a central government repository. These inscribed assumptions can be problematic in many African countries which suffer from weak or non-existent data privacy regulations, and low mobile phone penetration rates (GSMA Intelligence, 2020). Conversely, dimensions such as cultural values are more implicit. For example, experiences from prior infectious diseases suggest that there is stigmatisation and fear of contact-tracing measures. Greiner et al. (2015, p. 54) found that in some communities “naming a contact-person has been perceived as assigning a person to a death list”.

Additionally, the successful deployment of DCT presumes that staff are adequately trained and that users possess the required digital skills to use the app. But as prior studies showed, lack of digital skills is among the main contributors to the digital divide in Africa. Finally, the deployment and management of DCT requires a well-functioning public healthcare system and tight integration between the different state institutions involved in contact tracing, which are both problematic in the African context. Overall, Table 1 shows the need to contextualise inscribed assumptions into the design of technology as critical to avoid creating a “contextual collision” (Heeks, 2005) which could lead to the failure of new technologies like DCT and inhibit the containment of Covid-19 pandemic.

## 4. The way forward: From technology transfer to translation

While tracking contacts of positive cases and using technology may be effective in curbing the outbreak of Covid-19 pandemic,

application without adaptations could put public health at odds with the reality of the structural inequalities across Africa (Miller, Toffolutti, & Reeves, 2018). Any DCT should ideally be supported by initiatives that not only increase access to mobile technology, but also develop the infrastructure required for its effective deployment and uptake. It cannot be ignored that some individuals in African countries leave little or no trace in the digital realm (Robinson et al., 2015).

To mitigate the risks of contextual collision and mismatch in the design and deployment of DCT and the unintended consequences that follow, we propose a *blended epidemiological approach* to (digital) contact-tracing in Africa – a pandemic strategy that is underpinned by a process of *translation* whereby DCT is made to reflect the unique institutional and technological characteristics of African countries, through combining it with local initiatives learned from previous pandemics such as EVD. The idea of translation “refers to the process whereby ICT ideas are reinterpreted and implemented in particular organizational settings (Czarniawska & Joerges, 1996)” (Nielsen, Mathiassen, & Newell, 2014: 170). While the notion of diffusion implies that technologies are transferred unproblematically and without modification (Nielsen et al., 2014), the concept of translation emphasizes how technologies can be made relevant as actors translate and adapt them to suit their local conditions. Such an approach would involve developing a more inclusive containment strategy by relying and combining both DCT and bottom-up local initiatives to mitigate the unintended consequences that might arise from the sole reliance on DCT (see Table 2 in the online appendix for examples of local Covid-19 initiatives across Africa).

Accordingly, local initiatives like Mammy Queens, town criers (troubadours) and religious leaders, which aim at raising communities’ awareness of the disease, could be embedded with DCT to close the *information* dimension gap in Table 1. Prior research indicated that these community groups are a democratic method through which people can educate themselves on different topics (Bjerkaker, 2014; Wamala, 2012). The use of local inventions such as the Veronica Bucket which aims at facilitating public handwashing could complement DCT and close the gap of *other resources* dimension in Table 1. In addition to combining the existing local initiatives in Table 2 with DCT, African governments can further contextualise the process by using, for example, universal service fund<sup>2</sup> to help vulnerable people secure mobile phones as practiced in Taiwan. This will help close the *technology* dimension gap in Table 1. Our proposed blended approaches will go a long way in helping policymakers in Africa to protect vulnerable groups, who are already disproportionately impacted by Covid-19 pandemic.

### Conflict of interest

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers’ bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

### CRedit authorship contribution statement

**Emmanuel Arakpogun:** Conceptualization, Data curation, Supervision, Project administration, Investigation, Writing - original

draft. **Ziad Elsahn:** Conceptualization, Data curation, Supervision, Investigation, Writing - original draft. **Karla Simone Prime:** Data curation, Formal analysis, Resources, Writing - original draft. **Paolo Gerli:** . **Femi Olan:** Data curation, Resources, Writing - original draft.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.worlddev.2020.105105>.

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<sup>2</sup> See Arakpogun et al. (2017) for details.

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