

## **Developing a Digital Information and Consultation *telehealth* Platform in Zimbabwe for Zimbabwe**

REPORT/WORKING PAPER for UNDP Consultation on “**Scaling Up Telehealth to Promote Equitable Access to Essential Health Services**”, by dr Gertjan van Stam, Masvingo, Zimbabwe, gertjan@vanstam.net, +263776638773

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**Abstract.** This report presents a narrative on the development of a COVID-19 digital information and consultation – telehealth - platform for a province situated in Zimbabwe. The project fostered dialogue, engaged communities and stakeholders, and utilise locally available technologies and skills. In response to a WHO prediction and call to prepare for the worst, a team of medical and computer experts worked on a sovereign digital platform that facilitates COVID-19 triaging over the phone. In this report, the development of this digital platform is described in the wider concept of local development, data sovereignty, and growth of local capacity and abilities in Zimbabwe, under the auspices of the Zimbabwe Ministry of Health and Child Care. The work shows the successful development of a digital platform for COVID-19 digital health intervention that is aligned with local capacity and needs.

### **Introduction**

The world of platform economy is dominated by digital platforms from the USA and China [1]. In public health, the use of foreign, privately owned digital platforms is at odds with the functions of the health system, especially in providing appropriate and secure venues for health care [2]. The issues of data-sovereignty are crucial for Ministries of Health [3]. This report narrates the development of a government owned Digital Information and Consultation Platform (DICP) for a COVID-19 response in Zimbabwe in a process that is cognisant of these macro-political circumstances.

## **Method**

This retrospective work is drawn up in collaboration and co-development with participants, with capturing of information from the moment of the DICP conception, through its design and development, and its training and operational phases. The work is set along a dynamic and integrative epistemological route, integrating long-term, diverse and differentiated experiences, embodied understandings, value judgements, and actions, residing in Zimbabwe [4, 5]. The report harmonise longitudinal observations, experiences and learnings with the aim to recognise patterns and wrestle local understanding out from under an Eurocentric gaze as an act of decolonisation [6]. As such, the work addressed decentered, inclusive, multifaceted understandings and the emancipation of polyvocality (the consideration of many voices), diversity and multiple perspectives, with preference for the African positionality [7].

## **Sequence of events and their grounding (2020-2021)**

In March 2020, in response to the COVID-19 pandemic, the World Health Organization (WHO) signalled that Africa should prepare for the worst [8]. The projected worst-case scenario was a high prevalence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in an overwhelmed public health system. Immediately, the Zimbabwean Ministry of Health and Child Care (MoHCC) set out to consult its network of Digital Health specialists. The eHealth team of SolidarMed Zimbabwe – a Masvingo based private voluntary organisation, together with the Masvingo Hackathon [9] responded and developed participatory plans for an African, sovereign digital health intervention. The proposed digital health response was geared towards supporting and strengthening the Zimbabwean health system during the COVID-19 pandemic, taking into account the Zimbabwean context for digital health [10] and its desire for data sovereignty [3]. Subsequent development took place under close supervision and guidance of the MoHCC. The aim was to provide a digital health intervention that allowed for the continuation of access to health information and care in the event that the worst-case scenario described by the WHO would happen.

From the outset of the COVID-19 pandemic, the Government of Zimbabwe urged medical professionals to switch to digital health interventions. Developing a telehealth ‘contact centre’ to support the health system became an innovative way of heeding this call. From previous work [11, 12], the team was aware that decentered, inclusive engagement of all stake- and relationholders is crucial for shared ownership and the embedding of local know-how [13]. This is in line with

Philip Alston, the United Nations' special rapporteur on extreme poverty and human rights, argument that the protection of human rights when using technology depends on the level of its co-development [14]. This co-development includes the unlocking of embodied knowledge [15] and the depth of local engagement in underlying the processes that form the system [16]. Due to the lockdown to counter the COVID-19 pandemic, the engagement process materialised through regular interaction via communication platforms like Skype, WhatsApp and Zoom.

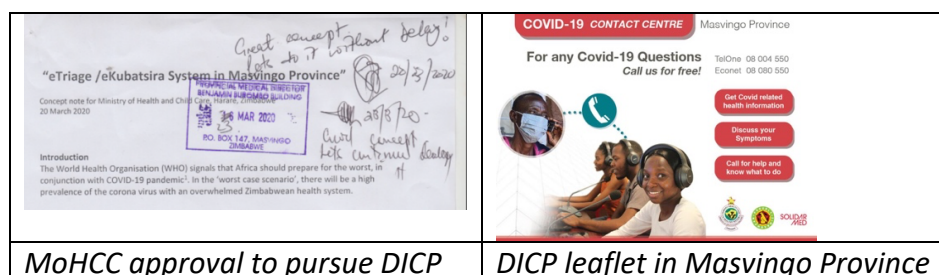
From his observations and lessons learned from years of ICT development projects, Tim Unwin, the UNESCO Chair in Information and Communication Technology for Development (ICT4D), offered the following priorities in developing digital platforms and interventions [17]:

- Ensure that there is no duplication of efforts
- Regard privacy and security carefully
- Ensure no detraction from official information
- Keep it simple and support and use *existing* technologies
- Collaborate and share

The project aligned with these principles. Also, the activities benefited from lessons learned from the parallel co-development of a transnational framework for digital health in international cooperation [18, 19]. Further inputs were gleaned from literature and the WHO. An evaluation of a national call centre in Guinea argues for the decentralisation and regionalisation of call centres, as the picking up of cases that need attention was found to be higher in local prefectures [20]. During the Ebola crisis, the GSM Association (GSMA), representing the interests of nearly 750 mobile network operators and associated industries at the time, stated: "Where possible, government should activate a call centre or support desks to respond to Ebola enquiries from citizens who call in." [21] The WHO reported positively about its experience with call centres in times of emergency (for example, Goma [22]). For the COVID-19 pandemic, the WHO advocated the use of call centres to spread information [23]. The Zimbabwean MoHCC operates a national call centre situated at the Parirenyatwa Hospital in Harare. A regionalisation of this call centre is envisioned, but no resources nor public infrastructure was available to establish such call centre facilities in the provinces. Hence, the conceptualised DICP was positioned to provide a proof-of-concept and proof-of-production through a Minimum Viable Product (MVP) to fill void, with an initial focus on providing COVID-19 services for Masvingo Province.

Within two weeks from the initial consultation, the MoHCC had reviewed and approved the concept for the development of the DICP as a Zimbabwean eTriage

system to be used in Masvingo. At the end of June 2020, three months later, a proof-of-concept was presented online to the MoHCC at the national level, and a functional proof-of-production, the MVP, was made to the ministry’s provincial leadership in Masvingo province, Zimbabwe three months later. After securing the platform against malicious traffic and connecting the DICP to public telecommunication networks, the DICP became fully operational in the last quarter of 2020.



### Context of telehealth: Digital Health

The term digital health is rooted in eHealth, which is defined as “the use of information and communications technology in support of health and health-related fields” [24]. In the African context, digital interventions are subject to behavioural, cultural, social, political, and economic determinants [25]. Therefore, digital health development demands comprehensive – not only technical – approaches within the national setting of public health, with careful considerations of national security [26] and efforts to keep health data within relevant sovereignties [27]. Further, digital health interventions, which currently involve a myriad of digital platforms and systems, are to become an integral part, and backbone of, health operations to facilitate nationwide service provisioning, measurement and evaluation. They are to harbour a range of tools and applications that are open to public and political scrutiny [10].

Digital platforms encapsulate and frame digital health interventions [2, 3, 28]. They can conceal efforts of geopolitical meddling. Strings attached to aid-packages can allow the entry of foreign interests, for instance, for market entrance [29]. At present, China and the USA own around 90% of the digital platform economy worldwide, with Africa conjunct with Latin America account for only 1% [1]. Opening up to foreign-owned, private digital data gathering platforms poses significant threats for people and national security [28]. Outsourcing the development of digital health infrastructure crowds out local agendas, autonomy, the beneficitation of local

capacity, public spaces, national values, and the involvement of national institutes of learning [30]. The use of foreign platforms strengthens foreign jobs while disempowering local capacity, subjugating it to “Africa failing” narratives of agency deficits, lack of imagination, and lack of capacity [31, 32].

The 2019 Zimbabwe Multiple Indicator Cluster Survey (MICS) found that in Zimbabwe mass media had a limited reach [33]: Newspapers reach 26%, radio 58%, and television 43% of the population. Additionally, the survey found that mobile phone had the highest penetration in households: 85%. In addition, the survey found that about 90% of Zimbabweans had used a mobile phone in the last three months. Therefore, the DICP focuses on the use of mobile phones, albeit cognisant that international reports on mobile phone use might not align with local realities [34].

References from resource-rich environments, with long-term embedded systems are no benchmark for interventions in resource-challenged environments. Africa has shown capacity for leapfrogging, where legacy systems did not exist. An example is the ubiquitous use of digital money platforms. In the Ebola outbreak disaster, companies like SES (Luxembourg) have benefitted in West Africa, as did various (Western) universities. All supporting digital health infrastructure and most health data was removed after the Ebola projects, leaving the government and institutes disempowered [35].

At the time of the first conceptualisations of this telehealth project, there were not many examples of digital health COVID-19 interventions that could be learned from. However, the situation changed rapidly, with companies, civil society organisations, international organisations, academics, and donors starting countless initiatives. Developers of US-based digital platformed pledged to provide cloud-based services ‘for free’ during the onset of the pandemic. After a grace period, however, users were expected to pay hefty fees. In the meantime, concepts, designs and data were extracted from Africa and could serve as blueprints for interventions with data stored and processed on the North American continent. Commcare, for instance, stated on its website: “data for projects using <https://www.comcarehq.org> is stored inside within the United States (AWS Data Centre in Northern Virginia)”.

## **Results**

The DICP facilitates COVID-19 services that provides health information to the population, consultation and counselling to patients, and information for health care workers while also having the ability to contribute to Zimbabwean data collection,

disease mapping and surveillance. During various phases of the COVID-19 pandemic, patients are encouraged to stay at home and health professionals to use the digital health tools. The DICP facilitates phone access for medical advice and guidance. This is particularly important where the frequency of emergencies seems to increase, for instance with Cholera outbreaks, and natural disasters like cyclones Idai in 2019 and Chalane in 2020.

The telehealth Digital Information and Consultation Platform (DICP) came into being using a participatory, co-development approach that relied on embedded, local, national, and African capacity aligned with local realities and geared towards African communities, in a bottom-up manner. Due to the volatility of the COVID-19 pandemic, everyone was learning 'on the fly'. With limited COVID-19 funding flowing 'all the way down' to intended recipients, the development team relied upon serendipitous rigour, taking advantage of opportunities that serendipity provides to resource local concepts and practices that advances the needs in the pandemic and empowers Zimbabwean communities-of-practice [14, 36, 37].

Software developments used an Agile software development approach with dedicated, digital project management and version control tools. Due to the subsequent and protracted lockdown of all areas/people in Zimbabwe, the engagements and work were primarily sustained in cyberspace. The various expertise and authorities were grouped into three teams, working in parallel:

- **Medical:** This team focused on the design of an electronic/virtual triage process, to develop the COVID-19 triage flowchart and compile and approve the content for agents, including protocols supporting information sharing and decision making. They guarded against duplication of efforts and aligns with the official communications from the Government of Zimbabwe, WHO and other (inter)national recognized bodies of knowledge, augmented by insights from the latest health research. The team consists of certified medical doctors only, including representatives of the MoHCC in Masvingo province (the Provincial Epidemiological Diseases Control Officer) and infectious disease specialist at MoHCC, headquarters. The team guarded the medical soundness of the digital health intervention.
- **Communications:** This team was responsible for the design and implementation of a communications server, using free and open software (FOSS) to provide for a contact centre capable of routing numerous concurrent calls and messages to agents located in a call centre in Masvingo, or at virtual locations (for instance,

experts in the diaspora). The team involved members of the Masvingo Hackathon, computer science and information system experts drawn from the MoHCC and the non-governmental organisation SolidarMed based in Masvingo province. The focus was to keep it simple and affordable by focussing on equipment easily available in Zimbabwe and leveraging on the practical and academic work done by communities and eHealth developments in Africa over the past years.

- **Information:** This team took on the scripting the web-interface, database and dashboard facilities that, through computer telephony integration with the communications team link incoming caller identification numbers with data registers. Each agent is provided with supporting information and led through the triage process (as designed by the medical team). The team drew upon information technology experts and designers from the MoHCC, Zimbabwean private professionals, and the Masvingo Hackathon, among others. Robust data management and the primacy of privacy and security was ensured by the involvement and dedication of certified IT professionals.

In 2020, in Zimbabwe, the COVID-19 pandemic did not develop into the worst-case scenarios anticipated at the start of the development. Alternative, private initiatives to provide phone-in COVID-19 services, like ZIMCAT, ran out of steam and folded services during the second part of 2020 (without transferring their data-repositories to the MoHCC). Meanwhile, the DICP MVP achieved outcomes beyond expectations. It comprised the first locally developed comprehensive COVID-19 digital health intervention able to cater for a provincial response.

Through SolidarMed, a private voluntary organisation in Masvingo province, CHF 45k funding was raised to facilitate the DICP development and training. Agents were selected by the Provincial Medical Directorate of the MoHCC in Masvingo. The initial team of agents consists of six MoHCC staff taking turns of responding to incoming support requests. Initial agents include the Provincial Health Information Officer, the supervisor of the team of agents, the Provincial Health Information Assistant, and 4 Environmental Health Officers/Technicians.

The DICP COVID-19 service became operational during the fourth quarter of 2020. The implementation was happened by lengthy administrative and security vetting of the organisations involved in the securing of toll-free Public Telephone Network lines from Zimbabwe telecommunications operators. After months of of filing

paperwork and meetings, two out of four Zimbabwean telecommunications operators granted access through their toll-free telephone numbers. Dissemination and marketing the availability of the DICP platform was done involving provincial and district offices as well as through health facilities and community workers. Furthermore, the toll-free numbers were announced through social media platforms like WhatsApp and Facebook, newspaper adverts, SMS, and other community interactions. Flyers and posters were developed in Shona, Shangani, and English language and distributed throughout Masvingo Province. Three videos for Facebook-distribution were developed, one addressing the general public, one for Health Care Workers, and one for DICP agent supervisors.

### **Discussion**

Early on in the onset of COVID-19, previously cited Tim Unwin warned that many digital development projects focus on donor profiles instead of impact. This would void lessons learned of past failures [38]. He argued the need for careful planning to bring about fundamental changes to infrastructure and government services, to ensure their embedding in the world ‘after the COVID-19 pandemic’. For the DICP developments, the concept of the Electronic Health Facility (EHF) provided for such a focus on embedding, positioning the DICP as an instance of an EHF for access to the national health system by means of communication devices [39].

The DICP development became forward resilient [40] due to the use of local expertise that autonomously designed the platform and services utilising local infrastructure. User interactions happened circularly with training events and follow ups with stakeholders. As soon as a proof-of-concept and Minimum Viable Product was developed, discussions started for national scale up, sustained by frequent visits forth and back of MoHCC with the development teams and other stakeholders.

### **Centring Zimbabwe**

The DICP outlook was for digital health interventions that build up from local knowledge, employing the value of ‘being together’, adhering to principles of open and co-development by engaging communities, enhancing local workforce, and catering for local and national thought leadership [in line with 19]. Imported digital health systems have a track record of complicating matters, as they are made without African needs in mind [41], inflicting high cost of ownership, need for specialist human resources, and the requirement for unnecessary high-capacity infrastructure. Adaptation of imported systems can be resource-intensive, with customisation processes while, during the adaption processes, supplier system-

parameters often change. Therefore, the DICP development focussed on solving local needs in alignment with embodied knowledge in Zimbabwe's community-of-health-practice. The system benefitted greatly from the involvement of the various levels of government, ultimately the largest resource for local, regional (provincial), and national development [42]. The focus on development in Zimbabwe strengthened self- and cross-pollination, resulting in an embedded and wholesome, locally build and maintained, modular digital platform offering services that amplify the intent of communities, as well as provincial and national institutions, and using close-by agency and national capacity to design produce, install, and maintain the platform and its services.

### **Community engagement**

Inclusion and participation are the hallmarks of community engagement [43]. Engagement must be grounded in shared values and shared purpose. Embedded in the authority of the Technical Working Group Digital Health in the MoHCC, and focussed on the call for readiness from WHO, this project derived its focus. The shared purpose – developing a COVID-19 eTriage system from and in Zimbabwe – expedited co-development and positioned the DICP for sustainability and respect for human rights [14]. Community members, the ultimate health care clients, co-developed the system and harnessed local resource for its conceptualisation right up to the moment of realisation. Local agendas, from the MoHCC both nationally and in the province, became the pointers, ownership was embedded, and proceedings propagated among various communities-of-practice – in health care and in information and communication engineering – in Zimbabwe.

In the development of the DICP, knowledge and expertise were found to be readily available within Zimbabwe. It was advanced through dialogue along national values, love for humanity (doing 'the right thing' as per *ubuntu/unhu* [44]), orthopraxis, and the synthesis of critical reflection and action. Dynamic, integral meaning-making, exploring meanings contextually and setting the frame of reference as a logic of local cultures, needs presence to instil embodied, local knowledge and ontological understanding. As a result, the DICP is an embodiment of local knowledge and practices.

### **Workforce enhancement**

In line with the ethical behaviour [44], workforce enhancement emancipated local communities and communities-of-practice. The work built on what is going well, using locally available tools and equipment, and existing capacity and agency, in line with Zimbabwean policies and visions. Such a workforce enhancement is sensitive to power-distances and differences in access to development. Bifurcation and foreign

concepts and categorisations were avoided, using locally developed guidelines in both health and systems management. Alongside the MoHCC (the public), and the communities, the involvement of Zimbabwean universities (academia) and businesses (the private sector) was key to the broad development of capacity, reconciling ‘ways of knowing’, balancing formal and informal modes of communication, and aligning with the dominance of oral cultures – putting the ‘who’ in front of the ‘what’ [45].

In the development of the DICP, the MoHCC created the space to develop a digital platform for deployment in its provinces, and gained experience for the emergence of EHF.

### **Thought leadership**

Thought leadership shares what is known from embodied knowledge [13]. Through thought leadership, communities-of-practice contributed to the Zimbabwean debate, influenced public policy and availed the relevant expertise and knowledge of professionals [46]. Through its development, monitoring and evaluation happened *in situ*, with the value proposition assessed from local understandings. Thought leadership, where Zimbabwe’s users informed, evaluated and shared about the content and use of the DICP, allowed for local expressions of its usability.

The project fostered and sustained national capacity for the design of context-appropriate platforms and applications, and the implementation and maintenance of the same. The DICP development, therefore, engendered skills development in information and communication technologies (using Zimbabwean resources in academia and business) and allowed Zimbabwean professionals to be productive in the local, national and international context of digital health for the benefit of the communities from which they come.

### **Systems integration**

The system conciliations through the DICP represented social innovation and engagement through expressions of Zimbabwean understanding of resource-availability and the beneficitation of digital health data. The integration and acceptance of new systems is a time-consuming process. All activities took into account the integration of the DICP in MoHCC operations. Ensuing iterative engagement processes catered for alignment of both the system and services needs of the DICP with MoHCC existing systems, emerging needs, and processes. Being vetted and allowed access to important health information involves much coordination with many different stakeholders from various institutes, MoHCC departments, and health care settings. This necessitated respectful positioning

according to local values and measurements of success, and understanding of the complex context and powers [19].

### **Outlook**

As an active partner during the ideation and development of this intervention, Zimbabwe's government took a pivotal role in the determination of the digital health potential and strategy of the DICP. An upscaling for the DICP, expanding its reach and functionality to include other diseases, are being discussed with MoHCC leadership. The following expansion of components of the platform can be foreseen:

- Expand and specify the triage and information services with amended approaches that are aligned with the increasing global and national evidence base regarding the COVID-19 pandemic.
- Continuous enhancement of the efficiency of call routing, messaging, database, and visualisation technologies to improve performance and align with emerging systems, for instance in electronic health registers; work towards integration with international standards as well as (e.g.) FAIR (Findable, Accessible, Interoperable, Re-usable) data management principles.
- Develop and embed context appropriate, locally developed data algorithms and harness the potential of Artificial Intelligence (AI) to enhance caller response systems, appropriate to the context of both the caller and the agent.
- Enhance real-time reporting and the content of dashboards to inform the MoHCC, including data from other digital health interventions, to facilitate ever more real-time evidence-based decision making and response.

DICP generic approach can provide responses to other specific disease outbreaks (e.g. malaria, cholera, typhoid) or calamities (e.g. cyclone or road traffic accidents). The modular system can be extended to respond to the most common diseases in the country. Amendments and enhancements of the platform can be done sovereignly by Zimbabweans, in country.

### **Conclusion**

A telehealth Digital Information and Communication Platform was developed in Zimbabwe that is locally managed and amended. A collaboration of the Ministry of Health and Child Care and the local community developed this electronic triaging for COVID-19 related cases against a database that keeps track of calls and case information coming through the contact centre, trained and established an operational, digital COVID-19 counselling and consulting service. The DICP

1. achieved a cost-effective proof-of-concept and proof-of-production telehealth intervention, defined, designed, developed and implemented in context by provincial and national players in Zimbabwe,
2. showed that developments outside of the capital (from a secondary or tertiary city and relative far away province) are feasible and can instruments for national developments,
3. provided confidence that Zimbabwe can design, build and operate an integrated and dynamic information and consultation platform in health to sustain Electronic Health Facilities.

Prioritising national inputs, agency and outputs resulted in a nationally developed and owned platform for specific digital health interventions and services, bolstering Zimbabwe's response to COVID-19. Prioritising developments within context counters the threat of data-extraction, (foreign) surveillance, and economic exploitation through, for instance, lock-in technologies, extortive licences, and the transfusion of dependencies. The system is 'built on what is going well', which is central to the National Health Strategy of Zimbabwe [47]. The DICP embodies teamwork and provides a platform for sustainable digital health interventions under the auspices of Zimbabwe's Ministry of Health and Child Care.

## References

1. UNCTAD: Digital economy report 2019: Value creation and capture - implications for developing countries. United Nations, New York (2019).
2. Mawere, M., van Stam, G.: Digital health, technology, and digital diplomacy: African solutions for African challenges. *J. Sustain. Dev. Africa*. 22, 35–45 (2020).
3. Mawere, M., van Stam, G.: Data sovereignty, a perspective from Zimbabwe. In: *WebSci'20 Companion: 12th ACM Conference on Web Science Proceedings*. pp. 13–19 (2020).
4. Bigirimana, S.S.J.: Beyond the thinking and doing dichotomy: integrating individual and institutional rationality. *Kybernetes*. 46, 1597–1610 (2017).
5. van Stam, G.: Why do foreign solutions not work in Africa? Recognising alternate epistemologies. In: van Reisen, M., Mawere, M., Stokmans, M., and Gebre-Egziabher, K.A. (eds.) *Roaming Africa: Migration, Resilience and Social Protection*. pp. 55–82. Langa RPCIG, Bamenda (2019).
6. Hlabangane, N.: Can a methodology subvert the logics of its principal? Decolonial meditations. *Perspect. Sci*. 26, 658–693 (2018).
7. Adamu, M.S.: Adopting an African standpoint in HCI4D: A provocation. In: *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems* (2020).

8. Baily, A., Esnault, D.: News First virus death in Sub-Saharan Africa as WHO warns “prepare for worst,” <https://news.yahoo.com/sub-saharan-africa-records-first-coronavirus-death-152022086.html>.
9. Hobbins, M., Kavenga, M., Manhibi, R., van Dijk, J.H., van Stam, G.: eHealth: Connecting communities for health, selected cases in Zimbabwe. *Med. Mundi Bull. Swiss online J. Int. Coop. Heal.* 148, (2018).
10. Chawurura, T., Manhibi, R., van Dijk, J.H., van Stam, G.: eHealth in Zimbabwe, a case of techno-social development. In: Nielsen, P. and Kimaro, H. (eds.) *Information and communication technologies for development. Strengthening southern-driven cooperation as a catalyst for ICT4D. ICT4D 2019. IFIP advances in information and communication technology*, vol 551. pp. 15–26. Springer, Cham (2019).
11. Bishi, J., Shamu, A., van Dijk, J.H., van Stam, G.: Community Engagement for eHealth in Masvingo, Zimbabwe. In: *1st International Multi Disciplinary Conference, 23-25 Aug 2017, Lusaka, Zambia* (2017).
12. Chawurura, T., Manhibi, R., van Dijk, J.H., van Stam, G.: Stocktaking the digital health infrastructure in Zimbabwe. In: *Public Health Conference (ICOPH 2020)* (2020).
13. van Stam, G.: Thought leadership in e-governance, e-infrastructure, and e-business in Africa. In: Bissyandé, T.F. and van Stam, G. (eds.) *e-Infrastructure and e-Services for Developing Countries, 5th International Conference, AFRICOMM 2013, Blantyre, Malawi, November 25-27, 2013, Revised Selected Papers*. pp. 49–58. Springer, Berlin, Heidelberg (2014).
14. Alston, P.: Report of the special rapporteur on extreme poverty and human rights. In: *United Nations General Assembly, 74th session. United Nations* (2019).
15. Mawere, M., van Stam, G.: Oratio: A framing of knowledge in the context of technology and academia. In: Mawere, M. and Mubaya, T.R. (eds.) *African studies in the academy. The cornucopia of theory, praxis and transformation in Africa?* pp. 251–264. Langaa RPCIG, Bamenda (2017).
16. Bidwell, N.J.: Wireless in the weather-world and community networks made to last. In: *PDC’20: Vol.1, June 15-20, Manizales, Colombia*. pp. 126–136 (2020).
17. Unwin, T.: Collaboration and competition in Covid-19 response, <https://unwin.wordpress.com/2020/03/26/collaboration-and-competition-in-covid-19-response/>.
18. van Stam, G.: Voices from the South. *Med. Mundi Bull. Swiss online J. Int. Coop. Heal.* (2020).
19. *Medicus Mundi Switzerland: Digital Health in International Cooperation: A Transnational Framework. Medicus Mundi Switzerland, Basel* (2020).
20. Lee, C.T., Bulterys, M., Martel, L.D., Dahl, B.A.: Evaluation of a national call center and a local alerts system for detection of new cases of ebola virus disease — Guinea, 2014–2015. *Morb. Mortal. Wkly. Rep.* 65, 227–230 (2016).
21. GSMA: *GSMA Ebola mobile response: Blueprint*. GSMA (2014).
22. Kisimir, J.: Behind the scenes in the Ebola response: The call centre manager, <https://www.afro.who.int/news/behind-scenes-ebola-response-call-centre-manager>.

23. World Health Organization: African countries move from Covid-19 readiness to response as many confirm cases, <https://www.afro.who.int/fr/node/12206>.
24. World Health Organization: WHO guideline: Recommendations on digital interventions for health system strengthening. World Health Organization, Geneva (2019).
25. van Stam, G.: Appropriation, coloniality, and digital technologies. Observations from within an African place. In: Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development, 2021. pp. 709–721 (2021).
26. Cartaxo, A., Melicherová, K., Smeets, A., Smits, K., Stocker, M., van Mourik, L., van Reisen, M., van Stam, G.: “The Prophet says the coronavirus will disappear on 28 March”: COVID-19 and the new digital and human security dimensions. In: van Iersel, F. (ed.) *Vredeseducatie in de krijgsmacht*. pp. 45–74. Eburon, Utrecht (2020).
27. Abdullahi, I., Amare, S.Y., Aktau, A., Ayele, W., Basajja, M., Chindoza, K., Flikkenschild, E., Folorunso, S., Ghardallou, M., Graybeal, J., Jati, P.H.P., Kawu, A.A., Lin, Y., Liu, F., Medhanyie, A.A., Mpezamihgo, M., Musen, M.A., Nalugala, R., Oladipo, F., Osigwe, O., Schultes, E., Stocker, J., Stokmans, M., Taye, G.T., van Reisen, M., van Stam, G., Wolstencroft, K., Wirtz, M.: Design of a FAIR digital data health infrastructure in Africa for COVID-19 reporting and research. *Adv. Genet.* (2021).
28. van Dijck, J., Poell, T., de Waal, M.: *The Platform Society. Public values in a connective world*. Oxford University Press, Oxford (2018).
29. Itimi, S.: *Is Foreign Aid a facilitator of Neo- Colonialism in Africa?* University of London, London (2018).
30. van Stam, G.: Power inequities. Observations on the development of information and communication technologies, from an African place. In: *WebSci’20 Companion: 12th ACM Conference on Web Science Proceedings*. pp. 54–59 (2020).
31. Dourish, P., Mainwaring, S.D.: UbiComp’s colonial impulse. In: *UbiComp’12, 5-8 Sep 2012, Pittsburgh, USA* (2012).
32. van Stam, G.: Unveiling orientalism in foreign narratives for engineering for development that target Africa. In: Mawere, M. (ed.) *Development Perspectives from the SOUTH. Troubling the Metrics of [Under-]development in Africa*. pp. 197–220. Langaa RPCIG, Bamenda (2016).
33. Zimbabwe National Statistics Agency: *Zimbabwe Multiple Indicator Cluster Survey 2019, snapshots of key findings*. ZIMSTAT, Harare (2019).
34. van Stam, G.: Access to digital platforms: Can ‘mobile’ networks coverage reports be relied upon? Observations from Zambia and Zimbabwe. In: Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development, 2021 (2021).
35. van Reisen, M.: International cooperation in the digital era. In: *Inaugural lecture, Computing for Society, 10 March 2017*. Leiden University, Leiden (2017).
36. Holst, C., Sukums, F., Radovanovic, D., Ngowi, B., Noll, J., Winkler, A.S.: Sub-Saharan Africa—the new breeding ground for global digital health. *Lancet Digit. Heal.* 2, e160–e162 (2020).
37. van Stam, G.: Reflections: a narrative on displacement of technology and meaning in an African place. Gertjan van Stam, Harare, Masvingo, Macha, Tilburg (2017).

38. Unwin, T.: Donor and government funding of Covid-19 digital initiatives, <https://unwin.wordpress.com/2020/03/25/donor-and-government-funding-of-covid-19-digital-initiatives/>.
39. Chawurura, T., Manhibi, R., van Dijk, J., van Stam, G.: Towards country-level capacity for Electronic Health Facilities. *Med. Mundi Bull. Swiss online J. Int. Coop. Heal.* (2021).
40. Russpatrick, S., Sæbø, J., Monteiro, E., Nicholson, B., Sanner, T.: Digital resilience to COVID-19: A model for national digital health systems to bounce forward from the shock of a global pandemic. In: *Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development, 2021.* pp. 67–80 (2021).
41. Bakari, J.K.: Power of home grown ICT solutions in developing Countries. In: *Keynote at the 15th international conference on social implications of computers in developing countries, 1 May 2019, Dar es Salaam* (2019).
42. Marais, M., Vannini, S.: Network weaving to foster resilience and sustainability in ICT4D. In: *Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development, 2021.* pp. 43–56 (2021).
43. van Stam, G.: Inclusive community engagement in social innovation, case Africa. In: *e-Infrastructure and e-Services for Developing Countries, 5th International Conference, AFRICOMM 2013, Blantyre, Malawi, November 25-27, 2013.* , Blantyre (2014).
44. Mawere, M., van Stam, G.: Ubuntu/unhu as communal love: critical reflections on the sociology of ubuntu and communal life in sub-Saharan Africa. In: Mawere, M. and Marongwe, N. (eds.) *Violence, politics and conflict management in Africa: Envisioning transformation, peace and unity in the twenty-first century.* pp. 287–304. Langaa RPCIG, Bamenda (2016).
45. Mawere, M., van Stam, G.: African engineering and the quest for sustainable development: Levelling the ground for all players. In: Mawere, M. and Nhemachena, A. (eds.) *Theory, Knowledge, Development and Politics: What Role for the Academy in the Sustainability of Africa?* pp. 189–206. Langaa RPCIG, Bamenda (2016).
46. SolidarMed: Digital Health in Masvingo Province, <https://www.facebook.com/eHealthzim/videos/685537072053133>.
47. MoHCC: *The National Health Strategy for Zimbabwe, 2016-2020. Equity and quality in health: Leaving no one behind.* Ministry of Health and Child Care, Government of Republic of Zimbabwe, Harare (2016).