Towards Informed Practice in HCI for Development

NEHA KUMAR, Georgia Institute of Technology, USA

NICOLA DELL, Information Science, the Jacobs Institute, Cornell Tech, USA

Our paper provides an enriched understanding of the relationship between research and practice through the study of practitioners variously engaged in field research on technology interventions in the context of global development. By conducting a qualitative inquiry with 33 practitioners from 26 global development organizations, we highlight how these practitioners have different goals, work practices, incentive structures, and expectations than researchers, making it challenging to co-create and coordinate productive and effective partnerships. Despite these challenges, practitioners in global development do appear to value and engage with research as they strive for positive impact across their target communities. Our analysis suggests that the domain of human-computer interaction for development (HCI4D) might benefit from engaging in *"informed practice"* through alignment with design-based implementation research (DBIR), which unites researchers and practitioners in their shared commitment to both research and practice, even if research and practice respectively remain their primary commitments. Our work provides CSCW and HCI4D researchers with new ways to conceptualize and navigate the above research-practice divide. We also emphasize the contribution such an approach might make to CSCW researchers beyond the context of global development, and more broadly concerned with making a positive societal impact with their work.

Additional Key Words and Phrases: HCI4D; ICTD; research; practice; DBIR

1 INTRODUCTION

Researchers in the fields of CSCW and HCI have demonstrated a longstanding interest in understanding how the results of research may be realized in practice, with many Special Interest Groups and workshops held over the years [4, 5, 39, 55]. In addition to these community-building efforts, a number of research publications have sought to develop a comprehensive understanding of HCI practitioners [22, 24, 26, 52], and to identify new ways for bridging what remains a widely acknowledged research-practice divide [9, 41, 47]. This prior work is primarily focused on practitioners who are user experience and/or design professionals employed in industry, perhaps the most commonly visible HCI practitioner. These practitioners typically work for technology companies, or as design consultants, and are tasked with improving the design of products, generally to improve saleability. In these contexts, the objective for research has been to equip practitioners with new theories, concepts, and design methods that might be engaged to drive wider adoption and use [7].

At the same time, CSCW researchers have worked to understand the complex and collaborative processes that underlie modern work environments (*e.g.*, [3, 12, 19, 57]), documenting human

interactions with digital technologies and exploring how these interactions are reshaping social cooperation more broadly (*e.g.*, [29, 37, 46, 49]). Our work furthers this research agenda by studying a new kind of practitioner relevant to the CSCW community—one who engages with technology in the context of global development. As CSCW research fast expands its reach to populations across the world, it brings new technology users from underserved communities into the fray. The diversity of practitioners engaging with and gaining from CSCW research has thus expanded and deepened to include, for example, individuals who work for non-profit and volunteer organizations [10, 13, 23], as frontline workers [15, 21, 45], in government agencies [56], and more.

We see this engagement in a growing body of HCI for Development (HCI4D) research published at CSCW and other venues [11]. There is thus a compelling need to enhance understanding of the goals and constraints of these practitioners that CSCW is starting (and wanting) to impact, and to analyze how research might better support them in fulfilling their goals and navigating their constraints, as the focus of their work practices range from improved learning outcomes, to financial inclusion, to universal access to healthcare, and more. Not only are these practitioners shaped by a shared attention to marginalized populations—globally located—battling limiting social and cultural norms, they are also primarily and unanimously committed towards developmental objectives instead of capitalistic ones, as we found. By examining the research-practice divide within HCI4D, our paper makes an important contribution to CSCW, deepening its understanding of the fraught collaborations between research and practice by illuminating the work practices of practitioners who engage with complex sociotechnical systems towards global development.

In this paper, we present the results of a qualitative inquiry that we conducted with a diverse group of 33 practitioners from 26 distinct global development organizations across the world. Our focus was on understanding these practitioners' (and their organizations') goals, their opinions and experiences with regards to engaging with HCI research, the benefits and challenges they have encountered along the way, and their recommendations for improving research, practice, and the bridge between the two, coming from a view to maximizing real-world impact. Our study confirms several prior findings, but also reveals important differences in the ways that global development practitioners engage with HCI research when compared to 'traditional' UX and design professionals. For example, we found that these practitioners claim to deeply value and consistently engage with research. This stands somewhat in contrast to Gray et al.'s [26] findings that HCI researchers and practitioners generally devalue each others' work. We also reveal how the (bi-directional) flow of knowledge between research and practice in global development contexts takes place on an ongoing basis through sustained partnerships, instead of after the research has been completed (as is common in prior models of research and practice). We show, additionally, how the label of *"informed practice"*, offered by a participant, effectively describes the possibility of research better understanding and shaping practice, as well as a shared commitment that both researchers and practitioners in global development might align on.

Our work extends discourses on the transfer of research innovations into products and/or services [7, 33]. For example, our findings demonstrate how practitioners in global development adopt and use software and hardware tools that began as academic research projects (*e.g.,* [28, 53]), providing evidence that HCI4D efforts are making an impact on real-world practice. Moreover, several organizations we engaged with were founded as a result of successful HCI4D research projects, and they remain friendly to research initiatives, even though practice is their primary focus. To emphasize and strengthen the collaborations between research and practice in this field, we forge connections with the methodologies underlying Design-Based Implementation Research (DBIR), which entail a commitment to both research and practice [18]. Although DBIR has thus far chiefly been explored in the field of education, we show that its commitments align with those of HCI4D (as well as bodies of work in CSCW and HCI) in terms of engendering strong ties between research

and practice for sustainable technology interventions, and its methodology is well-positioned for adoption by our participants. We also discuss how DBIR might be enriched from such adoption.

In sum, we highlight how researchers and practitioners in HCI4D contexts work in parallel, evolve together, and remain connected. In doing so, we reveal the priorities of a fast growing group of technology practitioners with a strong commitment to global development objectives that set them apart from those in other areas of HCI and CSCW. Unpacking these practitioners' perceived benefits from collaboration with researchers, as well as the challenges they face in doing so, we discuss possibilities for *"informed practice"* and draw on the methodologies of DBIR [18] to offer new ways of conceptualizing and navigating the research-practice divide. In addition to offering important insights for the CSCW community, our findings add value to research that is increasingly engaging with post-capitalist objectives (*e.g.,* [17, 20]).

2 RELATED WORK

The literature review below helps articulate our study's extension of existing CSCW and HCI scholarship, its critical contribution to the field of HCI4D, and its motivation of Design-Based Implementation Research (DBIR) as a potential avenue for researchers and practitioners to embrace in order to realize real-world impact.

2.1 Research and Practice in CSCW and HCI

Prior CSCW and HCI scholarship has discussed how research findings are rarely used in practice and pointed out large gaps between research and practice. Colussio et al. [9] studied why design practitioners do not use academic research and recommended resources to bridge the gap between theory and practice in HCI. Remy et al. [47] worked to bridge the theory-practice gap by applying the attachment framework for sustainable design. Norman [41] posited that there is an *"immense gap"* between research and practice and discussed reasons why this gap is so universal and so difficult to overcome. Finally, in the context of commercialization, Chilana et al. [7] described their experiences transitioning a research innovation to a commercial product, suggesting that successful transitions require a shift from user-centered to *"adoption-centered"* design. All of these scholars are in consensus regarding the importance of collaborations between research and practice.

HCI scholarship has also made headway in examining the connections between research and practice. For example, Geldof and Vandermeulen [22] describe the value of HCI research from the perspective of professional design consultants. Gray et al. [26] describe a 'bubble-up' of ideas from practice to inform research and theory development, and an accompanying 'trickle-down' of theory into practice, suggesting possible mechanisms for the research community to understand practice more completely. Goodman et al. [24] advocate a theoretical and methodological focus on the day-to-day, lived experience of design professionals. Stolterman [52] details the nature of design practice and discusses implications for interaction design research. Although these works all aim to understand how research might translate into practice, their focus remains on traditional practitioners that are design, or UX professionals. These practitioners are typically employed by technology companies to improve their product development processes. As the fields of CSCW and HCI diversify to include a wide range of underrepresented and marginalized communities, with commitments extending beyond capitalism to those of global development, the practitioners that engage with and are impacted by this research also expand and diversify. Our paper broadens the CSCW community's knowledge of research and practice by studying this emerging practitioner—one who works with technology in the context of global development (HCI4D).

2.2 Research and Practice in HCI for Development

There is growing interest in the HCI4D community for understanding the ties between research and practice in global development contexts. For example, Anokwa et al. [1] described *"stories from the field"*, highlighting the importance of partnering with practitioners and discussing some of the challenges and trade-offs that result from different goals and incentive structures. At CSCW 2015, Dell et al. [13] examined paper-digital workflows in global development organizations, showing the many infrastructural, social, cultural, and linguistic challenges faced by researchers and practitioners operating in these settings. Ho et al. [30] discussed the challenges of balancing conflicting stakeholder requirements in a healthcare project in Uganda, finding that prioritizing the needs of the practitioner organization eventually required abandoning the research [14]. Dearden and Tucker [10] discussed the unintended consequences of technology research that aims to aid global development and pointed out that projects often fail to deliver long-term benefits for target populations. Although these works cover research conducted across starkly different contexts, they collectively convey the costs and benefits that might result from poor and strong collaborations between research and practice in HCI4D.

Several other projects aimed to inform researchers about the needs and priorities of organizations in under-resourced settings. Gitau and Marsden [23] highlighted the need for *"fair partnerships"* in which researchers could avoid exploiting practitioner organizations and ensure that the project outcomes addressed the goals of the NGO as well as those of the researchers. Wyche and Steinfield [59] identified barriers that prevented farmers in rural Kenya from adopting market information services. Chib and Harris [6] described their work on strengthening research capacity in Asia, and Harris [27] surveyed ICTD researchers to assess the extent to which they follow practices for achieving socioeconomic impact. Most of this prior work focuses on the interactions between research and practice from a *research* perspective, predominantly through researchers' reflections on their own experiences interacting with partner organizations during specific research projects. We expand this focus with an empirical study that examines the perspectives of a diverse group of *practitioners* working across domains and geographies, proceeding to discuss how their collaborations with researchers may be made more productive and effective.

2.3 Embracing Design-Based Implementation Research

Dell and Kumar's [11] review of HCI4D literature identifies past challenges and highlights opportunities for growth of the field. This review, however, does not consider the critical role played by practitioners in realizing HCI4D aspirations. In addition to considering this role, we make an argument for fostering a thriving intersection of research and practice that engages DBIR [18]. The roots of DBIR lie in the field of education, as explained on the website dedicated to providing guidance on its methodologies [48]:

> *"Design-Based Implementation Research (DBIR) is an approach to organizing research and development intended to promote effective, equitable, and sustainable improvements in education. It is an emerging method of relating research and practice that is collaborative, iterative, and grounded in systematic inquiry. DBIR builds the capacity of systems and partnerships to engage in evidence-based, continuous improvement as they work toward the transformation of teaching and learning."*

Developed to address the challenges of sustaining and scaling up research-based innovations in learning environments, DBIR emphasizes design and research specifically focused on the issues of broader implementation [18]. Below are the four principles of DBIR; we make a case for borrowing and integrating these into HCI4D:

- *a focus on persistent problems of practice from multiple stakeholders' perspectives;*

- *a commitment to iterative, collaborative design;*
- *a concern with developing theory and knowledge related to learning and implementation through systematic inquiry;*
- *a concern with developing capacity for sustaining change in systems.*

We highlight the presence of these commitments among the practitioners we study, suggesting that embracing DBIR might be one potential approach for HCI4D researchers and practitioners to co-create the real-world impact they are collectively driven towards. We additionally suggest that DBIR's methodologies might find wider receptivity within the CSCW research communities, given their shared prioritization of collaborations across stakeholders.

3 METHODOLOGY

We conducted a qualitative study with practitioners engaged in designing and deploying technologies that target global development. We began by creating a detailed survey that sought participants' opinions, experiences, and perceptions regarding the importance of research in practice, the ways in which the two currently co-exist, the challenges experienced by practitioners as they strive to engage with and learn from research, opportunities for improved coordination and collaboration between research and practice, and ideas for how research could be more useful or relevant for practitioners. The survey had 29 questions organized into the following high-level categories:

(1) Collecting demographic and background data
(2) Understanding practitioners' motivations and experiences working in global development
(3) Understanding how practitioners currently learn from, undertake, or engage with research
(4) Understanding the benefits and challenges of engaging with research
(5) Understanding participants' aspirations and recommendations for improved relationships between research and practice

We chose an online survey as our primary method for collecting data for two reasons. First, we anticipated that our participants would be located all over the world, operating on constrained timelines, and an online survey would enable them to participate when it was convenient without additional burden of having to coordinate with us. Perhaps more importantly, we were cognizant of the fact that we were researchers who were explicitly asking practitioners what they thought about research, and we hoped that the online nature of the survey would enable participants to feel more comfortable providing their honest opinions than if we asked the questions face-to-face.

3.1 Recruitment

We began by reaching out via email to all the practitioners we knew who worked in global development organizations. We then used a snowball sampling approach [25] to engage with additional respondents. We asked our survey participants for names and contact information of others for whom the survey would be relevant and/or who would be interested in participating. We then contacted everyone that participants suggested, reaching out to approximately 80 individuals. Our use of snowball sampling undoubtedly has limitations. In particular, since both authors are researchers, our first iteration at a snowball sample undoubtedly reached organizations with at least a reasonable research focus. However, we believe that as we snowballed out, we were able to reach a diverse group of practitioners and organizations that both did and did not engage with research. In addition, we posted a link to the survey on several practitioner-focused mailing lists in an effort to reach a diverse audience. We targeted practitioner organizations of different sizes and geographic locations, diverse focus areas and domains of work, for-profit and non-profit, and with varying levels of engagement with research. We ended up with a total of 33 responses, written with

33 Participants		
Experience (years)	Min: 0.7 Max: 17 Mean: 5.3	
Education Level	Doctorate degree: 10	
	Masters degree: 8	
	Bachelors degree: 11	
	Unreported: 4	
Professional Role	CEO: 5	Founder: 3
	Manager: 8	Director: 6
	Coordinator: 3	Researcher: 3
	Advisor: 1	M&E Specialist: 1
	Teacher: 1	Engineer: 1
	Assistant: 1	

26 Organizations		
Organization Size	Small (1-25 employees):	14
	Medium (26-100 employees):	4
	Large (100+ employees):	8
Business Model	Non-profit: 18 For-profit : 8	
Operations Model	National (single country): 11	
	Multinational (several countries): 8	
	Global (many countries): 7	
Geographical Regions	South America: 10	Asia: 18
	Central America: 6	Africa: 14
	Middle East: 7	Oceania: 5
	The Caribbean: 5	Europe: 4
	North America: 9	
Application Domains	Education: 15	Health: 14
	Poverty: 10	Agriculture: 7
	Crisis response: 6	Finance: 6
	Human rights: 5	Journalism: 1
	Environment: 4	Refugees: 1
	Infrastructure: 5	Gender: 1

Table 1. Summary of participants and organizations represented.

considerable detail and attention. We stopped seeking participants when the responses appeared to have reached saturation, and additional responses no longer yielded substantially new perspectives.

3.2 Participants

Our 33 participants came from a wide range of countries and professional backgrounds (see Table 1). They were all well-educated, with almost all (29) reporting that they possessed a bachelor's degree or higher. In addition, most participants held relatively high-level positions at the organizations they worked for, such as being the organization's founder, CEO, or a manager/director. As a result, they were generally involved in high-level decision-making, determining their organization's strategy, and coordinating the running of the organization. We acknowledge that the relatively high-level positions held by our participants undoubtedly yielded different data and opinions than if we had recruited front-line workers. However, since our survey sought a broad understanding of these global development organizations' high-level visions, priorities, strategies coordinating multiple phases of practice (e.g., design, implementation, monitoring and evaluation), and different kinds of engagement with research, we believe that the participants we recruited were well-qualified for our study. On average, participants had worked in their current roles for 5.3 years (*SD* = 4.1 years).

3.3 Data Analysis

We analyzed 33 written responses to our online survey. Two of the 29 survey questions were numerical (e.g., *how long have you worked in your current position?*), five were short answer questions (e.g., *what is your job title?*), and nine were structured questions (e.g., *select all the geographical areas your organization operates in*). Analysis of numerical, short-answer, and structured questions was done by manually aggregating participant responses.

The rest of the survey questions (13 of 29) consisted of open-ended written responses (e.g., *what role do you think research should play towards informing practice?*) The average length of responses to these open-ended questions was 24.9 words per participant per question. We analyzed the data using a thematic approach [8]. We began by iterating through the data several times and allowing codes to emerge. Examples of first-round codes included *'concern about impact'*, *'partnership building'*, *'lack of technical capacity'*, and *'dissemination of findings'*. We iteratively refined these codes into higher level themes and categories that represent our findings described below. The high-level categories that we settled on as best representing our data are: *(1)* practitioners' diversity of backgrounds, *(2)* their views on research, *(3)* avenues they use to engage with research, *(4)* benefits and challenges of engaging with research, and *(5)* suggestions for bridging the research-practice divide. Final codes and themes were agreed upon by both authors.

4 FINDINGS

We begin by discussing the organizational backgrounds of our participants, how they viewed research, and their perceptions of the value it brought (or not) to their work. We then describe their engagement with research thus far, the (perceived) benefits, challenges, and opportunities that they identified from this engagement, and their aspirations for bridging the research-practice divide they experienced. Throughout, our goal is to highlight the perceptions of our participants vis-à-vis the potential they see for collaborations with research.

4.1 Understanding HCI4D Practice: Global and Diverse

Our 33 participants represented 26 global development organizations. As Table 1 shows, the organizations ranged in size from small and local, with a handful of employees who operated in a single location, to large and global, with hundreds of employees and offices around the world. The majority (18) of the organizations represented were non-profit, although a few were socially conscious for-profit organizations and start-ups. The organizations represented engaged in global development initiatives all over the world, with the most common regions being Asia and Africa. Participants also reported that 15 of the 26 organizations operated in more than one country.

Participants' organizations focused on a wide variety of application domains. For example, fifteen organizations said they conducted work in education, such as providing primary education to children from underserved contexts or improving infrastructure in under-resourced schools. Fourteen organizations mentioned their work in healthcare, including designing technologies for community health workers or improving disease diagnoses in clinics. Ten organizations said that they worked to reduce poverty, for example, through creating and disseminating locally-relevant content. Many (17) organizations simultaneously focused on multiple domains, including agriculture, financial services, crisis response, human rights, sustainability, and networking infrastructure.

We also asked participants to share their organizations' goals and mission statements so we could better understand the nature of their work. Many responses we received were high-level and overarching, such as *"technology for social change"*, *"develop innovations that impact people's lives"*, or simply *"community development"*. In addition, the organizations typically had broad goals, such as *"help people build a safe, secure, healthy and productive society"* or *"foster technological innovation and excellence for the benefit of humanity"*. Fourteen of the twenty-six organizations explicitly described designing or deploying technology as part of their high-level mission. Examples included *"to provide ICT expertise to NGOs"* or *"to engage with people in remote and hard-to-reach regions using mobile messaging"*. *"Data"* and *"media"* were mentioned by several organizations. In most cases, this focus on technology was in addition to providing other types of (non-technological) services/interventions for target populations. There were only a few (6) responses that mentioned development outcomes without mentioning technology, such as *"reducing the risk of Ebola reoccurring."*

This wide range of organizations highlights the diversity in goals, locations, and missions, while also spelling out the challenges that researchers encounter as they seek to speak to such an audience. This is also a motivation for us to write this paper, as we highlight that the playing field of global development is vast and variegated. As HCI4D researchers, we find it critical to understand the diverse perspectives of this audience and what they ask of HCI4D research.

4.2 Practitioners' Views on Research

We now examine our participants' perceptions around research. Our survey did not provide participants with a precise definition of research; rather, we sought for them to use their own view of research, before asking them to expand on how their work was impacted by it. Our questions included *"what kinds of research have impacted your organization's work?"* and *"please describe the role(s) that research plays in your work?"* Our data shows that participants did not converge on a precise definition—in their responses—for what they considered research to be. Almost half of our participants considered research to be formal academic work that resulted in published papers. Roughly a third saw it as a data-driven approach to assessing impact and measuring efficacy. For others, it was the process of producing reports and evaluations for funders.

Although we did not ask our participants how they defined what a *researcher* is or the role that *researchers* should have, we did receive several responses. One participant explicitly mentioned, *"many of our partners are academic researchers"*. Another suggested that researchers *"could be contacted as experts . . . as advisors"* to ensure the validity of projects. A third differentiated between *"in-house"* and *"external"* researchers, with the idea that researchers housed within the organization were more free to focus on the *"end-to-end operations of the company"*. Regardless of the lack of precise definitions of research or researchers, the practitioners in our study expressed a positive attitude towards research and the benefits it can bring, both to their work specifically and to global development work more broadly. We touch upon the different aspects of HCI4D practice where participants felt research could (and does) make a meaningful contribution.

Most importantly, and central to our motivation, was the assertion that researchers and practitioners had much to gain from working together and that the importance of collaboration between research and practice could not be emphasized enough. Participants recognized that while researchers wish to improve access to health, education, and information for the marginalized, they also face great challenges in identifying the areas that need most work, co-designing interventions (should they desire to), and studying their impact. There was a general theme in our data that these activities could only benefit with the support of researchers. At the same time, practitioners expressed that they gained from being able to reassess and redesign their products and services as needed, particularly because the technology landscape was rapidly evolving:

> *"End-user-facing practice is not possible without research. This is because typically practitioners are not users of their own technology, so they need [research] to understand what technology to build, how to encourage its usage, etc. by users whom they rarely understand very closely." (P25, CEO, Medium Org.)*

Not only does research highlight what technology to build and how to encourage its usage, it was also seen to (more generally) lead to informed and *"intelligent decisions"*. Importantly, participants further felt that research had a role of ongoing importance that did not end with just informing decisions at particular points in time or coming in to shape a technology deployment. *"Thorough, ongoing research"* had the ability to shape assessments of the quality and effectiveness of products and services and also identify areas for improvement.

Research was frequently (n=23) seen as a valid and reliable way for organizations to measure and/or prove the impact of their work, frequently the undertaking of HCI4D researchers. Organizations found it critical to measure this impact so that they could leverage this data towards external validation, which could potentially be used to secure future funding, directly impacting their projects, but also so that organizations could ascertain how to make greater impact with their work:

> "As an organization we talk a lot about our commitment to impact. There is a strong desire to understand from research if our tools are impactful and how we can make them more impactful. This is why we commit resources and try to let research guide us where possible." (P29, Manager, Medium Org.)

One prominent theme that arose in our data was that it will only be possible for work in the global development realm to achieve its targeted outcomes by combining research and practice:

> "Working together helps both parties: researchers can do relevant research that can have real world impact and practitioners can learn not to be ignorant about them being the first to create something and leverage existing work. Critical perspectives in academia are helpful for practitioners to be not be self indulgent." (P18, Researcher, Large Org.)

Despite the enthusiasm many of our participants evinced towards research, others were less excited about the future of HCI research in the realm of global development. Three participants said that research had not impacted their work at all. In these cases, participants explained that they had not had any opportunities to engage with research, voicing a desire for new platforms that might help them to find and engage with researchers who might be able to help with their practice. We also found that there was extra burden on research to prove its worth because of its relationship with outcomes that directly affected people's lives. Participants voiced an expectation that research should further practice by considering approaches that go beyond the status quo and that are impactful, sustainable, and cost-effective. This cost-effectiveness lay at the core of most concerns and suggestions, since practitioners generally viewed the role of research as making practice more pragmatic, targeted, and informed, building new bridges or making old ones stronger.

Even as we reflect on our participants' views on research, however, we acknowledge that our own understanding of research, as well as that of some of our Western-educated participants, might be quite different from that of global development practitioners who have grown up and been educated in very different cultural contexts. Irani et al. have discussed the challenges of translating design practices from Global North to Global South settings [32]. Were we to work with participants predominantly from the South, our findings might come out rather different.

4.3 How Practitioners Engage with Research

Having developed a nuanced understanding of our participants' views of research, we now discuss the concrete ways in which they engage with research. As discussed in the last section, only three participants said that research plays no role in their work. The rest relied on research to inform their practice in some form. One common model of engagement reported by 22 participants was for practitioners to read published research:

> "We read research papers and incorporate published findings into our work, We up to date our selves with the current education scenario, we follow the data analysis of primary education sector to understand the need of education and basic needs of slum/street children, All the hygiene research output helped us to think other ways and to adapt with new techniques." (P14, Founder, Small Org.)

Another 14 participants described how their organizations used software and/or hardware tools that were originally developed by researchers and were now widely available and generally useful for practitioners (e.g., ODK [28] and CommCare [53]). Eleven participants said that their organizations were founded as a direct result of a research project:

> *"My non-profit organization has research as part of its mission, so I and various academic and NGO partners not only generate research, but consult it to inform our programs in the field and in the research that we publish...In essence, my non-profit, partner NGOs, and universities around the world are constantly engaged in both research and applied development work." (P13, Director, Small Org.)*

As this quote suggests, the organizations that stemmed from research projects generally remained highly engaged with research despite now being more practice-oriented. In addition, many participants (n=21) described how, although practice is their main focus, their work also involves conducting research, although this research is not necessarily formal or academic in nature:

> *"We use research methods in planning interventions (i.e. impact studies) and analyzing data (i.e. statistical analysis). We try to be data driven in our business development and product development." (P1, CEO, Small Org.)*

A key insight here is that the roles of practitioner and researcher are less clearly defined than we had previously considered, and many of our practitioners also considered themselves to be researchers. In other cases, practitioners wore the researcher's hat once in a while, depending on the needs of their organizations. This dual identity may be tapped into to create opportunities for bridging the gaps between research and practice.

In addition to conducting formal or informal research in-house, most participants (n=27) described how the organizations they work for also collaborate with external researchers. These collaborations spanned a wide range of partnerships with both academic and non-academic organizations:

> *"We partner with non-academic organizations (e.g., Nielsen, PATH, World Bank) who run their own trials ... or we contract with third-party quality assurance surveys. We also partner with academic groups (e.g., JPAL, IPA, IFPRI, LSHTM, LBS) to analyze the data that we already collect or to run their own studies." (P17, CEO, Large Org.)*

The processes for establishing research collaborations varied. One participant described how their organization had well-established processes to reach out to partners, usually through existing or known connections. Another described how they were usually not the ones who reached out. This was not because they did not want to find potential collaborators, but rather because they were absorbed in the day-to-day running of their organization and did not have time or resources to spend on finding partners. Instead, they relied on researchers to get in touch with them:

> *"Researchers approach us and ask us to help them implement an intervention. 99% of our research work is through inbound leads, we hardly reach out." (P1, CEO, Small Org.)*

After engaging in research, our participants described how they used their research results in their own practice and also disseminated their findings through a variety of channels. Most commonly (n=20), practitioners incorporated the results of their research into reports that they created for governments, donor organizations, or other partners. Fifteen participants said that they published the work informally through blog posts (e.g., ICTWorks [31]) or on their organizations' websites, and fifteen also said that they submit formal publications to conference or journal venues. Six participants said that their organization does not publish or disseminate their findings at all. In an increasingly social computing-aware world, these are potential avenues for researchers to communicate their results to broader audiences and engage with practitioners. The recently

launched *Human-Centered Computing Across Borders* Medium publication is a step precisely in this direction [2].

4.4 Benefits and Challenges of Engaging with Research

We now describe the factors that made research both valuable and challenging to our participants. Although the distance between researchers and practitioners brought fresh, new perspectives, it also gave rise to challenges when researchers were hard to track down. The different work practices and incentive structures were viewed by participants as both problematic and complementary. While collaborations would sometimes be helpful from a funding perspective, there was also a sense that time and money were not enough. In general, although there were more diverse skill-sets available, these were not always adequate or focused on the right areas of need. Finally, sharing and disseminating research results so that they could be used in practice was always a challenge.

4.4.1 Navigating the Distance Between Research and Practice. The distance between research and practice was palpable across survey responses, appearing to exist both in terms of physicality as well as perspective. Indeed, staying in tune with research represents a challenge for organizations that may be located far from research institutions. Just as one participant voiced that their proximity to university campuses *"opens doors"*, another shared that organizing a research agenda was hard when scholars were *"dispersed around the globe"* or *"hard to pin down"*. One participant said that their organization *"hires PhD students for the summer"* to work around this problem, with these students serving as bridges. Others said they relied heavily on partnerships with academic collaborators:

> *"[Anonymous] Networks is a partnership between the University of the Western Cape (UWC) and the Mankosi community. We base most of our strategic decisions on the research results from UWC." (P15, Director, Small Org.)*

The distance in perspective was largely seen as a positive, because participants affirmed that they liked researchers to come from outside with *"fresh eyes"* and advise them on what was or was not working, *"[opening] up new venues for reflection"*. In addition, the fact that researchers (even when present) are psychologically removed from the day-to-day practicalities of implementing projects allows for a more holistic, big-picture perspective that can lead to fresh insights. For example, some participants said that having external researchers engage with their projects helped them think about and address questions that went beyond their focus on the day-to-day, also bringing perspectives from other similar and aligned projects:

> *"I think the benefits are immense. It brings an external perspective, and more importantly perspective of people who have been studying other similar systems/organizations. It helps in re-usability of concepts instead of re-inventing the wheel. It helps in cross-fertilization of ideas." (P30, Manager, Medium Org.)*

Thus, while distance was certainly recognized as a challenge, both because researchers were remotely located and had a more removed perspective, it also brought new and diverse perspectives to practitioners' work, leaving them better equipped to handle their day-to-day responsibilities.

4.4.2 Aligned Goals, Different Modi Operandi. Research and practice in global development share a symbiotic relationship, with participants describing how the partnership enables each side to get something that they want. One practitioner told us, *"We get tech, researchers get to use our data"*. In other cases, the impact goes much deeper:

> *"It definitely brings changes in the general way that people think in their daily life, it helps to put more facts and points out real issues. And these all help us to bring more betterment in certain areas of work." (P14, Founder, Small Org.)*

Although many goals do align, participants also felt that challenges arose from the different priorities in research and practice. For example, one participant suggested that there could be *"official structures"* in place to incentivize collaboration:

> *"I think the space really needs a structure in place to bridge research and practice. With the tight constraints the space operates in, inefficient utilization of resources is one of the last things to afford." (P30, Manager, Medium Org.)*

Another participant believed that it would be best to incentivize researchers to seek out practitioners, suggesting that every research project should have a practitioner collaborator as a prerequisite. Others called for a similar mechanism in the opposite direction, suggesting that practitioners would be incentivized to collaborate with researchers if their funding agencies mention research in their calls for proposals. Alternatively, one participant described how the burden should be on both researchers and practitioners, but that changes needed to be made *"from the top"* or at the policy-making level, so that there were concrete incentives for researchers and practitioners to work together.

Our analysis shows that practitioners also felt that research could sometimes be extractive or take advantage of them by failing to give them credit. In addition, one participant mentioned that *"researchers tend to have an agenda and sometimes its hard to work around their requirements" (P23).* Another shared that it was a challenge to keep researchers focused on areas or topics that the practitioners wanted prioritized:

> *"We have found it necessary to try to keep the research focused toward our needs as a practitioner. We have identified a couple of researchers whose interest areas align closely with ours, but otherwise, research can be unwieldy to engage with and focused on areas that appear more academic in nature rather than impact oriented or practically grounded in the field. Researchers do also tend to be pulled in varying directions—often at the same time—so, from a practitioner perspective, it can also be a challenge to maintain relatively tenuous relationships with the more laser-like focused dedication that implementation requires." (P17, CEO, Large Org.)*

However, research and practice often have very different incentive mechanisms for disseminating results. For example, one practitioner shared that, once the research is done, *"researchers are primarily interested in a paper or presentation . . . then they tend to lose interest" (P7).* For practitioners, publishing papers and presentations only appeared to be a priority inasmuch as they are useful for target communities, generating publicity, or to report to external donors.

4.4.3 Resources: Shared, but Constrained. One common theme in our data was that practitioners found research collaborations particularly beneficial for financial support. For example, research can help practitioners to procure funding if they use it to demonstrate desirable outcomes with their work. This was important for practitioners' work to stay sustainable and growing:

> *"Our partners (e.g., donors, government) value the rigor that we take in each initiative and use that as justification (and at times, their own marketing) for investing in supporting/scaling our approach." (P17, CEO, Large Org.)*

In general, obtaining sufficient funding was widely perceived (n=15) as a serious challenge, both currently and as one of the biggest issues that participants anticipated facing in the future. Participants said that they would love to incorporate more research into their work if they could afford it. They also sought funding from a variety of sources. One told us:

> *"We have a handful of very interested and loyal universities that are able to write NSF, NIH grants. It's more difficult to get funding from philanthropic agencies for research.*

We often self-fund our research, meaning that we conduct it alongside of running our programs." (P13, Director, Small Org.)

Finding or managing the resources necessary to make the work successful can be challenging in highly-constrained HCI4D contexts. For example, one of the resource constraints that introduced tension between research and practice was *time*, with participants describing how research was time consuming and required long-term patience to make everyone understand the outcome. One practitioner said that having the time to do research would be a *"luxury"*. Another suggested that research and practice could be better coordinated if the time scales could somehow be reconfigured:

"Practitioners and researchers in my world do not spend all that much time together. The time scales are all different, so figuring out how to accelerate research while slowing down practice for better monitoring will be a big challenge." (P32, Researcher, Medium Org.)

4.4.4   Expertise: Shared, but Inadequate. Participants shared that, *within* their organizations, research was often considered valuable to help grow their expertise, whether with regards to technology, providing better training, or scaling interventions. For organizations that had been operating for relatively long periods of time, iterating on their processes had become crucial:

"We use internally- and externally-run research primarily for program improvement (whether for analyzing data, running bottleneck analyses in the field, or quality assurance surveys) which informs the design of every aspect of our approach (e.g., from videos that get produced, to the training that we provide our partners, to the software that we design, our partnership scaling strategies). We use rigorous impact assessments (i.e., RCTs) primarily for policy/investment advocacy though, at times, that also informs program design too." (P17, CEO, Large Org.)

Practitioners also voiced that they were often unable to find *people*—researchers and other personnel—who had the requisite expertise to do their kind of work. As one explained:

"The limited local experiences on the subject of technology for social change makes it difficult to find people who can contribute to our work." (P6, Director, Small Org.)

One participant described how this lack of local expertise often led to an unwanted dependence on consultants or expatriates. Further, technical capacity is also often lacking. Software and/or other research tools are not always available in rural areas or are sometimes too expensive to use:

"We struggle with the limitations of the research software, its availability in rural areas, and its affordability. Technical capacities within our organization also need to be further developed to undertake research." (P21, Coordinator, Large Org.)

4.4.5   Communicating Research Results. Practitioners valued the practice of communicating research results because it could lead to policy-making, drawing attention to areas of concern, and enabling new information reach to reach interested parties. As P15 said, research was key so that one could *"make informed decisions about future plans, influence policy and create media attention so this model can be made available to other communities".* He also added that research had helped his organization create the sustainability model they used, learning from similar initiatives in prior work. It also played a role in monitoring and evaluation to understand the impact of their work.

One major concern that practitioners identified with formally published research was that the writing was often too complex and difficult to make sense of. As a result, practitioners often need help from researchers to turn the results into practical solutions that can be deployed. Making published research accessible to practitioners was also seen as a major challenge:

"There's a need to de-mystify research in order to make findings more accessible and useful. This is primarily a communication issue: too much research stays stuck in academic

language and academic publications. It would be useful for scholars to communicate their work to other scholars but also to rewrite/un-write/de-write their work in ways that bring forward their findings to practitioners. (P13, Director, Small Org.)"

Understanding how research results from one context may or may not generalize to other contexts is particularly challenging in HCI4D, where socioeconomic, cultural, environmental, and many other factors may uniquely (and substantially) affect the results of research. For example, translating results from an intervention targeting improved agricultural practices in India to 19 other countries, as one of our participants is working towards, is no easy task. To ensure validity, researchers are typically careful to limit their claims to the specific country and context in which the work was conducted. However, these cautious, caveated claims often do not help practitioners who need to decide what to implement and who just need *"a pretty good answer now."*

If the results have not been proven to be transferable to new contexts, then is it still justifiable to try and use them? One participant shared that they found it challenging to know how far outside the specific research context they could go:

"It is difficult to know how to incorporate research results into our practice: how far can we deviate before we aren't based on strong evidence anymore?" (P29, CEO, Medium Org.)

4.5 Suggestions for Bridging the Research-Practice Divide

Our participants contributed constructive suggestions for how research and practice could be better connected. One suggestion for bridging some of the gaps was to stop thinking about the dichotomy between research and practice and instead combine them into a single, larger entity:

"I don't think we need to make this dichotomy between research and practice. I think a better framing can be 'informed practice', which can take place both in academia and in the field. Academic researchers should be more engaged with the real life challenges. They should focus more on grounded theory approaches, rather than using theoretical tools blindly in analyzing field data. Similarly, designers and developers should not start with a hammer and find nails in the ground." (P33, Researcher, Large Org.)

This notion of *"informed practice"* aptly conceptualizes the way that many of our participants felt about their work, which we discuss in detail in the next section of the paper. In addition to spending less time focusing on the dichotomy between research and practice, another participant suggested that it would help if the agendas associated with research and practice could be better aligned. One concrete idea was to try and direct attention to the common goal that researchers and practitioners in HCI4D share: having a positive impact on target populations:

"It would be great if research aligned its agendas (and ideally, even its accountability) toward shared objective functions as practitioners, since that is likely to foster more natural collaboration and keep both research and practice directed toward creating an impact." (P17, CEO, Large Org.)

In striving towards having a positive impact, practitioners articulated a desire for both research and practice to do a better job of disseminating their results, particularly in ways that provide free and easy access to practitioner organizations, target communities, and society at large. One participant suggested that findings could be made available through television and radio shows or simply on social media. Another voiced a need for open access venues, complaining that *"Kenyan researchers don't have access to publications of research conducted in their own country" (P11)*. A third participant felt strongly that there was a need to make the research results accessible to the populations who participated:

> *"I think it's imperative that results and findings are returned to the communities where they were collected to not only benefit the community but to encourage a culture of knowledge exchange. We are working on a system whereby participants in our studies will receive by mobile the results from the survey they recently took." (P11, Manager, Small Org.)*

5 DISCUSSION: TOWARDS INFORMED PRACTICE

Our analysis contributes an in-depth understanding of what HCI4D practitioners think about research, as well as how and why they (might) engage with research in pursuit of a social impact on target populations around the world. This kind of examination of the potential for collaboration towards a shared goal (of real-world impact in global development) lies at the heart of CSCW scholarship, and we now discuss some of the broader implications that result from our findings, including how the domain of global development offers possibilities for *"informed practice"* in CSCW and the larger HCI community.

The goal of informed practice calls for greater synergy between research and practice, as it verbalizes the intent for research to continually communicate with and shape practice, and for practice to be open to such shaping (which our research indicates is the case). To imagine what this might look like, we first turn to the DBIR methodology, applying it to the goals of research and practice that we gleaned from our participants, and aligning them with DBIR's four focus areas. Then, we discuss additional goals mentioned by our participants to demonstrate how DBIR might be expanded upon to fit the expectations of practitioners. Although we focus on DBIR as we articulate takeaways of our research, we also note that CSCW researchers may not necessarily align with or follow every one of its commitments. We do believe, however, that many of them will see value in giving greater consideration to a focus on implementation research to see how they might target holistic, sustainable, and impactful design interventions in the context of complex sociotechnical systems.

5.1 Towards Design-Based Implementation Research

We now consider the four principles of DBIR [18] and assess how our findings aligned with those principles. In particular, we aim to highlight what our participants aspired towards in terms of research-practice ties, and how these aspirations fit DBIR.

First, as far as focusing on *persistent problems of practice* was concerned, most (though not all) of our participants were certainly keen to apply research to work on very practical problems. In addition, they were accustomed to working with widely disparate sets of stakeholders, generally adept at taking such a holistic approach. Here we also find a marked alignment with the field of CSCW that routinely engages with multiple stakeholders and complex sociotechnical systems.

Second, DBIR has a commitment to iterative, collaborative design. Participants (such as P17) felt that research and practice could have an aligned agenda, so that it could foster more natural collaboration and drive impact. Our study certainly showed that, in global development, researchers and practitioners often developed and maintained longstanding, sustained partnerships that enabled them to continuously work side-by-side towards a common goal, aiming to improve the lives of underserved populations.

Third, and this is where DBIR aligns particularly with HCI4D research, it aims to develop knowledge that could be useful across different settings. This could be done either to inform design or to develop deeper understandings of learning of different kinds (*e.g.,* student, teacher, organizational). While HCI4D research certainly focuses deeply on the education domain, as Dell and Kumar demonstrate in their recent review of this work [11], there are several other domains of development as well. In these cases, we might adapt DBIR to advocate for the development of knowledge and/or theory in order to advance the field of HCI4D research.

Fourth, our participants were concerned with *"developing capacity for sustaining change in systems"*. This commitment to sustainable change is central to the philosophies of global development work, where the most popular conceptualization of development goals is focused on sustainability (*i.e.,* the United Nations' Sustainable Development Goals [40]). Our participants also voiced their goal of being involved in projects for a duration that is long enough to achieve impact.

5.2 The Limitations of Design-Based Implementation Research

As mentioned, DBIR emerged in and for the field of education. Even as we recommend expanding its focus to include domains apart from education, there are ways in which we might consider defining its scope as well, particularly if we are to introduce it to the realm of global development.

For example, there is the question of the stakeholders that the research impacts. While the field of education might involve a relatively well-defined set of stakeholders, this could be rather complex in more informal settings such as rural Indian communities and the healthcare domain, for example. In these settings, we need to identify the stakeholders we wish to include in our research, with necessary justifications. An intervention that targets maternal health, for example, might involve the mothers, their children, in-laws, other households, healthcare professionals, hospitals, primary healthcare centers, community-based organizations, community activists, and the list goes on. To apply DBIR in such a setting would need identification of a scaled-down set of stakeholders that we might focus on. This scaling down will also need to be done with due justification.

There is also the challenge of funds that DBIR fails to adequately consider, but remains a perpetual source of contention in the field of global development, and most kinds of non-profit work. In realms that fail to align with capitalistic ideologies, such as those where our participants work, guaranteeing sustainability is difficult, when not impossible. It may be crucial, therefore, to define the terms of sustainability for the research in question.

Although social impact may be a commitment shared by researchers and practitioners, definitions of impact also need to be shared and agreed upon. While researchers may prioritize asking questions that successfully advance research and knowledge, practitioners may be interested solely in the number of lives touched by the work. Even as they embrace a common methodology, the goals must also be spelled out—who will the intervention touch, for how long, and in what ways; these are some of the first areas where researchers and practitioners must see eye to eye.

Finally, there is the question of what happens if an intervention or a researcher-practitioner relationship must come to a close, because the collaboration fails to succeed in ways imagined. This is a concern that has been raised in HCI (and HCI4D) research before [54], but not addressed to the satisfaction of either researchers or practitioners. It is also not an aspect that is adequately addressed in DBIR at present and would need further definition. It might be the case that the stakeholders look upon the discontinuation of an intervention favorably; failures are not always (and perhaps seldom) without growth.

5.3 Realizing Design-Based Implementation Research

We now make recommendations for how HCI4D researchers could take steps towards realizing the goals of DBIR and *"informed practice"*. Although some of these may come across as common sense, we believe that our paper would be incomplete without making them explicit.

Our analysis highlighted, for instance, that practitioners struggle with numerous resource constraints, including limited time, funding, and technical capacity. A fruitful way to engage them might therefore be for researchers to highlight how they, or the technologies they design, could ease these constraints or lead to increased resources, where they have the ability to do so. For example, focusing on how an intervention might save time and money for the organization, or volunteering

to provide technical support when needed may help organizations to see the collaboration as a benefit and not burden.

Many practitioners in our study described how the researchers they worked with usually approached them, rather than the other way round. Frequently, this was not because the practitioners were unwilling to engage with research, but rather because they focused all of their energies on the day-to-day running of their organizations. This suggests that HCI4D researchers might be proactive about identifying and reaching out to potential partner organizations with whom they wish to collaborate. In doing so, researchers could be mindful of the fact that different practitioners and organizations might understand and value research differently.

In addition, our analysis highlighted that many practitioners do not always have a clear understanding of what technology might have to offer. This could lead to situations in which practitioners expect technology to be able to solve more, or bigger, problems than is realistic. Alternatively, practitioners may be unaware of the potential for technologies to provide significant improvements in efficiency, data collection, work practices, and more. This suggests that HCI4D researchers may need to do the work of managing both their own and the practitioners' expectations, including expectations from the research itself as well as broader expectations regarding both the opportunities and limitations that technology brings.

Much of the prior work that discusses how to coordinate research and practice in global development is either anecdotal or includes researcher reflections on experiences conducting specific research projects (*e.g.,* [1, 13, 23]). In addition, although there have been several conference sessions and workshops that seek to bridge research and practice (*e.g.,* [50, 51]), the knowledge derived from these events remains limited to those who were able to participate. To the best of our knowledge, our paper is the first to gather empirical evidence directly from HCI4D practitioners themselves and discuss the challenges associated with bridging research and practice from their point of view.

6 CONCLUSION AND FUTURE WORK

Our research extends the CSCW and HCI communities' understanding of the complex relationship between research and practice by studying a new kind of HCI practitioner—one who engages in field research on technology interventions in the context of global development. We conducted a qualitative inquiry with a diverse group of 33 such practitioners from 26 organizations, working in numerous countries and contexts around the world. Our findings show how these practitioners value and engage with research as they implement global development initiatives aimed at having a positive impact on target communities. However, these practitioners also struggle to overcome a variety of challenges in their attempts to work side-by-side with researchers, including resource and personnel constraints, lack of technical capacity, different incentive structures, and more. We discussed how the role of global development practitioners suggests a new model of *"informed practice"* for HCI, aligned with the methodologies of design-based implementation research (DBIR). We then discussed how targeting DBIR might have particular limitations where HCI in domains of global development is concerned, and concluded with a discussion of how HCI4D researchers could take steps towards realizing the goals of DBIR in their areas of work.

Our research only engaged practitioners who work for global development organizations. However, we recognize that many other diverse and marginalized communities are engaging with HCI research, including in the context of health [34, 38], accessibility [35, 58], education [42, 43], and community-centric research [16, 36, 44]. Although additional research is necessary to explore the extent to which the issues we saw in global development contexts apply to these other domains, one property that these diverse contexts share is that researchers and practitioners are increasingly working side-by-side for the benefit of target populations. Thus, we hope that the pursuit of *"informed practice"* will be beneficial in these contexts as well.

7 ACKNOWLEDGMENTS

REFERENCES

[1] Yaw Anokwa, Thomas N. Smyth, Divya Ramachandran, Jahanzeb Sherwani, Yael Schwartzman, Rowena Luk, Melissa Ho, Neema Moraveji, and Brian DeRenzi. 2009. Stories from the Field: Reflections on HCI4D Experiences. *Information Technologies & International Development* 5, 4 (2009), pp. 101–116.

[2] Human-Centered Computing Across Borders. 2018. (2018). http://medium.com/hccxb

[3] Claus Bossen and Lotte Groth Jensen. 2014. How physicians' achieve overview': a case-based study in a hospital ward. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*. ACM, 257–268.

[4] Elizabeth Buie, Susan Dray, Keith Instone, Jhilmil Jain, Gitte Lindgaard, and Arnie Lund. 2010. How to Bring HCI Research and Practice Closer Together. In *CHI '10 Extended Abstracts on Human Factors in Computing Systems (CHI EA '10)*. ACM, New York, NY, USA, 3181–3184. https://doi.org/10.1145/1753846.1753951

[5] Elizabeth Buie, Clare J Hooper, and Aaron Houssian. 2013. Research-Practice Interaction: Building Bridges, Closing the Gap. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems*. ACM, 2493–2496.

[6] Arul Chib and Roger W Harris. 2012. *Linking research to practice: Strengthening ICT for development research capacity in Asia.* Institute of Southeast Asian Studies.

[7] Parmit K. Chilana, Andrew J. Ko, and Jacob Wobbrock. 2015. From User-Centered to Adoption-Centered Design: A Case Study of an HCI Research Innovation Becoming a Product. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 1749–1758.

[8] Victoria Clarke and Virginia Braun. 2014. Thematic analysis. In *Encyclopedia of critical psychology*. Springer, 1947–1952.

[9] Lucas Colusso, Cynthia L Bennett, Gary Hsieh, and Sean A Munson. 2017. Translational Resources: Reducing the Gap Between Academic Research and HCI Practice. In *Proceedings of the 2017 Conference on Designing Interactive Systems*. ACM, 957–968.

[10] Andy Dearden and William D Tucker. 2016. Moving ICTD research beyond bungee jumping: practical case studies and recommendations. *IEEE Technology and Society Magazine* 35, 3 (2016), 36–43.

[11] Nicola Dell and Neha Kumar. 2016. The Ins and Outs of HCI for Development. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 2220–2232.

[12] N Dell, T Perrier, N Kumar, M Lee, R Powers, and G Borriello. 2015. Paper-Digital Workflows in Global Development Organizations. In *ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*.

[13] Nicola Dell, Trevor Perrier, Neha Kumar, Mitchell Lee, Rachel Powers, and Gaetano Borriello. 2015. Paper-Digital Workflows in Global Development Organizations. In *ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*. 1659–1669.

[14] Melissa Densmore. 2012. Claim mobile: When to fail a technology. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 1833–1842.

[15] Brian DeRenzi, Leah Findlater, Jonathan Payne, Benjamin Birnbaum, Joachim Mangilima, Tapan Parikh, Gaetano Borriello, and Neal Lesh. 2012. Improving Community Health Worker Performance Through Automated SMS. In *International Conference on Information and Communication Technologies and Development (ICTD '12)*. 25–34.

[16] Carl DiSalvo, Illah Nourbakhsh, David Holstius, Ayça Akin, and Marti Louw. 2008. The Neighborhood Networks project: a case study of critical engagement and creative expression through participatory design. In *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*. Indiana University, 41–50.

[17] Tom Feltwell, Shaun Lawson, Enrique Encinas, Conor Linehan, Ben Kirman, Deborah Maxwell, Tom Jenkins, and Stacey Kuznetsov. 2018. Grand Visions for Post-Capitalist Human-Computer Interaction. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*. ACM, W04.

[18] Barry J Fishman, William R Penuel, Anna-Ruth Allen, Britte Haugan Cheng, and NORA Sabelli. 2013. Design-based implementation research: An emerging model for transforming the relationship of research and practice. *National society for the study of education* 112, 2 (2013), 136–156.

[19] Geraldine Fitzpatrick and Gunnar Ellingsen. 2013. A review of 25 years of CSCW research in healthcare: contributions, challenges and future agendas. *Computer Supported Cooperative Work (CSCW)* 22, 4-6 (2013), 609–665.

[20] Sarah Fox, Jill Dimond, Lilly Irani, Tad Hirsch, Michael Muller, and Shaowen Bardzell. 2017. Social Justice and Design: Power and oppression in collaborative systems. In *Companion of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*. ACM, 117–122.

[21] Rikin Gandhi, Rajesh Veeraraghavan, Kentaro Toyama, and Vanaja Ramprasad. 2007. Digital Green: Participatory video for agricultural extension. In *Information and Communication Technologies and Development*. IEEE, 1–10.

[22] Sabine Geldof and Joannes Vandermeulen. 2007. A Practitioner's View of Human-Computer Interaction Research and Practice. *Artifact* 1, 3 (2007), 134–141.

[23] Shikoh Gitau and Gary Marsden. 2009. Fair Partnerships–Working With NGOs. In *IFIP Conference on Human-Computer Interaction*. Springer, 704–707.

[24] Elizabeth Goodman, Erik Stolterman, and Ron Wakkary. 2011. Understanding interaction design practices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 1061–1070.

[25] Leo A Goodman. 1961. Snowball sampling. *The annals of mathematical statistics* (1961), 148–170.

[26] Colin M. Gray, Erik Stolterman, and Martin A. Siegel. 2014. Reprioritizing the Relationship Between HCI Research and Practice: Bubble-up and Trickle-down Effects. In *Proceedings of the 2014 Conference on Designing Interactive Systems (DIS '14)*. ACM, New York, NY, USA, 725–734.

[27] Roger W Harris. 2016. How ICT4D research fails the poor. *Information Technology for Development* 22, 1 (2016), 177–192.

[28] Carl Hartung, Yaw Anokwa, Waylon Brunette, Adam Lerer, Clint Tseng, and Gaetano Borriello. 2010. Open Data Kit: Building Information Services for Developing Regions. In *International Conference on Information and Communication Technologies and Development (ICTD)*. 10 pages.

[29] Pamela Hinds and Cathleen McGrath. 2006. Structures that work: social structure, work structure and coordination ease in geographically distributed teams. In *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*. ACM, 343–352.

[30] Melissa R. Ho, Emmanuel K. Owusu, and Paul M. Aoki. 2009. Claim Mobile: Engaging Conflicting Stakeholder Requirements in Healthcare in Uganda. In *Proceedings of the 3rd International Conference on Information and Communication Technologies and Development (ICTD'09)*. IEEE Press, Piscataway, NJ, USA, 35–45.

[31] ICTWorks. 2018. (2018). https://www.ictworks.org/

[32] Lilly Irani, Paul Dourish, and Melissa Mazmanian. 2010. Shopping for Sharpies in Seattle: Mundane Infrastructures of Transnational Design. In *Proceedings of the 3rd International Conference on Intercultural Collaboration (ICIC '10)*. ACM, New York, NY, USA, 39–48. https://doi.org/10.1145/1841853.1841860

[33] Lilly Irani, Janet Vertesi, Paul Dourish, Kavita Philip, and Rebecca E. Grinter. 2010. Postcolonial computing: a lens on design and development. In *Human Factors in Computing Systems (CHI '10)*. 1311–1320.

[34] Predrag Klasnja, Sunny Consolvo, and Wanda Pratt. 2011. How to evaluate technologies for health behavior change in HCI research. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 3063–3072.

[35] Richard E Ladner. 2016. Accessibility is Becoming Mainstream. In *Proceedings of the 18th International ACM SIGACCESS Conference on Computers and Accessibility*. ACM, 1–1.

[36] Christopher A Le Dantec and W Keith Edwards. 2008. The view from the trenches: Organization, power, and technology at two nonprofit homeless outreach centers. In *ACM conference on Computer supported cooperative work*. ACM, 589–598.

[37] Charlotte P. Lee and Drew Paine. 2015. From The Matrix to a Model of Coordinated Action (MoCA): A Conceptual Framework of and for CSCW. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*. ACM, New York, NY, USA, 179–194. https://doi.org/10.1145/2675133.2675161

[38] Sonali R Mishra, Shefali Haldar, Ari H Pollack, Logan Kendall, Andrew D Miller, Maher Khelifi, and Wanda Pratt. 2016. Not Just a Receiver: Understanding Patient Behavior in the Hospital Environment. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. ACM, 3103–3114.

[39] Michael J. Muller and Cathleen Wharton. 1997. Workshop on HCI Research and Practice Agenda Based on Human Needs and Social Responsibility. In *CHI '97 Extended Abstracts on Human Factors in Computing Systems (CHI EA '97)*. 234–234.

[40] United Nations. 2016. *Sustainable Development Goals Report 2016*. UN.

[41] Donald A Norman. 2010. The research-Practice Gap: The need for translational developers. *Interactions* 17, 4 (2010), 9–12.

[42] Amy Ogan, Erin Walker, Ryan SJd Baker, Genaro Rebolledo Mendez, Maynor Jimenez Castro, Tania Laurentino, and Adriana De Carvalho. 2012. Collaboration in cognitive tutor use in Latin America: Field study and design recommendations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 1381–1390.

[43] Eleanor O'Rourke, Kyla Haimovitz, Christy Ballweber, Carol Dweck, and Zoran Popović. 2014. Brain points: a growth mindset incentive structure boosts persistence in an educational game. In *Proceedings of the SIGCHI conference on human factors in computing systems*. ACM, 3339–3348.

[44] Joyojeet Pal. 2017. CHI4Good or Good4CHI. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. ACM, 709–721.

[45] Neil Patel, Deepti Chittamuru, Anupam Jain, Paresh Dave, and Tapan S. Parikh. 2010. Avaaj Otalo: A Field Study of an Interactive Voice Forum for Small Farmers in Rural India. In *SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*. 733–742.

[46] Pablo-Alejandro Quinones. 2014. Cultivating Practice & Shepherding Technology Use: Supporting Appropriation Among Unanticipated Users. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '14)*. ACM, New York, NY, USA, 305–318. https://doi.org/10.1145/2531602.2531698

[47] Christian Remy, Silke Gegenbauer, and Elaine M Huang. 2015. Bridging the theory-practice gap: Lessons and challenges of applying the attachment framework for sustainable hci design. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 1305–1314.

[48] Design Based Implementation Research. 2018. (2018). http://learndbir.org/

[49] Daniela K Rosner. 2012. The material practices of collaboration. In *Proceedings of the ACM 2012 conference on computer supported cooperative work*. ACM, 1155–1164.

[50] ICTD 2015 Open Session. 2015. Innovation accelerator: Connecting ICTD researchers and practitioners. In *International Conference on Information and Communication Technologies and Development (ICTD'15)*.

[51] ICTD 2016 Open Session. 2016. From Research to Action: Challenges in Transforming Impactful ICT4D Findings into Practice. In *International Conference on Information and Communication Technologies and Development (ICTD'16)*.

[52] Erik Stolterman. 2008. The nature of design practice and implications for interaction design research. *International Journal of Design* 2, 1 (2008).

[53] T Svoronos, P Mjungu, R Dhadialla, R Luk, C Zue, J Jackson, and N Lesh. 2010. CommCare: Automated quality improvement to strengthen community-based health. *Weston: D-Tree International* (2010).

[54] Nick Taylor, Keith Cheverst, Peter Wright, and Patrick Olivier. 2013. Leaving the Wild: Lessons from Community Technology Handovers. In *Human Factors in Computing Systems (CHI '13)*. 1549–1558.

[55] Jeroen Ubink, Piet Bögels, Austin Henderson, Gerard van der Heiden, Joan Minstrell, Lucas Noldus, Matthias Rauterberg, Alice Thomas, Gerrit van der Veer, Karel Vredenburg, and Willy Wong. 2000. National and International Frameworks for Collaboration Between HCI Research and Practice. In *CHI '00 Extended Abstracts on Human Factors in Computing Systems (CHI EA '00)*.

[56] Rajesh Veeraraghavan. 2013. Dealing with the digital panopticon: the use and subversion of ICT in an Indian bureaucracy. In *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers-Volume 1*. ACM, 248–255.

[57] Peter Samuelson Wardrip, R. Benjamin Shapiro, Andrea Forte, Spiro Maroulis, Karen Brennan, and Ricarose Roque. 2013. CSCW and Education: Viewing Education As a Site of Work Practice. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work Companion (CSCW '13)*. ACM, New York, NY, USA, 333–336. https://doi.org/10.1145/2441955.2442035

[58] Jacob O Wobbrock. 2017. Ability-Based Design: Elevating Ability over Disability in Accessible Computing. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. ACM, 5–7.

[59] Susan Wyche and Charles Steinfield. 2016. Why don't farmers use cell phones to access market prices? technology affordances and barriers to market information services adoption in rural Kenya. *Information Technology for Development* 22, 2 (2016), 320–333.