A Review of Perspectives and Challenges for International Development in Information and Communication Technologies

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We provide an overview of the field of Information and Communication Technologies for Development (ICTD). This field is concerned with how information and communication technologies can be used to support poor and marginalised people in social, political and economic spheres. Through referring to seminal authors in ICT4D and its sub-fields, Human-Computer Interaction for Development (HCI4D) and Participatory Design for Development (PD4D), we articulate the main themes, debates and challenges presented in this field. We conclude by arguing that communication challenges must be solved before technological ones: impact and success in ICT4D rely first and foremost on having a common and mutual understanding of needs, values and perspectives, which will determine whether and which technologies are needed.

Keywords: ICTD, ICT4D; HCI4D; PD4D; Design; International Development

# Introduction

Information and communication technologies for development (ICT4D) is a field concerned with how information and communication technologies can be used to support poor and marginalised people in social, political and economic spheres. ICT4D is associated with ideas of development, growth, progress and globalisation (Unwin, 2008). There is a body of literature reporting and debating on the actual impact of ICT4D in the developing world. Within the ICT4D literature, we also find the sub-fields of human-computer interaction for development (HCI4D) and participatory design for development (PD4D). In this paper we provide a brief overview of these fields and their contribution.

# ICT4D

The two papers that probably are the most dominant in driving development discourse in ICTD are Kleine (2010) on ICT4What, putting forward a framework for actually pursuing a development agenda, and Irani et al. (2010) on postcolonial computing. Kleine develops an argument that situates development beyond discourses of economic impact and growth using Sen's (2001) capabilities approach. In this context, Kleine argues that assessing and measuring impact from an economics perspective constraints the analysis of development, which needs to be done in a more holistic and systemic way where value and growth are found not only on material indicators but on social, cultural and human capital. The ‘choice framework’ places development as a direct function of structure, agency and choice where individual freedom is the main quality goal of ICT4D. Irani et al. (2010) paper on postcolonial computing presents ‘a shift in perspective motivated by the challenges and problems of transferring of technological knowledge, particularly in ICT4D and the human-computer interaction (HCI) questions it inspires’ (p.1312). As discussed later in this paper, many authors in HCI for development (HCI4D) research are concerned with these types of issues in transferring, translation and appropriation of technology and methods. Postcolonial computing is then seen as an attempt to bind this debate by highlighting common traits in ICT4D experiences that relate to uneven economic and power relations, intercultural encounters and epistemologically diverse agendas for development across stakeholders. While Irani does not explicitly align herself with ICT4D research, her work on Amazon Turk naturally involves working with low income IT workers, including those in India (Irani & Silberman, 2013). Both Irani and Kleine are not based in the developing world, even though Kleine does fieldwork there frequently.

A subsequent paper by Dourish and Mainwaring's (2012) takes the postcolonial perspective to the field of ubiquitous computing (ubicomp). In this paper they question the value of omnipresence and universality in networked technological integration, which tends to be situated outside of the human and cultural realities of those who are the intended users of such technologies. In this context, there is a call to recognize the historical specificities of sites of technology production and use. They also refer to the ethical problems in designing and deploying ubicomp, where narrow perspectives are taken to a position of central importance and reframe others in terms of this dominant view.

The above discussion highlights the critical value of the human dimension of ICTs; in which designing useful and usable solutions depends on how empathic and compatible they are with the material and sociocultural contexts they are intended for. HCI research and literature provide useful conceptual and methodological tools to understand the human dimension of ICT4D.

# HCI4D

Human-Computer Interaction (HCI) as a discipline must address tensions created between local cultures and the assumptions, priorities and values embedded in the tools and concepts of this discipline. In order to avert the postcolonial issues already discussed, translating local knowledge into valid and useful HCI tools requires re-defining and re-negotiating disciplinary boundaries and relations as well as reconfiguring the subject and object of the interaction design. Engaging with indigenous awareness and practices in interaction design comes with interesting realizations for the ontological and epistemological assumptions for usefulness, usability and user experience. For instance, local communities that prioritize respecting the views of their leaders do not automatically share the democratic values of equal participation driving user-centred design. Addressing these gaps requires different perspectives on how various disciplines and professions explore and conceptualize the relation between users, designers and other stakeholders.

While conceptual and methodological HCI frameworks are exported globally, research in HCI4D reports on local experiences, adapting and implement this knowledge, on how it can be made locally accountable (Suchman, 2002). Social science approaches on HCI such as ethnology and ethnography, technomethodology (Dourish & Button, 2009), and national culture models (Hofstede, 2001) and activity theory (Kaptelinin & Nardi, 2012) have tried to address the issues of designing interactive systems for culturally different users, but knowledge emerging from explicitly local or indigenous perspectives, approaches and experiences with HCI has not become substantial (Kurosu et al., 2004). In this context, what constitutes a useful and usable system in different cultural locales remains partially explored but is a crucial condition of success and impact in HCI4D projects.

Of relevance is the work of Camara and Abdelnour-Nocera (2013), which provides a socio-technical perspective to explicate several disciplinary and cultural perspectives in the elicitation of user requirements for Kenyan farmers. Through a socio-technical evaluation matrix it was possible to inform design decisions for the user interface of a knowledge management system that would support and communicate the farmers’ activities. Another good example of localised HCI practice in a context that would not normally be referred to as developed, is that of Kavanaugh et al. (2013). This is a case study from the South Appalachian Mountains in rural Virginia showing the importance of local interpretive frames of low IT literacy groups in bridging the use of more advanced technologies through their experience of mobile phones for a better quality of life. The authors identify interpretive frames used by local populations to leverage the design of larger studies leading to interface design of computer learning strategies and materials that are culturally and cognitively sensitive to frame bridging theoretical approaches. There are clear similarities with the mPesa experience in South Africa where the use of mobile phones was used as the main driver in the adoption of electronic payments (Hughes & Lonie, 2007). Both Camara and Abdelnour-Nocera (2013), and Kavanaugh et al. (2013) are clear examples of successful attempts to localize the process and product of interaction design in an HCI4D context.

One of the most exhaustive, reflective and critical reviews of the field of HCI4D was the one conducted by Ho et al. (2009). This review concludes with the presentation of the grand challenges for HCI4D: the need to problematize the field, reuse of knowledge, supporting affordable computing ecosystems, a sustained focus on semi-literate and illiterate users and the development of local capacity. A more recent literature review by Dell and Kumar (2016) charts research on HCI4D through a survey of 259 papers published in relevant HCI venues and journals since 2009. As a conclusion, they stress that ‘HCI4D does not represent a new agenda for HCI but contributes instead to reinvoking a previously neglected agenda’ (Dell & Kumar, 2016, p. 2229). Through its focus on disparate peoples, cultures, and geographies HCI4D has also helped to globalize and diversify HCI research, a need already highlighted above. Dell and Kumar show how HCI4D research has contributed to methodological learnings by helping conceptualize what it means to be situated in a global and cross-cultural context. The first African conference in HCI held in Kenya in 2016 is a strong sign of the expanding value of HCI and the need to ‘decolonise’ disciplines (Bidwell, 2016), as also pointed out by Irani et al. (2010) and Dourish and Mainwaring (2012). Bidwell reaffirms the first African conference in HCI as not only trying to widen Africans’ international participation in HCI, but also as trying to advance HCI by increasing awareness of locally senseful designs, tools, inventions, methods, theories, and pedagogies for creating and using technology in Africa.

Despite presenting some examples of local and indigenous perspectives relevant for HCI4D, the final analysis of HCI in an international development context is still far from complete. According to Abdelnour-Nocera et al. (2013), key questions driving the agenda for researchers and designers in this field should be the following:

* What is meant by local and indigenous HCI and why this is important for the ICT4D research and practitioner communities? This means being willing and able to shift the epistemological position of the discipline towards what constitutes valuable knowledge and how to obtain it. Making sense of what are useful technologies is therefore a co-constructed process based on local realities and perspectives.
* What are the ethical issues in engaging in HCI4D activities? What are the power relations and scripts embedded in this process? While HCI as a discipline carries values of participation and the ultimate beneficiary is the user, there are more complex ethical issues of value co-creation and informed consent in projects where there are clear intercultural and interdisciplinary dimensions.
* How do we approach and study the interpretive frames used locally and/or from an indigenous perspective to make sense of the current body of knowledge and tools in HCI? This question points at the methodological challenges in establishing meaningful communication spaces for all stakeholders in HCI4D projects and associated arenas of participation. Eliciting, conveying and explicating the semiotic dimensions of research engagement and interventions is a fundamental challenge constantly reported in the literature referred to in this article.

# PD4D

Participatory design (PD) has been used as an obvious approach to develop an emic understanding of users in ICT4D and HCI4D contexts, but it does come with certain challenges. PD methods were first implemented in the developed world and in consequence they embed certain assumptions about stakeholder relations. These assumptions underpin certain values over how interaction and knowledge exchange should occur, and which stakeholders can engage and in what stages in the process of design. For instance, PD embeds strong ideals of democracy due to its Scandinavian origins, reflecting its suitability to more horizontal societies. However, when PD is tried to implement in more vertical societies, there are some potential conflicts as the issue of who gets to have a voice or a say follows different social arrangements. At the same time, it has also been recognized that insufficient indigenous perspectives have been dedicated to PD in the developing world (Puri, Byrne, Nhampossa, & Quraishi, 2004) Successful PD4D experiences in Namibia indicate an appropriation of not only methods but also of key values defining participation closely linked to Ubuntu philosophy (Winschiers-Theophilus, Chivuno-Kuria, Kapuire, Bidwell, & Blake, 2010)

Indigenous perspectives in PD4D should include different mentalities, thought patterns and problem solving strategies that are anchored in different cultures, for example having contrasting attitudes toward power relations, division of labour and life values. A review of the literature in Participatory IT Design and Participatory Development by Dearden and Rizvi (2008) highlight this type of tensions where ‘designers who claim to be participatory, must reflect critically on their skills, their motivations, their practices, their relationships and their priorities’ (p. 89). Considering local and indigenous perspectives should lead to a common conversation code while discussing and adapting well-known PD methods for local cultures.

According to Oyugi et al. (2008) , typical challenges to be faced when applying PD in a developing context include perceived power relations in communities and designers, cultural and language barriers, incompatible PD methods with local values, geographical dispersion, low literacy levels and poor telecommunication infrastructure.

A good example of PD research where these challenges are mostly addressed is that of Zaman et al. (2015) where co-design was applied to work with a remote community in Malaysian Borneo to help preserve the Oroo’ visual language through its integration into a mobile digital messaging system. Several PD methodologies including card sorting with the elderly and youth members of the Long Lamai community, and personas created by the younger group were successfully implemented. The PD methods were negotiated between the researchers and the community thanks to a sustained collaboration that preceded this project. The elderly and the youth collaborated through a PD approach in such a way that the young participants helped the elderly to get acquainted with technology, while the elders taught Oroo’ language to contribute to its digital preservation.

# Ethics and Conflicting Values

Participatory and co-design approaches naturally lead to a grappling with issues of ethics and values (Winschiers-Theophilus, Chivuno-Kuria, Kapuire, Bidwell, & Blake, 2010; Holeman et al 2017). At the same time, the topic pervades all of ICT4D research and practice. By what standards do we measure our activities and actions? Sterling and Rangaswamy (2010) point out the difficulties in gaining true informed consent. Others critique the discourse of interventionist and “white savior” do-gooders saving the poor (Dearden 2012; Pal 2017). Anokwa et al (2009) highlight power dynamics, false promises and conflicting agendas entailed in ICT4D fieldwork. Frequently encountered are communities experiencing “research fatigue”, frustration with the constant stream of researchers promising to fix everything but failing to deliver, or worse, misrepresenting or exploiting them. The reality is that stakeholders, including the researchers themselves, have often differing objectives, which can lead to unworkable or inadequate solutions (Luk 2009; Ho 2009). In response, the South African San Institute has developed a code of ethics for research with San communities, exhorting that researchers must show care, respect, honesty, and fairness in the research they do (2017). Gertjan van Stam considers the ethics of community-based research, especially with respect to decolonialism, and deliberately seeks permission from the community leaders where he worked to defend and publish his dissertation, presenting it first as a letter to them (2017). Questions around intellectual property ownership, especially in community-centred cultures, are still unanswered, and should always be discussed from the beginning with the community. We emphasize the need to plan for mutual benefit and reciprocity, beyond immediate honorariums for participation in research studies, and to consider and strive for equality in partnerships, whether between Western and Southern researchers, or between the researcher and the community. Finally, as researchers in the 4D space, it is important to be willing to “fail” your technology if it becomes apparent that another approach is more suitable to the partners (Densmore 2009).

# The Real Balance of 4D

So what is the real balance in international development initiatives? There are some clear wins, for instance:

* 99DOTS ([www.99dots.org](http://www.99dots.org)) helps to monitor TB medication adherence by giving patients customized blister packs with hidden phone numbers behind each dose. Patients get daily reminders via SMS and calls, and are required to make a free call to the number, which, combined with the patient’s mobile number, verifies that the patient is taking the medication as intended. This has demonstrated potential as a low-cost solution for monitoring and improving medication adherence using information technologies. This innovation has deepened our understanding of the potential of novel low-tech approaches can solve important problems. .
* Digital Green (<http://www.digitalgreen.org/>) is a farmer service that produces participatory videos (i.e. featuring farmers) about agricultural technology, and then disseminates them through hosted viewings, typically using a mobile phone connected to a projector. It first gained recognition as a Microsoft Research project demonstrating its effectiveness (Gandhi, Veeraraghavan, Toyama, & Ramprasad, 2007), and subsequently became Microsoft Research’s first non-profit spin-off in 2008. While it’s initial focus was novel ICT, the work of scaling up and developing a sustainable approach has involved more focus on management practices. They continue to explore digital innovation from a community-driven perspective. In addition, collaborative work with Digital Green continues to contribute to understanding of how farmers interact with media (Cuendet, Medhi, Bali, & Cutrell, 2013).
* The Open Data Kit (<https://opendatakit.org/>) as an open source tool to collect and manage mobile data collection used to support socio-economic and health surveys and decision support in general. First developed at Google and University of Washington, they have over 100 deployments in 42 countries and the international space station[[1]](#footnote-2) (Hartung et al 2010; Brunette et al 2013).

Overall, there is a wider availability of ad-hoc wi-fi equipment, enabling more last-mile and community wireless based solutions. Low-cost laptops such as netbooks, are now a reality as a result of Intel's Classmate PC and the ATOM processor. Mobile phones, through services like m-Pesa, Interactive Voice Recognition systems and SMS programs for public health education and monitoring, have proven to be the most important technology associated with ICT4D and HCI4D projects.

One Laptop Per Child (OLPC) is often referred to as a good example of an ICT4D failure as it did not meet its cost and distribution expectations, i.e. from being labelled a $100 laptop its cost raised to $188, lack of training, and the ultimate belief that it was not considered to be appropriate for regions (Shah, 2011). Victoria McArthur (2009) confirmed that this personal computer was designed with western metaphors in mind without taking into account local cultures. Other failures in ICT4D, are referred to as following the telecenter archetype (Heeks, 2008; Dodson, Sterling & Bennett 2012) due to issues related to poor sustainability and scalability: it was about ICT4D 1.0 as a field trying to fulfil needs that echoed those of the Western contexts where these digital hubs where initially used. Instead, Heeks pointed, and rightly so, towards new models of innovation in ICT4D, a 2.0 paradigm, with less emphasis on PCs and more emphasis on what is actually used such as mobiles, radio, television. Looking at the years following Heeks’ paper and the evolution of ICT4D successful projects, it is clear his observations were accurate. We can see how innovation flourished in initiatives developed ‘with’ and not ‘for’ the disadvantaged.

The above points towards an argument linking success in ICT4D to a combination of an inductive approach with user participation. This approach is referred to as part of a discourse of *social embeddedness* in ICT4D interventions and research (Maail, 2011). Such a discourse gives value to local knowledge and contextual factors driving and shaping technological innovation. This in contrast with an earlier but still prevalent *transfer and diffusion* discourse in ICT4D, especially in Information Systems (IS) research (Bada, 2002; Walsham, 2002) where user participation is also defined as a success factor but mainly from a role of helping to adapt technology to local needs and contexts. Maail (2011) concluded after a systematic study of the literature that more user participation does not lead to automatic success in ICT4D projects as there are other conditional factors such as the ones developed so far in this paper.

As our society increasingly moves into economic paradigms dominated by knowledge exchange and co-creation and the pursue of ethical values through transformation (Gardien, Djajadiningrat, Hummels, & Brombacher, 2014), technological innovations embedding sustainable models such as FreeBasics (info.internet.org) and Open Data (Davies & Perini, 2016) emerge as interesting promises in a complex development landscape, but is too early to judge its impact and value. The truth is that measuring "D", or "d", as a direct impact of ICTs is hard and the results are not always evident, unless maybe a comparison is made with what would happen if no technologies are integrated in ten years from now in concrete cases.  Our brief review also makes it clear that interventionist "4D" initiatives and approaches from the West have had very little impact when considering the number of people working on these problems.

A more radical approach would be to drop technology altogether from any development project labelled as ICT4D, i.e. to drop the ICT, at least until an emic understanding of the communities to be supported or intervened emerges. There seems to be a deeply rooted unquestioned ontological position in ICT4D where technology is embedded with progress and benefits, and that the real challenge is how to extract and articulate those successfully by or for the communities to be developed. We believe that a communication and hermeneutical challenge exists before a technological one: we believe that impact and success in ICT4D rely first and foremost on having a common and mutual understanding of needs, values and perspectives which will determine whether and which technologies are needed.

# References

Anokwa, Y., Smyth, T. N., Ramachandran, D., Sherwani, J., Schwartzman, Y., Luk, R., ... & DeRenzi, B. (2009). Stories from the field: Reflections on HCI4D experiences. Information Technologies & International Development, 5(4), pp-101.

Bada, A. O. (2002). Local adaptations to global trends: A study of an IT-based organizational change program in a Nigerian bank. *The Information Society*, *18*(2), 77–86.

Bidwell, N. J. (2016). Decolonising HCI and Interaction Design Discourse: Some Considerations in Planning AfriCHI. *XRDS*, *22*(4), 22–27. https://doi.org/10.1145/2930884

Brunette, W., Sundt, M., Dell, N., Chaudhri, R., Breit, N., & Borriello, G. (2013, February). Open data kit 2.0: expanding and refining information services for developing regions. In Proceedings of the 14th Workshop on Mobile Computing Systems and Applications (p. 10). ACM.

Camara, S., & Abdelnour-Nocera, J. (2013). Revealing the Socio-Technical Context of Design Settings: Toward Participatory IS Design. *International Journal of Human-Computer Interaction*, *29*(4), 289–307. https://doi.org/10.1080/10447318.2013.765767

Cuendet, S., Medhi, I., Bali, K., & Cutrell, E. (2013). VideoKheti: Making Video Content Accessible to Low-literate and Novice Users. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2833–2842). New York, NY, USA: ACM. https://doi.org/10.1145/2470654.2481392

Davies, T., & Perini, F. (2016). Researching the emerging impacts of open data: revisiting the ODDC conceptual framework. *The Journal of Community Informatics*, *12*(2).

Dearden, A. (2012, March). See no evil?: ethics in an interventionist ICTD. In Proceedings of the Fifth International Conference on Information and Communication Technologies and Development (pp. 46-55). ACM.

Dearden, A., & Rizvi, H. (2008). Participatory IT Design and Participatory Development: A Comparative Review. In *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008* (pp. 81–91). Indianapolis, IN, USA: Indiana University. Retrieved from http://dl.acm.org/citation.cfm?id=1795234.1795246

Dell, N., & Kumar, N. (2016). The Ins and Outs of HCI for Development. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 2220–2232). ACM.

Densmore, M. (2012, May). Claim mobile: When to fail a technology. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1833-1842). ACM.

Dodson, L. L., Sterling, S., & Bennett, J. K. (2012, March). Considering failure: eight years of ITID research. In Proceedings of the Fifth International Conference on Information and Communication Technologies and Development (pp. 56-64). ACM.

Dourish, P., & Button, G. (2009). On “Technomethodology”: Foundational Relationships Between Ethnomethodology and System Design. *Human-Computer Interaction*, *13*(4), 395–432.

Dourish, P., & Mainwaring, S. D. (2012). Ubicomp’s colonial impulse. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing* (pp. 133–142). ACM.

Gandhi, R., Veeraraghavan, R., Toyama, K., & Ramprasad, V. (2007). Digital Green: Participatory video for agricultural extension. In *2007 International Conference on Information and Communication Technologies and Development* (pp. 1–10). https://doi.org/10.1109/ICTD.2007.4937388

Gardien, P., Djajadiningrat, T., Hummels, C., & Brombacher, A. (2014). Changing your hammer: The implications of paradigmatic innovation for design practice. *International Journal of Design*, *8*(2).

Hartung, C., Lerer, A., Anokwa, Y., Tseng, C., Brunette, W., & Borriello, G. (2010, December). Open data kit: tools to build information services for developing regions. In *Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development* (p. 18). ACM.

Heeks, R. (2008). ICT4D 2.0: The Next Phase of Applying ICT for International Development. *Computer*, *41*(6), 26–33. https://doi.org/10.1109/MC.2008.192

Ho, M. R., Owusu, E. K., & Aoki, P. M. (2009, April). Claim mobile: engaging conflicting stakeholder requirements in healthcare in uganda. In Information and Communication Technologies and Development (ICTD), 2009 International Conference on (pp. 35-45). IEEE.

Ho, M. R., Smyth, T. N., Kam, M., & Dearden, A. (2009). Human-computer interaction for development: The past, present, and future. *Information Technologies & International Development*, *5*(4), pp–1.

Holeman, I., Blake, E., Densmore, M., Ssozi, F., Goodman, E., Medhi Thies, I., & Wyche, S. (2017, May). Co-Design Across Borders Special Interest Group. In Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (pp. 1318-1321). ACM.

Hofstede, G. (2001). *Culture’s Consequences: Comparing Values, Behaviors, institutions and organisations across nations*. London: Sage.

Hughes, N., & Lonie, S. (2007). M-PESA: mobile money for the “unbanked” turning cellphones into 24-hour tellers in Kenya. *Innovations*, *2*(1–2), 63–81.

Irani, L., & Silberman, M. S. (2013). Turkopticon: Interrupting Worker Invisibility in Amazon Mechanical Turk. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 611–620). New York, NY, USA: ACM. https://doi.org/10.1145/2470654.2470742

Irani, L., Vertesi, J., Dourish, P., Philip, K., & Grinter, R. E. (2010). Postcolonial Computing: A Lens on Design and Development. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1311–1320). New York, NY, USA: ACM. https://doi.org/10.1145/1753326.1753522

Kaptelinin, V., & Nardi, B. A. (2012). *Activity theory in HCI fundamentals and reflections*. [San Rafael, Calif.]: Morgan & Claypool. Retrieved from http://public.eblib.com/choice/publicfullrecord.aspx?p=919702

Kavanaugh, A., Puckett, A., & Tatar, D. (2013). Scaffolding Technology for Low Literacy Groups: From Mobile Phone to Desktop PC? *International Journal of Human-Computer Interaction*, *29*(4), 274–288. https://doi.org/10.1080/10447318.2013.765766

Kleine, D. (2010). ICT4WHAT?—Using the choice framework to operationalise the capability approach to development. *Journal of International Development*, *22*(5), 674–692. https://doi.org/10.1002/jid.1719

Kurosu, M., Kobayashi, T., Yoshitake, R., Takahashi, H., Urokohara, H., & Sato, D. (2004). Trends in usability research and activities in Japan. *International Journal of Human-Computer Interaction*, *17*(1), 103–124.

Luk, R., Zaharia, M., Ho, M., Levine, B., & Aoki, P. M. (2009, April). ICTD for healthcare in Ghana: two parallel case studies. In Information and Communication Technologies and Development (ICTD), 2009 International Conference on (pp. 118-128). IEEE.

Maail, A. G. (2011). User Participation and the Success of Development of ICT4D project: A Critical Review. In *Proceedings of SIG GlobDev 4th Annual Workshop*.

McArthur, V. (2009). Communication technologies and cultural identity a critical discussion of ICTs for development. In *2009 IEEE Toronto International Conference Science and Technology for Humanity (TIC-STH)* (pp. 910–914). https://doi.org/10.1109/TIC-STH.2009.5444367

Oyugi, C., Nocera, J. A., Dunckley, L., & Dray, S. (2008). The challenges for participatory design in the developing world. In *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008* (pp. 295–296). Indiana University.

Pal, J. (2017). The fallacy of good: marginalized populations as design motivation. interactions, 24(5), 65-67.

Puri, S. K., Byrne, E., Nhampossa, J. L., & Quraishi, Z. B. (2004). Contextuality of participation in IS design: a developing country perspective. In *Proceedings of the eighth conference on Participatory design* (Vol. 1, pp. 42–52). ACM Press. https://doi.org/10.1145/1011870.1011876

Sen, A. (2001). *Development as freedom*. Oxford ; New York: Oxford University Press.

Shah, N. (2011). A blurry vision: reconsidering the failure of the one laptop per child initiative. *WR: Journal of the Arts & Sciences Writing Program*, (3).

South African San Institute. (2017). San Code of Research Ethics. Retrieved from the TRUST Project. http://trust-project.eu/wp-content/uploads/2017/03/San-Code-of-RESEARCH-Ethics-Booklet-final.pdf

Sterling, S., & Rangaswamy, N. (2010, December). Constructing informed consent in ICT4D research. In Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development (p. 46). ACM.

Suchman, L. (2002). Located Accountabilities in Technology Production. *Scand. J. Inf. Syst.*, *14*(2), 91–105.

Surana, S., Patra, R. K., Nedevschi, S., Ramos, M., Subramanian, L., Ben-David, Y., & Brewer, E. A. (2008, April). Beyond Pilots: Keeping Rural Wireless Networks Alive. In NSDI (Vol. 8, pp. 119-132).

Unwin, T. (2008). *ICT4D: information and communication technologies for development*. Cambridge: Cambridge University Press.

van Stam, G. (2017). Reflections: A Narrative on Displacement of Technology and Meaning in an African Place (Doctoral dissertation). Tilburg University. Harare/Masvingo, Zimbabwe; Macha, Zambia; and Tilburg, the Netherlands.

Walsham, G. (2002). Cross-cultural software production and use: a structurational analysis. *MIS Quarterly*, 359–380.

Winschiers-Theophilus, H., Chivuno-Kuria, S., Kapuire, G. K., Bidwell, N. J., & Blake, E. (2010). Being Participated: A Community Approach. In *Proceedings of the 11th Biennial Participatory Design Conference* (pp. 1–10). New York, NY, USA: ACM. https://doi.org/10.1145/1900441.1900443

Zaman, T., & Winschiers-Theophilus, H. (2015). Penan’s Oroo’ Short Message Signs (PO-SMS): Co-design of a Digital Jungle Sign Language Application. In J. Abascal, S. Barbosa, M. Fetter, T. Gross, P. Palanque, & M. Winckler (Eds.), *Human-Computer Interaction – INTERACT 2015: 15th IFIP TC 13 International Conference, Bamberg, Germany, September 14-18, 2015, Proceedings, Part II* (pp. 489–504). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-22668-2\_38

1. Open Data Kit Deployments. <https://opendatakit.org/about/deployments/> Accessed 21 September 2017 [↑](#footnote-ref-2)