ICT4D Research: Reflections on History and Future Agenda

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Abstract

Research on the use of ICTs for international development, or ICT4D research, has a history going back some thirty years. The purpose of this paper is to take stock of the ICT4D research field at this important juncture in time, when ICTs are increasingly pervasive and when many different disciplines are involved in researching the area. The paper first provides some reflections on the history of the field broken down into three phases from the mid-1980s to the present day. This is followed by a detailed discussion of future research agenda including topic selection, the role of theory, methodological issues and multi-disciplinarity, and research impact. ICT4D research started largely in the academic field of information systems but it is concluded that the future lies in a multi-disciplinary interaction between researchers, practitioners and policy makers.

Keywords: ICT4D, ICTs, international development, historical reflections, research topic selection, role of theory, methodology, multi-disciplinary, research impact

1. Introduction

ICT4D (Information and Communication Technology for Development) is a relatively new label for the academic field concerned with the use of ICTs for international development. Other acronyms are sometimes used such as ICTD and ITD. The main focus of both research and practice in the field is the so-called developing countries and, in particular, emphasis is often placed on the less materially advantaged members of those societies. Thus ICT4D can be seen as a part of a wider concern for global development. Terms such as development are multifaceted and often contentious (Heeks 2010a, Qureshi 2013), and we will explore some of the nuances of this plurality, and its impacts on the field of ICT4D, later in the paper.

ICT4D and its related research activities can be considered to be of great significance at this point in time. We are all aware of the ubiquity, availability and widespread use of ICTs. ICTs have penetrated to all corners of the globe, not least through the unprecedented spread of mobile phones. However, despite the importance of the field, there are still many questions to which we do not have clear answers. For example, to what extent are ICTs contributing to development, particularly that of the relatively poor members of society? How can we extend the benefits of ICTs more widely in society and mitigate the negative effects of rich/poor divides for example? How can we as researchers theorize what is happening in a compelling way?

The purpose of the current article is to try to take stock of ICT4D at this important juncture, and in particular of ICT4D research. The article will discuss some achievements of the research field to date and will explore elements of future agenda. This is not an easy task for at least two reasons. Firstly, the last decade has seen, in line with the growth in the availability and use of ICTs, a large increase in the number and range of published work on the topic. A second reason why 'taking stock' of ICT4D is difficult is that the field involves a whole range of disciplinary approaches. Academic fields where work on ICT4D takes place include information systems, computer science and sub-fields such as HCI, geography, anthropology, community informatics and development studies. Comprehensive surveying of this large and multi-disciplinary terrain is beyond the scope of a single article. The approach adopted here will therefore be much more selective, choosing examples and illustrations for particular themes and arguments rather than conducting full literature reviews.

Earlier articles which attempted to take stock of the ICT4D field include Walsham and Sahay (2006), where the authors discussed the landscape of IS research concerned with developing countries, provided examples from the existing literature and discussed future opportunities. Avgerou (2008) reviewed the IS literature on how developing countries have attempted to benefit from ICTs and identified three broad discourses which pervade that literature, namely ICTs as technology and knowledge transfer, a process of socially embedded action, and transformative intervention. These early articles about a decade ago reflected the state of ICT4D at that time, but much has changed since then in terms of ICTs and their use throughout the world and, as noted above, in the academic literature on ICT4D. For example, more recent work includes surveys of the literature including Gomez et al (2012), Gallivan and Tao (2013) and Thapa and Sæbø (2014), and the setting of future agenda for the field (Heeks 2014).

We will draw on the above sources as appropriate but the purpose of this paper is to provide a current synthesis of ICT4D in terms of both its history and future prospects. The rest of the paper is structured as follows. The next section provides a brief history of ICT4D research over the last thirty years, and highlights some examples of research achievements in particular periods. Future agenda are then discussed on topic selection, the role of theory, methodology and multi-disciplinarity, and research impact. The final section draws some conclusions on the ICT4D field and its significance in the future.

2. A Brief History of ICT4D Research

ICT4D research can be considered to date from the mid-1980s, at least in terms of substantial amounts of formal research published in refereed journals or conferences. The history of the field since then will be broken down in this section into three periods. Each period will be discussed with respect to characteristic features, publication outlets and some research achievements. It is clear that a fuller history would involve much more than is presented here, and indeed a book-length exposition might be appropriate. The purpose of the 'brief history' in this paper is to identify elements of the evolution of the field over the historical period as a basis for projecting into the future. Table 1 provides a summary of the main points in the section. Heeks (2014) also attempted a brief history of 'development informatics research' and came up with similar periods or 'waves' to those discussed below, although an earlier pre-history prior to the mid-1980s was identified by Heeks.

[Insert Table 1 here]

2.1 Early Beginnings: mid-1980s to mid-1990s

In its early beginnings from the mid-1980s, ICT4D research was carried out largely within the information systems (IS) field. A key event in this early history was the conference in New Delhi, India in 1988 on the 'social implications of IS in developing countries'. The conference was organised under the auspices of IFIP, and led to launching of working group 9.4 a year later. This conference series has continued up to the present day with the most recent being the thirteenth conference in Sri Lanka in May 2015. The conference proceedings have provided a valuable research outlet for ICT4D work, and earlier conferences resulted in a published book – see Bhatnagar and Bjørn-Andersen (1990) for the Delhi conference. At that time, few other outlets existed for the publication of work on IS in developing countries, although it is important to mention the journal *Information Technology for Development (ITD)* which published its first volume in 1986.

A broad categorisation of the work being carried out at that time, based on re-reading of all the papers in the 1990 book by the current author, is that it involved themes from mainstream IS carried over and adapted to developing countries. This can be illustrated by four themes which are identifiable from the Delhi conference proceedings. The first theme is that 'context is important'. Robey et al (1990) argued that cultural barriers to implementation present more difficult problems than technological issues because they provide the social context within which IS are interpreted and given meaning. In a related vein, Walsham et al (1990) argued that computer-based IS should be conceptualised as social systems in which technology is only one of the dimensions.

Three other themes from the Delhi conference also have a familiar IS feel about them: 'participative and cooperative design'; 'the need for indigenous development'; and 'IT is only one element of change efforts'. Korpela (1990) argued that the most important guarantee for including all important aspects in designing IS is participation or co-operative design of the computer-supported activity by a group consisting of users as well as computer experts. Bhatnagar (1990) considered that, although technology can be borrowed or adapted by developing countries, a significant part needs to be developed indigenously. Avgerou (1990) argued that IT is not enough by itself and that computer projects in public administration in developing countries need to be incorporated in programs of far-reaching reform.

The above four themes, as well as having a clear mainstream IS origin, are remarkably fresh in some ways. They still have resonance twenty five years later in terms of ICT projects at the current time. It is sometimes argued that IS has an inadequate cumulative tradition, but these themes provide a counter to that in terms of retaining their relevance in the longer term as a basis for others to build on. However, it is not surprising that, as we will see, other themes have come to prominence over the years and decades following these early beginnings. We move on now to the second period in our brief history.

2.2 Expanding Horizons: mid-1990s to mid-2000s

It may not be necessary to remind readers of this journal that ICTs have changed dramatically over the last twenty years or so, but it would be remiss to omit mentioning it in the context of an article on ICT4D research. There is little doubt that the widespread availability and decreasing cost of technologies such as the internet, the world wide web, and sophisticated search engines produced a large increase in interest in using ICTs in the context of developing countries. One result was an increase in the scope and range of ICT4D research in the IS field. A second feature of this decade, however, was the start of an interdisciplinary focus on ICT4D.

Both of these above features were mirrored in the history of publication outlets during this time. The IFIP wg9.4 conferences continued and the ITD journal was published consistently from 2005 onwards, after a rather chequered history of publication gaps earlier. The *Electronic Journal of Information Systems for Developing Countries (EJISDC)* was started in 2000. This journal has two features worth noting. First, it has been open access since its inception, particularly important in reaching developing country readers and institutions with limited library budgets. Second, the journal is refereed, but tries to be open to a wider range of authors than is typical for the regular IS journals, again with the aim of reaching out to developing country readers and researchers. In addition to these IS outlets, this decade saw the arrival of the new journal *Information Technologies and International Development (ITID)* which started in 2003, and is also open access. However, it is not an IS journal as such but, rather, is explicitly interdisciplinary in focus.

Walsham and Sahay (2006) made an attempt to summarise some of the work taking place over this decade under a range of headings including issues studied, theoretical stance and level of analysis. Key issues included local adaptation and cultivation of ICTs, standardization versus localization of technology, and in-depth studies of particular technologies such as GIS. A wide range of theories

was drawn on including theories of globalization, post-colonialism and theories of power. Levels of analysis included individual, groups and organizations. And the focus of analysis included issues such as public/private sector partnerships, and cross-cultural working.

The work outlined above is substantial in nature and certainly contributed to the subsequent research efforts and publications up to the present time. However, it is worth noting that this period also threw up a number of critiques of ICT4D research which remain relevant today. For example, what is the 'development' to which ICT4D wishes to contribute? Heeks (2006) argued that it was important for the ICT4D field to move beyond the mere application of ICT to theorizing its use in addressing development issues. Avgerou (2003) questioned the rhetoric, common in international development agencies at that time, that ICTs are an instrument for economic and social gains only within the context of a market regime. Brown and Grant (2010) commented that work in the past had normally not distinguished between 'ICT in developing countries' and 'ICT for development'. We will return to this complex issue of development later in the paper. Gender is a related issue which surfaced in response to research work in the decade from the mid-1990s. Gillard et al (2008) argued that a notable omission in Walsham and Sahay (2006) was any reference to gender or gender relations. They argued that gender is a central issue if we wish to increase our understanding of information systems for development.

2.3 Proliferation: mid-2000s to present

The last decade has seen an explosion in the use of ICTs in developing countries, much of which can be attributed to the mobile phone. We need to be careful of claims made of the effects of mobile phones (see, for example, Burrell and Oreglia (2015) on the myth of market price information), but mobiles have impacted the lives of almost everyone on the planet and the effect has been particularly striking in poorer communities and countries where ICTs have previously been less common. Whilst it is not the only cause, there is little doubt that the mobile revolution has been a major contributory factor to the involvement of many disciplines in ICT4D research. Computer scientists see an opportunity to develop applications based on mobile, sociologists and anthropologists encounter mobiles all the time in their field studies, economists see potential for significant economic impact and the list goes on. The discipline of development studies is interesting in this regard. Prior to the last decade, little published work in the field of development studies dealt with ICTs at all. In contrast, the eminent development studies scholar Robert Chambers had this to say about ICTs in the current era:

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'... cornucopia of potentials through email, internet, video conferencing, participatory GIS, mobile phones, SMS, blogging, Twitter and beyond ... a whole new domain of participatory interaction has opened up'. (Chambers, 2010, p. 29).

In terms of publications, existing journal outlets such as ITD, EJISDC and ITID have continued their contribution. In addition, there have been occasional special issues in what may be termed 'prestigious journals' such as MIS Quarterly (see Walsham et al 2007). With respect to conferences, a new arrival in the last decade is the ICTD (Information and Communication Technologies for Development) Conference. The first of these was in 2006 at Berkeley and the latest is the seventh conference in Singapore in 2015. Two things are notable about this conference. First, its mission is explicitly interdisciplinary. Secondly, it attracts a large multi-disciplinary audience including a range of academics, practitioners, and policy makers. In that sense, it reflects the proliferation of interest in the ICT4D field mentioned above.

Much substantial research has been carried out during the last decade and a full review is not possible in this short article. However, I will pick out two examples of work which goes further, in some sense, than work in the previous decade, and addresses critiques from that earlier period. The first of these concerns the issue of theorizing what is meant by development in ICT4D research. There are many approaches to this and published work includes a human development approach and its links to the IT artefact (Sein and Harindranath 2004), linking of theories of development to particular e-commerce approaches (Boateng et al 2008), and the need for better understanding of the development context to show up particular views of development implicit in specific projects (Prakash and De' 2007).

A further approach which has attracted increasing interest over the last decade or so (Gallivan and Tao 2013) draws on the work of the development economist Sen (1999) and his capability approach (CA). The CA is a much broader approach than is typical in economic theories of development that focus solely on issues such as income, expenditure and growth models. In contrast, the CA focuses on the 'freedom' which individuals have to lead the kinds of life they value. Two major constituents of the CA are functionings and capabilities, the former referring to realised achievements and the latter to effective possibilities for achievements. Although little mention is made by Sen of the role of technology, a number of ICT4D researchers have recognised its potential to theorize the impact of ICTs on development (Zheng 2009; Smith et al 2011). Kleine (2011, 2013) operationalised the CA to

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generate a choice framework incorporating the role of ICTs. She applied the framework to a case study of telecentres in Chile as part of a broader ethnographic study of how state ICT policies affected microentrepreneurs in rural Chile. It is interesting to note that work on applying the CA to ICT4D has involved researchers from differing academic disciplines. For example, Zheng has an IS background whereas Kleine is a geographer by training. This creates an interdisciplinary rather than multi-disciplinary space since the researchers from the different backgrounds engage with each others' work.

A second illustration of substantial ICT4D research which is interdisciplinary in nature, and addressed the critique from earlier eras that gender had been largely ignored in ICT4D research, is the work on African women and ICTs carried out by the GRACE network (Buskens and Webb 2009, 2014). The theme of the work is the role of ICTs in transforming the lives of African women, and the books demonstrate the diversity and complexity of women's experiences. Strong evidence is provided that mobile phones, for example, can empower women in a number of ways, such as enabling economic activity on their part. However, old male-dominated hierarchies persist, and the use of mobiles does not necessarily enhance the status of women in their communities. Recent work by Oreglia and Srinivasan (2016) on women ICT workers in India and China reinforces this point through an interesting discussion on whether and how they are able to renegotiate patriarchal social structures. The GRACE network of researchers was coordinated by Buskens who is a cultural anthropologist and Webb who is trained in sociology and gender studies. However, the 30 other researchers come from a kaleidoscope of backgrounds including anthropology and sociology, public administration, computer science, development studies and, in several cases, information systems.

The picture of sophisticated theorizing and genuine interdisciplinary research painted in the two examples above is perhaps a somewhat rosy one when compared to the ICT4D field as a whole. For example, mention was made earlier of the relatively new set of ICTD conferences which are an important forum for ICT4D researchers. However, Walsham (2013) reviewed the activities in the 2010 and 2012 conferences and raised some challenges for the field in the future. Firstly, many of the formal conference papers did not theorize development in any specific way or indeed refer to the term directly. Walsham argued that we would be dismissive of any paper submitted to an ICTD conference that largely ignored the ICT part, so why not the same treatment for the D part? Secondly, while the conferences are undoubtedly multi-disciplinary, the interdisciplinary element is often missing with individuals attending sessions in their own discipline but not that of others. Thirdly, Walsham noted that research on strategic policy with respect to ICTs would be a

complement to the more usual local implementation studies. Finally, Avgerou (2008) identified three discourses concerned with ICT4D with the last of these being a process of techno-organizational intervention associated with global politics and economics. Walsham argued that this discourse was largely absent at the ICTD conferences and that he would like to see more research reflecting a political view as to who was pushing which technologies and why. Putting it another way, political scientists were less evident at the ICTD conferences than computer scientists.

3. Topic Selection

The brief history provided in the previous section ended with some future challenges and this leads on to the rest of the paper which has a strong future-oriented focus. This section will address the issue of topic selection. Many papers do discuss why their topic is interesting but they normally say little if anything about the socio-political background which lead them to selecting a particular topic. This black box of topic selection is opened up a little here in four ways. Firstly, different disciplinary approaches to topic choice are discussed. Secondly, some interesting current topics are examined. Thirdly, the question is asked as to whether the ICT4D community is tackling 'major' societal issues and, if not, what future work could be carried out. Finally, two new developments in IS research, namely 'big data' and 'social media', are examined to assess their relevance to ICT4D research.

3.1 Disciplinary approaches to topic selection

There is a danger of stereotyping in discussing different disciplinary approaches to topic selection but any examination of the ICT4D literature shows some clear differences between disciplines. For example, computer scientists tend to build ICT applications and then evaluate them in particular field contexts. This focus on creating an artefact or system has undoubted merits in terms of concrete outputs from a research project, but it can sometimes be at the expense of any substantial analysis of the subtle interaction between the ICT artefact and the context. This interaction can be considered at different levels, both the impact on day-to-day lives and the way in which long-standing institutional issues affect particular projects. A good example of the latter would be the impact of male-dominated communities and societies on women's use of ICTs as discussed earlier in the paper.

In contrast to computer scientists, sociologists and anthropologists normally address contextual issues in some depth but do not construct artefacts. Economists, gender studies people,

educationalists and all the other disciplines now 'competing' in the ICT4D space all have their particular biases in topic selection. One obvious way in which these different disciplinary approaches can be combined, at least in principle, is through interdisciplinary project teams. An example of this is the work of the Health Information Systems Programme (HISP) which started in the 1990s in post-apartheid South Africa and is now applied in a wide range of countries and contexts (Braa et al 2004). This work has involved computer scientists in building artefacts, IS people in developing information systems, and a range of others including sociologists and anthropologists in implementation processes.

Despite the relative success of research projects such as HISP, interdisciplinarity is not without its own problems. For example, researchers need to pursue their own careers and the structures of academia can be harsh in terms of rewarding interdisciplinary work. We will return to this issue of interdisciplinarity and its pitfalls in more depth in the later section on methodology. In terms of the current section on topic selection, the key message is that selection is deeply influenced by disciplinary background and that researchers need to be more aware of this bias than they appear to be, judging by the limited attention given to the reasons for particular topic selection in most published ICT4D work.

3.2 Some interesting current topics

Turning now to suggestions for interesting topics of research, a clear candidate for substantial work in the coming years is the whole area of *what is meant by development and how ICTs can contribute to it*. As noted earlier in this paper, there is already a promising body of work based on Sen's capabilities approach. In addition to the references cited earlier, a recent book by Gigler (2015) draws on the capability approach to examine the impact of ICTs on disadvantaged communities, with extensive empirical evidence from the rural poor in Bolivia. The book criticises simplistic analyses based solely on whether people have ICT access or not and, instead, identifies a more complex ICT impact chain. This involves the need for enhanced information capabilities for the poor including communication capabilities, information literacy and knowledge sharing abilities. The role of intermediary organizations is emphasized in supporting disadvantaged communities to develop and use these skills.

The capability approach is of course not the only way of looking at development and its relationship to ICTs. An interesting alternative approach is that of Madon (2009) who argues that technology-

based projects aimed at development goals in specific context should not be studied in isolation but in conjunction with a deep investigation of the historical processes of development and governance that have evolved over time in that context. She illustrates her approach with detailed studies of e-governance projects in India. Madon's work makes it clear that there are no short-cuts to understanding what is happening with technology projects in rural India, but rather that we need the kind of painstaking studies which she has carried out over an extended time period of many years

The book 'New Media, Development and Globalization' (Slater 2013) is also based on extensive ethnographic field studies. It is critical of traditional approaches to the meaning of terms such as development and globalization which tend to be western-centric, and see 'new media' projects as ways of raising developing countries to western standards. In contrast, Slater repositions 'beneficiaries' of ICT4D projects as equally valid partners, along with development 'experts', as to what constitutes 'development' for them, or how new connections are achieved by them in 'globalization' processes. Slater argues that the meanings of the three terms new media, development and globalization should be sought in grounded, diverse everyday street lives. It is of course hard to achieve a more symmetric position between 'experts' and 'beneficiaries' but Slater argues that it is a goal worth striving for.

A second area for extensive future work in ICT4D is that of women and ICTs or, perhaps better, of *gender and ICTs*, since male attitudes are deeply important in studies of women and ICTs and vice-versa. But it is important to note that such work should not be relegated to the 'gender studies' category, as if that is a special subject to be studied by women and not part of the mainstream.   In contrast, Gillard et al (2008) argued that gender should be seen as a central issue in our understanding of ICTs in developing countries. Women are key players in many crucial areas where ICTs are introduced, including sectors such as education, health, entrepreneurship, agriculture, and commerce. There is a big future opportunity here for researchers to bring gender into the ICT4D field in a major way.

A third area for substantial future work for ICT4D researchers is that of *new ICT-enabled models* that can transform the processes and structures of development. Heeks (2010b) referred to this as Development 2.0 and he gave some examples of transformative processes based on ICTs. One area is 'connecting the excluded', with an example of job advertisements through SMS. A second area is 'digital production', illustrated through text translation into local languages via mobile phone

crowdsourcing. Thirdly, Heeks described 'new social enterprise models' of development, with an example of poor Indian women in the state of Kerala in India doing state government entry and digitization of records.

A further example of new ICT-enabled models of development was provided by one of the keynote speakers at the ICTD2012 conference, David Kobia, director of technology development at Ushahidi. Ushahidi, which means testimony or witness in Kiswahili, had its origins in the post-election violence in Kenya in 2008. The system provides a crowdsourced, map-based system to monitor and display data with inputs from text messages, photos, online posts, Twitter and so on. The software is open source and has already been adapted for use in a variety of contexts, including disasters, conflicts and emergencies. The transformative element of Ushahidi is in its enabling potential for people at all levels of society to participate and see what is happening in their own context.

It is not surprising that these new ICT-enabled models, such as Ushahidi, tend to be popular with the ICT4D community since they provide examples of where ICTs appear to make a difference, and a transformative one at that. There is, however, a need for some solid research here as to what exactly are the effects of these ICT-enabled models. What is the nature of the socio-political transformation? Who benefits and who loses? Who is pushing particular approaches and why? What are the agenda of interested parties such as aid agencies and commercial organisations and how do these affect the processes which take place? There is as much a need for careful painstaking studies here as for the other topics discussed in this sub-section.

3.3 Major societal issues

Studies of development, gender and ICT-enabled transformative models discussed in the previous sub-section are ways of moving the ICT4D field forward, but we continue by asking whether other areas should be receiving attention and, more dramatically, is the ICT4D field tackling 'major' societal issues? It would be presumptuous to suggest that anyone can define precisely what are major societal issues and what are not, so the attempt to list some major issues here is aimed at providing examples for discussion. For each issue, there is a brief discussion below on the current ICT4D research contribution, examples of such work, and potential future research on the topic. Table 2 summarises the discussion.

[Insert Table 2 here]

Most ICT4D studies to date have been aimed at the issue of *economic well-being* such as the work on livelihoods (Duncombe 2006) which will be discussed in more detail later in the paper. We have already noted that future work could broaden the definition of well-building beyond basic economics, as has already started in the work on ICTs and the capability approach. *Systemic poverty* is a further issue in many countries and Cecchini and Scott (2003) provided an early article on the use of ICTs to benefit the poor, noting the benefits of approaches such as the use of intermediaries and community involvement. More recent in-depth field studies of ICTs in poor communities are a further contribution, for example on social outsourcing to marginalised groups (Heeks and Arun 2010, Madon and Sharanappa 2013, Sandeep and Ravishankar 2016).   It can be argued that much more remains to be done. For example, Walsham (2010) examined the literature on ICT-based initiatives in India in the previous decade and argued that the beneficiaries were almost never the poorest or most disadvantaged groups. Disadvantage here could include disability for example, a topic which has received almost no attention in the ICT4D literature.

Equality for women is a major issue in all countries of the world and recent work on women and ICTs, discussed earlier in the paper, provide exemplars for a much wider range of studies in the future. Heeks (2014) argues that *global health* and ICTs has been the subject of substantial work to date such as the work on the HISP project discussed earlier, but a whole range of further issues could be addressed such as malnutrition, obesity, pandemics and epidemics, maternal health, primary health care and hospital systems. ICTs have a potentially important part to play in all of these issues .

The remaining four major issues deal with things to be avoided or mitigated. Tarafadar et al (2015) argue that the *'dark side' of ICTs* is a topic of growing interest in western countries. Their article introduced a special issue on this topic in the *Information Systems Journal* and noted dark side issues as including internet crime, pornography, identity theft, cyber-attacks and surveillance versus privacy. The list of issues may not be exactly the same in all countries, but there is wide scope and relatively untapped potential for ICT4D research in this area. Tarafdar and colleagues noted that little work has been carried out on dark side issues at the societal level. Perhaps researchers do not normally choose these issues as being the less attractive element of ICTs, but future research is still needed in these 'dark' areas.

Environment and climate change are major issues for us all and certainly for many developing countries. Limited work has been carried out here by ICT4D researchers but surely information technology and systems have a big role to play in, for example, monitoring, managing and forecasting environmental issues and climate change impacts. A specific example is work on environmental monitoring systems (Rajão and Hayes 2009) which will be discussed in more detail in the next section of the paper. Heeks (2014) noted environment and climate change as a key future issue related to the post-2015 development agenda.

Humanitaraian crises caused by natural disasters such as earthquakes have attracted the attention of ICT researchers in recent years. For example, Tusiime and Byrne (2011) describe a case study of the development and use of an international development organization's logistics and supply chain system in Chad. Other work in the humanitarian space includes various responses to the earthquake in Haiti including the use of text messaging and crisis mapping (Meier and Munro 2010) and community mapping systems (Soden and Palen 2014). It is clear that the use ICTs in humanitarian crises is a worthwhile area for further activity and research.

War and terrorism are unpleasant but inevitable evils in the coming years. There has been little work in this space by ICT4D researchers , but ICT4D research could, for example, evaluate and discuss the privacy risks of major state surveillance against the potential anti-terrorist gains. The book edited by Ekine (2010) describes how SMS and mobile phones can support mobile activism in Africa and make a significant contribution to the promotion of social justice, so this can be considered as perhaps reducing the likelihood of conflict.

3.4 Big data and social media

We end this section on ICT4D topic selection with a brief discussion of two topics which can be considered to be relatively new developments in IS research, namely big data and social media. They can be thought of as transcendent topics in the sense that they may have relevance across many of the topic areas already discussed in this section. So the question for this paper is whether they are potentially important to ICT4D research.

Abbasi et al (2016) argue that the volume, velocity, variety and veracity of big data disrupts the traditional information value chain and thus opens up a whole new set of agenda for IS research. Their paper does not address implications for ICT4D research although they do touch on areas of

ethical concern, including privacy and security. Baack (2015) discusses a case study from Germany to show how the open data movement can support democratic values, participation and empowerment. These ideas show considerable promise for developing countries and thus for ICT4D research. However, the article by Mulder et al (2016) sounds a word of warning about simple techno-optimism concerning the potential of participatory big data. Their paper examines the generation and use of crowdsourced data with reference to the humanitarian response to earthquakes in Haiti and Nepal. They conclude that local people, often including the original 'crowd' who supplied the crisis data, may be excluded from the information flow which results and may be marginalised from the later interpretation processes.

One of the driving forces for big data in recent years has been the proliferation and extensive use of social media. This has resulted in much discussion of how these media should affect our research agenda. For example, Kane et al (2014) investigated social media networks and argued that they require a new agenda for the longer-established field of social network analysis. However, as with big data, we need to be cautious about assuming only positive effects from social media and, of relevance to this article, of social media for development. Nicholson et al (2016) introduced a recent special section of the journal *Information Technology for Development* on this latter topic, and noted that social media may contribute to poverty alleviation, opportunities for capacity building and a role in reducing corruption. But they also noted a dark side of social media such as cyber-bullying, organising riots, and spreading hatred. The four papers in the special section gave further examples on the positive and negative aspects of social media for development. It is clear that social media and big data are here to stay, but that they have a complex relationship to development issues. This offers a fruitful area for future ICT4D research.

4. The Role of Theory

The previous section has described a wide range of topics which are pertinent to the future of ICT4D research. However, for any topic, it is important that we aim to create a cumulative research tradition so that others can build on what has already been done. A key way of doing this is through the development and application of theory. Theory can be regarded as a key approach to the goal of generalizability, enabling the moving from a particular setting or application to more general statements or conceptual frameworks of potential value in understanding other contexts. Drawing from work in the IS field, Lee and Baskerville (2003) criticised the notion that statistical generalizability from a sample to a population is the only way of moving from the particular to the

general. They demonstrated that it is possible to generalize from empirical evidence, even from a single case study, to wider theoretical constructs and structures.

Others have noted that theory is crucial to the ICT4D field. For example, Heeks (2006) argued the need for more theory-based evidence about the impact of ICTs on development. Avgerou (2010) suggested that a major theoretical challenge for the ICT4D field was to strengthen its capacity to associate ICT innovation with socio-economic development. Gomez et al (2012) noted that their literature survey showed an increasing interest in theory. Hayes et al (2013) described a number of ways in which theory can be valuable in the ICT4D field including helping to define research questions and empirical approaches, and enabling a more critical and reflexive position on the part of the researchers.

But which theories are to be selected for particular topics and what do these offer to ICT4D research? A full answer to this question is beyond the scope of this short article. Based on a literature review of ICT4D research from 2005 to 2012, Andersson and Hatakka (2013) identified no fewer than eleven streams of research and associated theories. Rather than trying to deal with all this diversity, the rest of this section will illustrate the role and value of theory in ICT4D research using three examples. The three theories chosen are actor-network theory, institutional theory and the sustainable livelihoods framework.   These particular theories were selected since they have been widely used in the ICT4D field, reflect different disciplinary bases and tackle the notion of development in distinctly different ways.   In each case, the theory will be briefly summarised, an empirical example of its use will be given, and the value, limitations and future prospects of the theory will be discussed. The aim is to provide some illustrative examples of the role and value of theory in ICT4D research as a template for other researchers choosing theory for their own topic.

4.1 Actor-network theory

Gallivan and Tao (2013) noted from their literature survey of IFIP working group 9.4 papers that actor-network theory has been widely used for a number years in the ICT4D field. The initial development and application of actor-network theory (ANT) was concerned with the sociology of science (Latour 1987) but later work has included a strong focus on technology (Latour 1996). ANT examines the motivations and actions of actors who form elements, linked by associations, of heterogeneous networks. A key feature of the theory is that actors (or actants as they are sometimes labelled) are taken to include both human beings and non-human actors such as

technological artefacts. A major focus of the theory when applied in particular contexts is to try to trace and explain the processes whereby relatively stable networks of aligned interests are created and maintained, or alternatively to examine why such networks fail to establish themselves. Successful networks of aligned interests are created through the enrolment of a sufficient body of allies, and the translation of their interests so that they are willing to participate in particular ways of thinking and acting that maintain the network.

It should be evident from the above brief introduction to ANT that it immediately seems to offer potential to ICT4D researchers. ICT4D projects can be thought of as networks of actants and successful implementation as the creation and maintenance of a network of aligned interests. An empirical example is provided by Dìaz-Andrade and Urquhart (2010). The project which they researched was an ICT-based initiative intended to bring development to underserved rural communities in the Peruvian Andes by providing access to computers and the internet through 8 telecentres. The researchers describe four stages of the project's progression. In the first phase, labelled problematisation in ANT, the project initiator conceived of a centralised information system run through an information processing hub. In the second stage, concerned with interesting and involving all the actors in the vision for the project, commitment was rather mixed. Thus, in the third stage, many supposed beneficiaries were not enrolled in the network. In the final stage, concerned with mobilising the network, the researchers note that 'the network was left adrift to the needs of quite dissimilar contexts of the (8 different) communities and the priorities given by different actors'. The researchers concluded that: 'from an ANT perspective, the existing social networks and the superimposed technological network were incompatible'.

The theory can be considered to be of value in explaining the progression of the project from project initiation though attempted processes of enrolment to the eventual failure of widespread project mobilisation. Thus ANT offers a theoretical approach to the development of a detailed analysis of ICT project successes and failures. Dìaz-Andrade and Urquhart go further in their project analysis to discuss the added value, in their view, which ANT brought to the analysis. For example, with respect to the construct of network alignment, they argue that many ICT4D projects conduct some form of stakeholder analysis, but that the ANT idea of alignment enables the analysis to go one step further in thinking about the degree to which actants are in agreement with how the project will proceed.

All theories have their limitations so what are these for ANT? Two challenges to the theory are quite longstanding. First, the theory has been criticised for addressing local and contingent effects, but

paying little attention to broader social structures that influence the local. A second criticism of ANT, forcefully articulated in Winner (1993) is the 'almost total disregard for the social consequences of technical choice'. In other words, that ANT analyses pay too much attention to the detail of what choices were made and why in the development of a particular technology, but not enough to the moral and political consequences of those choices. With respect to the specific domain of ICT4D research, one obvious criticism is that ANT offers no view, in itself, of the meaning of the term development. Proponents of ANT would argue that this is not desirable since the nature of the 'development' which does or does not take place is best understood by a detailed ANT-type study of events and their impacts. Interested readers may wish to read other studies using ANT in the ICT4D field to form their own view on its merits and limitations (Effah 2012; Gao 2007; Heeks and Stanforth 2007; Rhodes 2009).

4.2 Institutional theory

Institutional theory has been developed and used over many decades in a variety of academic fields including economics, political science, sociology and organizational theory. A good summary of the theory as a whole is provided by Scott (2001) who defines institutions as follows:

> Institutions are multi-faceted, durable social structures, made up of symbolic elements, social activities, and material resources. Institutions exhibit distinctive properties. They are relatively resistant to change. They tend to be transmitted across generations, to be maintained and reproduced. (p.49)

Institutional theory offers a wide range of concepts and approaches to analyse institutional persistence and institutional change. Technology is not a central focus of mainstream institutional theory, unlike ANT, but nevertheless it has attracted interest from researchers concerned with the relationship between ICTs and the institutional contexts within which they are embedded. Some of these fall within the ICT4D field (Avgerou 2002; Madon et al 2009; Miscione 2007; Noir and Walsham 2007). A specific example is discussed below.

Rajão and Hayes (2009) describe a longitudinal study of the uses made of the Amazon rainforest monitoring system in Brazil over a 44-year period. The system is basically a set of radar and satellite-based geographic information systems used by the Brazilian government to track deforestation. The authors discuss three 'conceptions of control' which have motivated the use of the system at various

stages over time. The first of these is a military perspective which wishes to protect Brazil's Amazonian region against threats to its economic and political sovereignty. The second is economic, concerned with developing a wealthy and prosperous Amazonian region by expanding and modernizing its economy. The third is ecological, wishing to preserve the Amazonian environment. The authors describe how these conceptions of control have shifted over time from the dominance of military and economic concerns in earlier periods through the emergence of ecological concerns in the 1990s to the recent dominance of ecological issues.

The authors used institutional theory as a way of understanding this history of enduring and shifting institutional contexts and, in addition, the way in which this affected and was affected by ICTs. For example, the different conceptions of control over time affected the design and use of the monitoring systems. In the early days the monitoring systems were focused on supporting economic development whilst protecting military security. One of the first uses of the system was to check if the subsidies given to those cutting back the forest and creating agricultural areas were effective. In the late 1980s a new monitoring system called PRODES was created which was focused on environmental degradation. However, it was impractical for the purpose since it detected deforestation only once a year, and the deforestation map had restricted access due to military and economic concerns. However, the shifting conceptions of control towards a dominance of ecological issues over the first decade of the 2000s resulted in a new monitoring system, one component of which could detect the precise location of deforestation within days. In addition, much more open access was enabled over the internet to the results from the monitoring system.

It was noted earlier that some critics of ANT argue that it addresses local effects, but pays little attention to broader social structures which influence the local. Institutional theory certainly addresses social structures but a criticism of it could be that little detail is normally provided on individual agency, or indeed the detailed process of change at the micro level. An obvious conclusion might be that the two theories could be used to complement one another and, indeed, such an argument is made in Avgerou (2002). What prospects are there for institutional theory as a way of thinking about ICT4D? The case study described above shows good potential in terms of institutional structures and their relationship with ICTs, and the paper also touches on development issues through discussion of economics for example. But there is no explicit model of 'development' in institutional theory as with ANT. We turn next to a theory which does have a specific model of development.

4.3 Sustainable livelihoods framework

A development theory that has been widely used since its initial proposal in the late 1980s is the sustainable livelihoods framework. Chambers and Conway (1991) defined a livelihood as follows:

> 'A livelihood comprises the capabilities, assets … and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term' (p6).

The reference to capabilities relates to Sen's work described earlier and, indeed, there are overlaps between these theories. The livelihoods approach has been operationalised through a sustainable livelihoods framework including the following elements: vulnerability context; livelihood assets; transforming structures and processes; livelihood strategies and livelihood outcomes. The framework was adopted by a number of development agencies including the UK's DFID (1999) who argued that it was 'a way of putting people at the centre of development, thereby increasing the effectiveness of development assistance'.

Duncombe (2006) drew on the livelihoods framework and provided a new contribution by explicitly discussing the role of ICTs in the approach. He made an interesting distinction between two roles for the use of information and ICTs. The first of these is an analytical role whereby information can be used in an applied research capacity to assess vulnerabilities, identify and measure assets, and investigate structures and processes. The second is a functional role in terms of how information and ICTs can be applied within livelihood strategies to create favourable outcomes. Duncombe illustrated his approach through an analysis of ICT applications for microenterprise in Botswana.

The first part of the analysis of the Botswana case concentrates on the analytical role and looks at the various components of the livelihoods framework and how they are related to information and ICTs. For example, with respect to the vulnerability context, three variables are highlighted which are important in analysing vulnerability: the location of the microenterprise, the type of activity undertaken, and the gender of the business entrepreneur. The most vulnerable of the microenterprises are those based in rural areas, involved in activities that generate lower incomes and are headed by women. With respect to ICTs, these vulnerabilities affect both access to

technologies and their affordability. Turning to the functional role of ICTs, Duncombe puts forward specific approaches to how ICTs can be used in practice by microentrepreneurs in the Botswana case. For example, ICTs can be applied to strengthen local community-based organisations, private sector providers, and other infomediaries that directly interface with the poor.

Duncombe draws some interesting conclusions on the value of the livelihoods framework as a way of analysing and supporting the role of ICTs for microenterprise in Botswana, and more generally. He suggests that ICT applications may only bring marginal direct benefits for poverty reduction, but that greater benefits for the poor may be derived from ICTs if they are applied to strengthen a broader range of social and political assets, and if they are able to assist in building more effective structures and processes that favour the poor. Duncombe also concludes that one of the merits of the livelihoods framework with respect to ICTs is that it serves to give an 'only one among many factors' weighting to information and ICTs, thus acting to prevent any undue emphasis on ICTs alone.

There is a considerable amount of later work on the livelihoods framework and ICTs, much of it drawing in part from Duncombe's analytical approach. This includes a book of case studies on how ICTs can help strengthen rural livelihoods using evidence from India, Sri Lanka, the Philippines and China (Grimshaw and Kala 2011). Other work has involved the study of mobiles phones, rural livelihoods and poverty reduction in the Morogoro region of Tanzania (Sife et al 2010), and ICT use in microenterprises in South Africa (Makoza and Chigona 2012). It is noticeable that, in all of this work, including that by Duncombe, the 'sustainable' part of the sustainable livelihoods framework receives rather less emphasis than the livelihoods part. Indeed the shortened term 'livelihoods framework' is in common use and reflects this bias. Yet, sustainability was a key element of the original approach proposed by Chambers and others, and it needs more attention in the future, not least because there are often tensions between short-term livelihood generation and longer-term sustainability goals.

5.   Methodology and Multi-Disciplinarity

A key theme throughout this paper has been the multi-disciplinary nature of ICT4D research. We noted earlier that this affected topic selection and, of course, the different theories discussed in the previous section arise from different disciplinary bases. For example, ANT came originally from science and technology studies but has been used extensively in IS. This multi-disciplinary nature of ICT4D research is good in principle, allowing a wide range of approaches to flourish and offering

complementary insights into the various phenomena being researched. However, two questions are raised and discussed in this section. Firstly, how should different disciplines collaborate on ICT4D research, bearing in mind that they often differ radically in terms of chosen topics, theories used, methodological approaches and research dissemination practices? Secondly, how should individual researchers deal with the dilemma that the academic world is often structured in disciplinary silos and that promotion and other reward systems tend to be conducted within these silos?

5.1 Transdisciplinarity

There has been much debate over the years in the IS field about methodological approaches such as positivism and interpretivism and whether they can be combined in multi-methodological approaches (Mingers 2001). However, for ICT4D research, it is clear that multiple methodologies are an intrinsic property of the field. It is inconceivable that the various disciplines contributing to the field, such as anthropology, computer science, geography, development studies and information systems, could be brought together under one methodological or theoretical umbrella. So we should welcome the various approaches and try to see whether they can be combined in a complementary way in interdisciplinary work. Some empirical examples of such work have been given throughout this paper.

Moving towards interdisciplinary work does not mean that an individual researcher needs to abandon his or her disciplinary background. Indeed, it is precisely because individuals bring their own disciplinary background to the table that they have something different to offer. Bryant and Land (2012) quote a definition of transdisciplinarity that captures this quite well:

> 'To hold on to both the specificity of particular ways of thinking and knowing that define disciplines, while creating the space of their productive encounter so that a different kind of knowledge emerges in the act of intersection and traverse of varied fields through which a shared concept might travel'.

So it is possible to retain one's own disciplinary base – in this author's case, information systems – while retaining a relatively open and welcoming approach to the contributions of other disciplines.

5.2 Career progression and publishing

So interdisciplinarity or transdisciplinarity seems to offer a good way forward for the ICT4D researcher but there is a problem. The academic world tends to be structured in single disciplinary silos and career progression normally takes place within those silos. This can be illustrated by the information systems field in business schools. According to prevailing orthodoxy, there are two 'top' journals, *MIS Quarterly* and *Information Systems Research*, and a range of others of lesser prestige. An IS academic working in the ICT4D field may wish to target a good development studies journal for example, but this will often not 'count' for promotion or other career rewards. In addition, the specialist ICT4D journals mentioned earlier in the paper, *ITD, ITID* and *EJISDC,* are not normally in the business school lists at all, despite the fact that they are a good outlet for an ICT4D researcher to showcase their work to a knowledgeable and interested audience.

There is no simple answer to this dilemma of a tension between the academic desirability of publishing in varied academic outlets, for example in fields other than one's own and in specialist ICT4D publications, and the realities of current structures of academic prestige and reward. One approach is a portfolio publication strategy that targets the 'conservative' journals in one's own field as well as a wider set of outlets. However, whatever one's approach to publication, encouragement can be taken from the fact that none of us know what the future holds in terms of what research is perceived to be of high value. ICT4D researchers are working on an important topic area, and one that is not likely to lessen in interest in the foreseeable future. Try to do good work, publish it and hope that future reward structures are fair to work of merit!

6. Research Impact

A primary objective of any research field, and ICT4D is no exception, is to have a significant research impact on their domain of interest. The previous material in this paper was aimed implicitly at this goal through the identification of important topics, the discussion of relevant theories and the choice of methodologies and approaches to multi-disciplinarity. The purpose of this penultimate section is to discuss the issue of research impact more directly and ask the question as to what could be done in the future to enhance the impact of the ICT4D research field.

One approach with potential to increase impact would be to unify the ICT4D field around a particular definition or ideology of development in order to provide coherence and critical mass around this shared agenda. Thapa and Sæbø (2014) discuss different development theories used in the ICT4D literature and suggest Sen's capability approach as an overall guiding framework to explore the link

between ICTs and development. This work is interesting but it seems unlikely that a single development theory will be sufficiently strong and widely accepted to provide overall coherence. Rather, it can be argued that we should *allow different ideologies of development but make them more explicit.* A good illustration of this approach is provided by Heeks (2014) by using the post-2015 development agenda to identify priorities for future ICT4D research.

It may not be possible to agree on a shared definition of development but an alternative approach to coherence for the ICT4D research field, and thus the potential for enhanced research impact, may be by *developing a shared conceptual framework for the ICT4D field.* Van Biljon and Alexander (2014) provide one approach to this through a conceptual map of discipline, research paradigm, underlying theory, research methodology, data capturing strategy and data analysis.   The conceptual framework was tested and refined through an analysis of the full papers from the ICTD2013 conference.

The material in the two paragraphs above is oriented towards more coherence for the ICT4D research field in the hope that this might provide increased research impact. A more direct way of trying to increase impact is through *engaging with user and policy-making communities.* Support for this approach is provided by the literature survey of Gomez et al (2012) which demonstrated an increasing interest in policy recommendations over the first decade of the new millennium. This is encouraging in terms of potential future research impact but Harris (2016) provides some words of caution based on a literature review of research impact and a survey of ICT4D researchers. Harris agrees that ICT4D researchers are interested in influencing both practice and policy but notes that they are less inclined towards the activities which would make this happen, especially engaging with the users of their research and communicating their findings to a wider audience. In addition, Harris argues that the institutions within which ICT4D researchers are located often do not provide incentives for researchers to adopt these engagement practices.

One way of trying to engage with users, practitioners and policy makers is through communities of practice based on particularly themes and issues, for example health or agriculture or human rights. This relates to *seeing ICTs as part of a bigger picture of development.* It is interesting to note that this theme of ICTs as insufficient in themselves, but important to an overall approach, was identified way back in 1988 in the Delhi conference discussed in the historical part of this paper. Raiti (2006) sees the need for a multidisciplinary field with multi-disciplinary authors and ICT4D as 'part of a larger puzzle of development'.   It could be that the most effective way for ICT4D researchers to

achieve impact is, somewhat ironically, to play down the importance of ICTs in themselves but emphasize their role in multi-faceted development approaches.

7. Conclusions

The purpose of this paper as set out in the Introduction was to 'take stock' of ICT4D research at this important juncture, where ICTs are pervasive and many disciplines are involved in researching the role of ICTs for development. Some achievements of the ICT4D field were identified through the brief history presented earlier, and future prospects and challenges have been discussed including topic selection, the role of theory, methodology and multi-disciplinarity, and research impact. It is hoped that the paper will provide a useful reference point for both established ICT4D researchers and those relatively new to the area. I will end the paper by a few personal remarks about the ICT4D research field and its importance, and a brief comment to information systems researchers in particular.

The current world remains one of striking inequity, despite major advances in many areas including that of technology. Thus a major ethical challenge for us all is to try to create a better world (Walsham 2012) where people from less advantaged backgrounds can be enabled to enhance their capabilities and increase their participation in matters which affect their lives. Those of us working on ICT4D research have a contribution to make here in exploring the role and value of ICTs in supporting this 'development'. But we should not see ourselves as the 'experts' bringing top-down solutions to 'beneficiaries'. Rather, we should see ourselves as co-contributors with everyone else, since all people throughout the world have views about 'development' in their particular context.

Information systems was the academic field which first explored issues of ICT4D in any detail. Is there still a significant role for IS to play in ICT4D research in the future? I would answer a resounding yes to this question, but not as the only discipline addressing the complexity of ICTs for development. IS researchers need to adopt a transdisciplinary perspective, seeing their contribution as potentially important but respecting and engaging with the perspectives from other disciplinary fields. Publishing the results of such work in IS journals is good, but there is also a need to engage with researchers and publication outlets from relevant areas such as development studies, anthropology, geography, computer science and the rest. In addition, ICT4D researchers from any disciplinary background need to engage with users, practitioners and policy makers to enhance the impact of their work. A difficult but exciting task for the future!

Period	Characteristic Features	Publications	Some Research Achievements
Early Beginnings: mid-1980s to mid-1990s	• Largely within IS field • Social implications of IS in developing countries	• Proceedings of IFIP wg9.4 conferences from 1988 • ITD journal launched in 1986	• Themes from mainstream IS applied to developing countries
Expanding Horizons: mid-1990s to mid-2000s	• Major changes in technology • Increase in scope and range of ICT4D research in IS field • But also start of interdisciplinary focus of ICT4D	• Continuation of IFIP wg 9.4 and ITD journal • EJISDC started in 2000 – open access • ITID started in 2003 – open access and explicitly interdisciplinary	• Wide range of issues, theories, levels and focus of analysis • Start of critiques on development, gender etc.
Proliferation: mid-2000s to present	• Explosion of technology in developing countries e.g. mobile • Many disciplines involved in ICT4D research	• Consolidation of existing outlets • Some special issues of prestigious journals • ICTD conference started in 2006 – explicitly interdisciplinary	• Substantial research work in a range of areas • But critiques continue to raise complex issues e.g. on nature of development, role of new technologies, need for interdisciplinarity

Table 1: Summary of ICT4D Research History

Major Issue	ICT4D Research Contribution	Potential Future Work
Economic well-being	Most ICT4D studies to date are aimed at this issue e.g. work on livelihoods (Duncombe 2006)	Broader definition of well-being e.g. capability approach
Systemic poverty	Some work on in-depth field studies of ICTs in poor communities e.g. social outsourcing to marginalised groups (Heeks and Arun 2010)	More extensive research work needed with explicit pro-poor focus
Equality for women	Significant work in last decade e.g. renegotiation of patriarchal power structures (Oreglia and Srinivasan 2016)	Wide scope for further studies here
Global health	Some substantial work on ICTs and health e.g. heath information systems (Braa et al 2004)	Whole range of further issues could be addressed
Dark side of ICTs	Growing interest in this research area in western countries e.g. internet crime, pornography, identity theft (Tarafdar et al 2015)	Relatively untapped potential for more global work on this issue
Environment and climate change	Some work has been carried out e.g. on environmental monitoring systems (Rajão and Hayes 2009)	Crucial issue for many developing countries and ICTs have a part to play
Humanitarian crises	Some recent work on this issue e.g. logistics and supply chain IS (Tusiime and Byrne 2011)	Clear area for further activity and research
Wars and terrorism	Little to date although some related efforts e.g. ICTs to support activism for social justice (Ekine 2010)	What can ICTs do here? e.g. role of state surveillance

Table 2: Major Societal Issues and ICT4D Research

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