

Technical ICT research for Development? Getting from research to practice

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ABSTRACT

In this paper we argue that, if technical ICT research is going to contribute positively to development, the activities of specialized, highly paid ‘researchers’ must be combined with skilled contributions from many other actors. In particular, there is a critical need to develop the capacity available in development organizations, community based organizations, and in local economies, to innovate and to adapt technologies to support their objectives. This suggests that the methods that we adopt in research and in design should be open to local appropriation and contribute to capacity building, and that education programmes are needed in developing countries to support the broader processes of innovation. We describe the Mobile Innovation & Enterprise partnership, which is working to develop the innovation capacity available in Uganda.

Categories and Subject Descriptors

<http://www.acm.org/class/1998/>

General Terms

Design, Human Factors

Keywords

ICT4D, design methods, mobileHCI, capacity building

1. INTRODUCTION

When positing the possibility of one or more interdisciplinary research fields, with titles such as ICTD, ICT4D, HCI4D or ‘Technical ICTD’, we must ask fundamental questions about the nature of knowledges, the nature of research, and the meanings of ‘development’ that should be applied. Whilst it is legitimate to argue that the interdisciplinary nature of the field should encourage dialogue between researchers and practitioners with different perspectives, this should not be used as an excuse for a lazy epistemological relativism where anything is acceptable as ‘research’, but equally evidence shows that the most successful work in the field goes beyond a single understanding of context and design space. In seeking to define “effective” or “reliable” methods for designing technology and for generating new knowledge in ‘Technical ICTD’ we are forced to ask:

- How do we understand the nature of ‘knowledge’? In

particular, how do we understand knowledge related to ICT systems, and knowledge related to ‘development’?

- How do we understand the process by which knowledge is shared between people? In particular, how does knowledge generated by an activity labeled as ICTD research, or technical ICTD research relate to the practice of applying ICT in Development activities? (diffusion of innovations)
- What do we believe about the methods by which new knowledge can best be generated or obtained?; and
- How do we see the relationship between activities within ‘Technical ICTD research’ and designing activities within ‘ICT for Development practice’?

Our understanding of these questions will have a significant effect on arguments about how different individual and organizational actors (e.g. researchers, practitioners, NGOs, government agencies, universities, funding agencies, commercial organizations and local communities) should best engage and collaborate in research and in designing ICT. The suggested relationships then have consequences for the design and research methods that we might wish to recommend for ‘Technical ICTD’.

In this paper, we explore some of these questions and argue for an approach to ‘Technical ICTD’ research and practice that demands capacity building at multiple levels.

2. ICT AND OR FOR DEVELOPMENT?

A common debate among technical researchers investigating ICT in developing regions, particularly amongst those interested in developing technical systems, has been whether the field should focus on ‘ICT and Development’ or ‘ICT for Development’, for example, see Ho et al. (2009). Proponents of the ‘and’ designation argue that an understanding of the relationship between two phenomena (ICT and Development) is important for guiding policy. Clearly, there is an important role here for researchers in social sciences and humanities and the approach allows for a critical reading of ICT research practices.

Proponents of the ‘for’ designation suggest that the aim of research activity, particularly for technical ICT research, should be to develop new knowledge that can contribute towards development. Although technical ICTD researchers may claim to subscribe to either stance (*and* or *for* development), in our experience as authors and reviewers of research proposals, the justifications offered to obtain research funds from government

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agencies, usually suggest that the research will (ultimately) bring positive benefits to people in the developing world. An alternative justification for research might be to argue that research might lead to increased uptake or sales of ICT products or services in the developing world. However, we have seen fewer examples of research funding bids framed in this way, and most ICTD researchers recognize that increased sales of ICT is not *a-priori* a positive development outcome. For example, increased sales of ICT products might result in added problems from e-waste and could divert resources from other basic needs (e.g. spending on food, health, water, education, shelter etc.).

We therefore argue that the dominant goal of Technical ICTD research is in fact ICT *for* Development. Hence approaches to generating knowledge, and methods of design should be assessed by reference to their relations with development. If our goal as development, then methods whose goal is usability, or quality of user-experience, or level of product sales, must be significantly enhanced and adapted to be usable as methods for ICT4D. Methods that are successful in creating attractive and adoptable technologies do not necessarily support the 4D objective.

3. WHAT KIND OF DEVELOPMENT?

At the first CHI workshop on Interaction Design & International Development, Uday Athavankar challenged the assembled researchers to address the question of “What is Development?” (see Dearden, 2008). There is a vigorous debate in development studies around this topic, with growing recognition that development is more than increase in GDP, or adoption of particular lifestyles. The Millennium Development Goals raise dimensions of financial income, health, education, environmental sustainability and gender equity. The capabilities perspective (Sen, 1999), which treats development as freedom, including political voice is an increasingly influential framing.

These definitions of development are incompatible with strategies that create permanent situations of dependency, and limit the power of local self-determination. If the form and function of ICT is entirely controlled by remote organizations without local accountability or engagement, this will unavoidably set limits on the capabilities (in the sense of Sen, 1999) that can be achieved. If we aim to design ICT that is 4D, the approaches that we adopt must be sensitized to how they empower people locally to progress their own visions of the kind of social development, and therefore the form and function of ICT that they want. Process and outcome must be open (Light and Anderson 2009). Hence ICT programmes *for* development must adopt strategies that build local capacity so that communities at local, regional, national and international levels can make and enact their own choices, and leverage both local indigenous knowledge and knowledge acquired from external sources.

4. RESEARCH FOR DEVELOPMENT

The goal of research is the generation of new knowledge. Research in mobile HCI produces knowledge in a number of different forms. Four common types of research output are:

1. Research may generate a new understanding of how people are interacting with existing mobile technologies; e.g. Wakunuma (2007) discusses the social impact of mobile phones on the empowerment of

Zambian women, or Jensen’s (2007) classic report on the use of mobiles by fishermen in Kerala;

2. Research may create toolkits to enable innovative ways of constructing mobile systems, e.g. the SensMobile framework (Gross & Paul-Stueve, 2010), or the EpiCollect system (Aanensen et al., 2009);
3. Research may devise innovative methods for designing mobile systems; e.g. Dearden & Rizvi, (2009); and
4. Finally, research may lead to the creation of an innovative artifact or system, that demonstrates a new way of interacting using mobiles, e.g. Maunder et al (2008) describe the BigBoard system;

Each of these types of research will have different relationships with the goal of conducting research *for* development. We therefore need to carefully examine the means by which the knowledge generated can be applied to promote development.

In the case of research examining use of mobiles, there is considerable opportunity to understand how ICT in general and mobiles in particular interact with the social processes of development. If such research addresses relevant questions, then outputs could support policy debates and inform the decisions of individuals, community based groups and organizations (in the statutory, private or third sector). In seeking to shape such studies as research *for* development, there will be important roles development actors in: initially scoping and prioritizing the research questions, in conducting the research (often involving development actors and communities as co-researchers), and in evaluating the research outputs and outcomes.

In the case of novel software architectures that simplify the construction of mobile systems, again the expected pathway from research to social development is clear. The assumption is that the architecture is to be used as a framework from which groups involved in social development (and software designers working with them) can create systems to support their objectives.

A similar pathway can be imagined for innovative design methods, which can be applied by systems designers to assist groups working in social development. Though the transfer and adaptation of methods between different global design contexts and different cultural settings is as much a research question as is the development of new methods in any particular context.

But, a common feature of all these first three routes from ICT research to development is that their successful translation from research into positive development outcomes is dependent on the active contribution of actors who are not (primarily) ICT researchers. The actors involved in this process are very diverse, ranging from government policy makers, to software systems designers, to community based organizations.

In the case of developing novel mobile interactive systems the question of how these novel technologies will impact on development is more complex. Unless we adopt a naïve technological determinism, we must critically examine how these innovations might actually support development. One possible answer is that the innovation may be adopted by groups or organizations that are working in the field of development, and these technologies can then help them to enact their development mission. This is a model in which technology supports the making of social change, rather than one in which it is designed to directly

facilitate it (see Dearden and Light, 2008, for more on this distinction). If this pathway is envisaged, then lessons from previous generations of technology in development (Douthwaite, 2002), as well as results of widely cited research in HCI (Berg, 1997; Bowker & Star, 1999) point to both the pragmatic difficulty of devising solutions that are appropriate to context without allowing for extensive local adaptation in each setting; and to the political significance of local adaptation as an expression of freedom (& hence development). Thus, this form of technical ICT research, also needs non-researcher actors in order to be translated so as to qualify as research 'for development'.

Finally, without falling into naïve technological determinism, it is possible to imagine technologies that are designed with a deliberate goal of promoting specific social change. Dearden & Light (2008) describe the concept of 'Technology as Social Action', using examples such as TheyWorkForYou.com – a website that makes the voting records of UK parliamentary representatives easy for constituents to access and review. This technical solution changes the power relations between members of parliament and their constituencies by making the actions of MPs more transparent. However, the most successful examples of such technologies have not been come from technical ICT researchers, but from activists with ICT innovation skills.

Thus a key element of any strategy for research in Technical ICT that aims to be explicitly *for* Development, is the capability of those involved in development to utilize the outputs of the research. This capability has to go beyond being able to maintain systems that are designed and built elsewhere. The key to successful translation of mobile HCI research into positive development outcomes will be primarily through processes of innovation driven by development actors, activists and technologists working in developing regions. It will be work on the ground that makes the difference, whether or not this includes formal academic researchers and exogenous teams.

A corollary of this observation is that, for mobile ICT for D research to be effective, there will be a pressing need for a cadre of people with skills in innovation with mobile technology, and for sustainable organizations to support local technology innovation efforts. People will be needed within development organizations (governmental & non-governmental), within community based organizations and in local industries. They will need skills as technologists, as development practitioners, as business innovators and as mobile interaction designers. These organizations will also need access to affordable services from innovative designers and specialized technology providers who can support their activity. For reasons of economy, the scale of the development challenges, as well as the need for local adaptation and local sustainability, these people will primarily come from the same countries in which they are working. Just as the remittances of members of diasporas are an important element of most developing world economies, the innovation skills of these individuals will be critical to the social and economic development opportunities of their compatriots.

5. INNOVATION AND ENTERPRISE

Based on this understanding of mobile HCI research *for* development, the Cultural, Communication & Computing Research Institute (C3RI) at Sheffield Hallam University, in the UK and the Faculty of Computing and Information Technology

(CIT) at Makerere University in Uganda are working together to build up sustainable capacity to underpin future innovation with mobiles in Uganda. Makerere is one of the leading centres for ICT teaching and research in sub-Saharan Africa. It was the first university in the region to introduce mobile programming into its undergraduate and masters ICT curriculum, as well as offering short courses for continuing professional development. We take the view that sustainable capacity to promote mobile HCI research *for* development will (at least) require:

- Students and graduates with relevant skills, that will enable them not only to work as technology developers within the mobile ICT industry, but also skills in innovative and user-centred design;
- Staff within the faculty of CIT who are able to develop and nurture these skills in future cohorts of students;
- Strong links between CIT, the mobile sector, and development actors in Uganda;
- Ongoing research, technology development and ICT4D activities to maintain these collaborative networks

With funding from the British Council Education Partnerships with Africa programme, the Mobile Innovation & Enterprise project is an 18 month collaboration in which we aim to develop:

1. A group of graduates skilled in creating innovative applications using mobile phone technology;
2. Increased capability at Makerere in teaching innovation, user-centred design, business and entrepreneurship skills relevant to the IT industry;
3. A business plan for a sustainable mobile phone innovation centre at Makerere.

To achieve these aims, the project plan involves a group of 3rd year undergraduates doing their final year projects developing mobile technologies, and applying interaction design methods. Each team of students (between 3 and 5 students per team) is developing an application for one particular domain and is building links to relevant partners (e.g. local hospitals, businesses, and agricultural organizations). To prepare the students for these new ways of working, the students participated in three workshops.

The first workshop, delivered by the UK team, focused on methods for understanding users and contexts, whilst the second explored divergent thinking and ideation; and ways of reviewing design concepts from usability, practicality and commercial perspectives. One aspect that seemed particularly new and challenging for the students was developing their skills of enquiry. However, the students rapidly adjusted to this novel role for themselves, and we were very impressed by their confidence in approaching external stakeholders to collect information. The third workshop focused on technical skills and the pragmatics of building software on mobile devices. Here the students were more comfortable, adapting their existing programming skills to a slightly different technical environment.

The workshops helped launch the projects, which will be presented in a 'showcase' event to demonstrate the potential available through the university to a wider group of stakeholders, on completion. In parallel, CIT have been developing other partnerships, Memoranda of Understanding (MoUs), and general contacts with government, NGOs, private companies, and major donors who are interested in the potential of mobiles to support their missions. Together with these partners, the staff of the two universities shall develop a business plan for a technology design and development service that could form a bridge between CIT

and these multiple stakeholders. The centre would enable Makerere graduates to refine their skills whilst working on projects that can contribute to the economic & social development of Uganda.

At the time of writing, the students are developing their design concepts. Table 1 lists the projects that students are working on.

Table 1: The students' projects

Design concept	Relevant partners
Electricity Metering is a challenge where electricity is postpaid. Reading of meter is carried out manually leading to delays in billing and inaccurate records. The idea is to provide a mobile interface where real-time meter reading can be communicated to the billing system	Postpaid services providers such as Water and Electricity companies
The increase in the number of patients needing close monitoring in their homes e.g. those with chronic conditions, has challenged healthcare providers in Uganda in delivering close and real-time monitoring.	Hospitals
The process of marketing, crop selection and finding storage is a challenge to farmers. The existing system to support marketing choices, storage and logistics in Uganda is unreliable. Farmers often have to sell their produce at low prices in their localities, unable to reach high value markets.	Farmers and farmers' organizations – Uganda Co-operative Alliance
Whereas there are many sports lovers and followers in Uganda who are willing to bet, the concept of betting is largely seen as an activity for the semi-illiterate unemployed or under-employed youth. The elite and many corporate workers who are genuinely interested do not want to be seen at the betting points. The idea is to tap on this market by providing a secure mobile based platform where anyone can bet in the privacy of his/her mobile device.	Public, bookmakers

By the time of the proposed workshop we shall be able to report on the systems that they have produced and their evaluations.

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