Research Article

ICT 4 the MDGs?
A Perspective on ICTs' Role in Addressing Urban Poverty in the Context of the Millennium Development Goals

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Abstract

Since the year 2000, the Millennium Development Goals (MDGs) have anchored efforts to combat global poverty. As we near 2015, this article assesses ICTs' role in reaching the goals, with an emphasis on urban poverty. Over the lifespan of the MDGs, debate about ICTs and development has grown. At one pole of this debate are those who see ICTs as enabling rapid growth and citizen empowerment; at the other pole are those who warn that "technical fixes" cannot overcome the historic and structural causes of poverty. In this article, using the organizing framework of the eight MDGs, we discuss these debates by reviewing examples of ICT projects that aim to further the goals' realization. Many of these projects suggest that ICTs are useful, particularly with respect to increasing information and enhancing services, a common theme throughout this article. However, we also raise critical queries about the allure of "technology-boosterism" (Heeks, 2010, p. 629). These range from questioning the measurable impact and sustainability of ICT4D to the vision of development embedded in ICT4D and whether new technologies can subvert the underlying causes of global poverty. Our article shows that, while ICTs can be enablers for developmental processes, we must listen to communities in poverty when deciding how ICTs should feature in the post-2015 agenda.

Introduction

Since the year 2000, the Millennium Development Goals (MDGs) have anchored efforts to combat global poverty. As we near 2015, this article assesses ICTs' role in reaching the goals, with an emphasis on urban poverty in the developing world. Half the world's population now live in cities, and consequently, UN Habitat "describes cities as the 'new locus of poverty'" (GlobeScan, 2007, p. 16). Many of the developing world's urban dwellers face precarious situations including informal settlements, lack of legal tenure or personal registration, city governance issues, and lack of waste disposal or clean water (GlobeScan, 2007; Raftree, 2012). Whether ICTs can contribute to poverty reduction and sustainable development in these contexts is a pressing question.

Curiously, given that the MDGs' launch coincided with rapid ICT development and emergence of the so-called globalizing "knowledge economy" (Unwin, 2007, p. 21), the MDGs made little reference to ICTs. Only the eighth goal (MDG8) refers to ICTs in the context of public–private partnerships for development (UNDP, 2013b). However, over the lifespan of the goals, a growing interest around ICTs for Development (ICT4D) has emerged and is now more conspicuously present in deliberations over the post-2015 agenda, for example, in the work of the UN System Post-2015 Task Team on Science, Technology and Innovation (UN Development Policy, 2012) and in the report by the (UN's) High-Level Panel of Eminent Persons on the Post-2015 Development Agenda (2013). At the poles of debate about ICT4D are those who see integration into the knowledge economy as enabling rapid growth for developing countries, as well as providing other benefits such as enhanced services in education and health—or even political empowerment. Others, however, warn that technical fixes cannot overcome poverty, given the ongoing impact of historical and structural dynamics that have produced global inequalities. They even suggest that ICTs may exacerbate global divides (Carmody, 2012a).

In this article, after further elaborating our conceptual and theoretical framework, we use the organizing framework of the eight MDGs to review examples of ICT projects that aim to further the goals' realization, particularly in urban contexts. Many of these projects suggest that ICTs are useful for development, particularly with respect to increasing information and enhancing services, a common theme throughout this article. However, we also raise critical queries about the allure of "technology-boosterism" (Heeks, 2010, p. 629). These range from questioning the measurable impact and sustainability of ICT4D, to the vision of development embedded in ICT4D and whether new technologies can subvert the underlying causes of global poverty.

The field of development informatics, or ICT4D, is intrinsically interdisciplinary (Heeks, 2010). This article is itself the result of interdisciplinary cooperation among authors: by a development practitioner and academics from the fields of computer science and peace studies. Given our diverse backgrounds, we can both identify the innovative impact ICTs can have in situations of urban poverty and draw attention to their limitations. We draw on our analysis to offer suggestions about the role ICTs can play in the emerging post-2015 agenda, with particular regard to addressing urban poverty.

Theorizing the Connections: The MDGs, Development, Urban Poverty, and ICTs

Prevailing theories of what constitutes "development" have been through a number of recognizable turns over the previous decades. In the 1950s–60s, development was synonymous with state-led industrial and infrastructural modernization and developing states were expected to mirror the path followed earlier by the industrialized world. In contrast, by the 1980s–90s the predominant trend was toward advocating neoliberal growth and state roll-back as the powerful driving forces of development, although contending theories also emerged that paid more attention to human development and quality-of-life factors beyond economics. The globalization of democracy through the 1990s led to growing interest in civil society participation in development alongside capability and human rights approaches (Kingsbury, McKay, Hunt, McGillivary, & Clarke, 2008). The coexistence of these often–diametrically opposing trends in the '90s—neoliberalism and those who opposed it with a more human-centered approach—ensured ongoing fractiousness over defining and achieving development. Something of a middle-of-the-road global consensus—that the bottom line in terms of development had to be poverty reduction—took shape through the UN as the MDGs of 2000. The MDGs forged some kind of consensus because by prioritizing reducing extreme poverty, they remained compatible with (neo)liberal growth economics, but by focusing on people as the "ends of development rather than the means to get there," they also assuaged (to an extent) the lobby for "human development" (Fukuda-Parr & Hulme, 2011, p. 24). Despite the many critics of the MDGs and the tenuousness of the consensus among development theorists, the idea that the world should set itself clear, measurable, understandable goals for development has gained normative consensus and set the development agenda in the last decade (Poku & Whitman, 2011). As mentioned above, ICTs' role in the wording of the MDGs is limited, and yet, because ICTs are central to contemporary global life, their role in

economic growth in the developing world is now much discussed within the field of ICT4D. And even for those whose vision of development is broader than (or even against) the economic growth agenda, the potential of ICTs to facilitate the building of social networks that empower people or to cut environmental costs suggests that ICTs have an important role to play in development, however ICT may be conceptualized. It is therefore important to assess both aspects—the growth question and the social understanding of development—when assessing ICTs' role in realizing the MDGs.

The Millennium Development Goals' central mission is to reduce extreme poverty by 2015 by pursuing eight objectives: (1) ending extreme hunger and poverty; (2) ensuring primary education; (3) redressing gender inequality; (4) preventing child mortality; (5) improving maternal health; (6) stopping the spread of HIV and other infectious diseases; (7) creating environmental sustainability; and (8) building a global partnership for development (UNDP, 2013b). While three quarters of those experiencing egregious poverty in the developing world still live in rural areas, the magnitude of urban poverty is growing rapidly and the "poor are urbanising at a greater rate than the population as a whole" in the developing world (Ravallion, Chen, & Sangraula, 2007, p. 669). *Urban poverty* is difficult to define, with both words subject to debate. *Urban* usually implies a nonreliance on agricultural production, with *poverty* being relative and related to costs of living, which are higher in cities (Ravallion et al., 2007). However, the World Bank now estimates that "approximately 750 million people living in urban areas in the developing world live below the poverty lines" (set by the World Bank at the equivalent purchasing power of US$1.25–$2 per day), which is equivalent to one third of all urban residents across the developing world on average but rising to 40% of urbanites in sub-Saharan Africa (Baker, 2008, p. 3). As the disparate figures from Africa as contrasted to the global average show, urban poverty is not experienced to the same degree everywhere because "deep divisions and complex cleavages occur within . . . as well as between developing countries" (Gilhooly, 2005, p. 12). However, while urbanization may promise long-term growth for many who make the move to towns and cities because they are centers of commerce and innovation (Garland, Massoumi, & Ruble, 2007), many liv-

ing in situations of urban poverty across the developing world face a number of common challenges related to their contexts: issues of limited access to employment or insecure employment in informal economies, lack of land tenure, slum conditions, poor sanitation, pollution, overcrowding and the health costs associated with these conditions, poor services and transport, and high levels of inequality. Reliance on the cash economy and lack of access to subsistence means increase poor urban dwellers' vulnerability to economic shocks and natural disasters (Baker, 2008). Under MDG7 the international community committed itself specifically to improving the lives of at least 100 million slum dwellers—one of the few MDGs that the UN claims to have met ahead of target through programs to introduce water supplies, sanitation, etc. However, the particular challenges of urban poverty emerge in various ways in relation to all eight MDGs, so it is to each of these goals the next sections turn to explore the role of ICTs in achieving development—understood as both an economic and social phenomenon—for the urban poor.

ICTs and Goal 1: Eradicating Extreme Poverty and Hunger

MDG1 addresses the persistence of extreme poverty and hunger, with 1.4 billion people living below the international poverty line of US$1.25 per day (UN, 2010). MDG1 committed to halving the number of people below the international poverty line by 2015, and key to this is fostering economic growth and employment.

ICT Strengths
Advocates of ICT for development (ICT4D) see it as constituting an economic revolution on par with the historic agricultural and industrial revolutions, opening up a new "technoeconomic paradigm" for growth in an increasingly globalized setting (Lock-Teng Low, Ong, & Law, 2011). This new information, or knowledge, economy (Unwin, 2007) offers the potential for jobs and growth by integrating developing economies into the global economy, improving market knowledge and efficiencies for enterprises, creating new products, or selling ICT hard- and software (Carmody, 2012a). The development of ICTs within any country creates a whole new ICT ecosystem involving individuals who buy, sell, regulate, manage, and use technology, with all

these people engaging each other in various ways including social networking, service provision, innovation, content and app development, and governance (InfoDev & World Bank, 2012). Such an ecosystem holds great economic potential, especially as ripple effects lead from ICT innovations into adjacent industries such as communications (Gilhooly, 2005), perhaps particularly so for those in cities where the necessary infrastructure to sustain the ecosystem is stronger and ICT access is more readily available (Chew, Levy, & Ilavarasan, 2011). However, as noted above, there are particular challenges for the urban poor such as obtaining formal employment in the prevailing insecure, informal economy and accessing reliable, affordable transportation to get to work. ICTs' potential strengths and weaknesses in relation to these challenges are discussed below.

One example of ICTs' contribution to growth lies in the exponential spread of mobile phone technology, which has high penetration even in poor areas. Across the developing world, mobile phone connectivity remains varied in its reach. For example, 75% of South Africa's poor have mobile phones, compared to much weaker penetration in Ethiopia due to the state's monopoly of the ecosystem (Geldof, 2011; InfoDev & World Bank, 2012). Despite these variations, the UN's High-Level Panel on Post-2015 now considers that "many mobile (m-) applications m-banking, m-health, m-learning, and m-taxes can radically change economies and service delivery in sustainable ways" (UN High-Level Panel of Eminent Persons on the Post-2015 Development Agenda, 2013, p. 4).

In some cities in the developing world, mobile phones are helping people enter the labor market. LabourNet, a Bangalore-based social network, increases employment by matching the skillsets of people available to work with the needs of those who require workers. Potential clients contact a call center that matches workers in the database, who are contacted by mobile phone (Srinivas, 2008). Traditional banking has been inaccessible to a large proportion of people in developing countries but mobile technology has helped breach that barrier. M-Pesa is a mobile phone–based money transfer and microfinancing service in Kenya and Tanzania. The system is low-cost, enabling users to deposit, withdraw, and transfer funds and to pay bills using a mobile device, with limited involvement of banks (Mas & Radcliffe, 2011).

Access to information through ICTs is an important enabler for markets, especially so for isolated or poor neighborhoods. CellBazaar in Bangladesh is an electronic marketplace based on mobile phone technology that supports buying and selling products for 4 million registered users (Zainudeen, Samarajiva, & Sivapragasam, 2010). In Senegal, Manobi-Senegal is a mobile and Internet service company that provides real-time price and location-specific information for a range of agricultural and fish products (Manobi, 2013). The evidence of these examples is that ICTs enhance job prospects and markets as well as reduce transaction costs for poor farmers and traders, thereby tackling some of the root causes of poverty and hunger.

ICT Limitations

The claim that ICTs create an economic paradigm and associated possibilities is, however, problematic. Rather than constituting a reshaping of global economic practices, ICT represents "a form of thin, rather than thick, integration ('thintegration') in the global economy . . . because it does not lead to high value-added exports, (and) does not fundamentally alter the continent's dependent position" (Carmody, 2012b, p. 1). While ICT consumption, particularly of mobile phones, is increasing enormously, the transformative effects of this are debatable. In the ICT value chain, African economies are what they ever were: suppliers of raw materials, importers of (duty-heavy) finished products, markets for northern-based tech and communication companies, and sellers of associated products (such as airtime; Carmody, 2012a). While mobile technology may create jobs in the informal sales/repairs sector in Africa, this neither enhances the tax and welfare base of states nor leads to the development of a high-value knowledge economy (Carmody, 2012b). Moreover, in relation to thintegration, Carmody's empirical study of ICT use within the furniture manufacturing businesses of Durban, South Africa shows that ICTs are being used more to recruit and control labor and manage supply chains than to integrate the businesses into the global economy (Carmody, in press), while Chew, Levy, and Ilavarasan's study of ICTs' effects on women's microenterprises in Mumbai revealed only minimal impact on profits or numbers of workers (Chew et al., 2011).

Additionally, despite increasing ICT possession, it is doubtful whether the global digital divide is

diminishing. Originally, *digital divide* related to blunt North–South disparity in terms of ICT connections and access. This disparity remains globally uneven but the term also now encompasses divides in digital literacy and other social barriers to incorporation in the ICT economy (Qureshi, 2012). One Chinese study found that ICT access and use paralleled and reinforced existing divides, with affluent *indigenes* of "urban villages" possessing sophisticated ICTs, while unintegrated migrant workers had only basic or shared access to ICTs (such as TV) (Guo & Chen, 2011). Researchers such as Aker and Mbiti, while generally hopeful about ICTs' potential impacts on economic growth, are also aware of the replication of social divides in relation to ICT access. As they write of M-Pesa, it is "the wealthier, better educated, urban and 'already banked'" who predominantly engage with m-banking (Aker & Mbiti, 2010, p. 221).

Overall, the fundamental issue of whether economic growth alone constitutes the route to poverty alleviation and development needs to be considered by asking whether ICTs can eradicate extreme poverty and hunger. As Unwin points out, this is only one view of development, one that is infused with the belief that top-down technical progress creates growth and development, reflective of the "modernity bias" among ICT4D advocates (Díaz Andrade & Urquhart, 2012). This neglects other views that development must be shaped from the bottom up, with the voices of the poor and marginalized being heard and determining what *development* means (Unwin, 2007).

Goal 2: Achieve Universal Primary Education

Education is central to tackling global poverty. Education is good for a person's ability to generate income but education also makes other, greater contributions to a person's individual development and to society such as increasing self-esteem and quality of life and enabling engagement in the social and political worlds (Melin, 2002). MDG2 committed the UN community to ensure that by 2015 all children would have access to primary education.

ICT Strengths
ICTs feature prominently in efforts to achieve universal education, particularly in enabling access and providing means to optimize costs and resources. A notable example is HiWEL (Hole-in-the-Wall Educa-

tion) in New Delhi. Learning stations are made available on playgrounds, with technology advances ensuring weather- and tamperproofing. Students use the stations collaboratively for information access and project preparation (HiWEL, 2012), and the stations' outdoor availability ensures optimum use.

One radical idea for supporting universal primary education is to provide laptops to every schoolchild in the world. One Laptop per Child (OLPC) is an initiative supported by a number of companies and the 50x15 Foundation (an organization whose goal is to provide computers and Internet access for 50% of the world's population by 2015) (50x15 Foundation, 2010). Similarly, the Indian government has promoted and subsidized the production of a $20 tablet for school children (Wadhwa, 2013).

ICT Limitations
ICT connectivity is vital to contemporary education, enabling people to reap the benefits of social networking and knowledge economies. However, in many developing countries there exist "deep-seated cultural, institutional and political barriers" to accessing education, some of which are related to the costs of school fees or school supplies, others due to the economic role children often play in families, and others from gendered norms about the roles expected, in particular, of girls (Alter, 2008; Shabaya & Konadu-Agyemang, 2004, p. 395). Although in spatial terms, the urban poor are more likely to be in the vicinity of schooling than the rural poor (Shabaya & Konadu-Agyemang, 2004), school enrolment for the urban poor can be obstructed by other factors. As one study in Delhi revealed, while 88% of all children attended school, only 68% of slum children attended due to inequalities (of religious background, migratory status, etc.), the proliferation of unaffordable private schools, and bureaucratic hurdles such as lack of birth certificates to enable matriculation (Tsujita, 2011).

There are also deficits in fundamental educational infrastructure including buildings, teacher training, curriculum development, and materials. For some advocates of ICT for Education (ICT4E), digital technology seems to be the magic bullet, bypassing the enormous costs of educational infrastructure by providing affordable education directly to the child. The OLPC philosophy, for instance, suggests that the $100 laptop will connect children straight to learning, transcending the need for classrooms and

teachers. This view has been criticized for failing to understand that problems in education systems are systemic and "reforming education is hard work that involves making coordinated changes in pedagogy, curriculum, assessment, and teacher training" (Kozma, 2007) as well as ensuring necessary resourcing. Kozma, among others, queries the profit motive, which inevitably intertwines with the growing role of private-sector companies in supplying classrooms.

Undoubtedly, access to educational software and the superabundance of information on the Internet enhance learning. However, information itself is not neutral. Curriculums are designed to convey certain knowledge and search engines prioritize results. English as the principal Internet language creates yet another digital divide. Access to educational ICTs is not enough; acquiring the digital literacy to make critical sense of the information (Unwin, 2007) is equally important and perhaps unrecognized by those who simply prescribe "one laptop per child."

Goal 3: Promote Gender Equality and Empower Women

Women and girls constitute three fifths of the world's poor (UNIDO, 2013); therefore, efforts to overcome poverty must address gendered norms and practices that perpetuate this state of affairs. Several studies suggest that the benefits of promoting gender equality reverberate widely, as women's empowerment yields economic, health, and educational benefits for families and communities (Chatham House, 2010; PRB, 2011). MDG3's subclauses thus focus on tackling gender inequality by enhancing girls' and women's educational, political, and employment access.

ICT Strengths

ICTs have featured in efforts to promote gender equality and empower women in many ways, for example, through employment support, increased knowledge and communication, and e-learning for healthcare professionals.

Access to jobs is key to combating poverty, but women with home responsibilities are often disadvantaged in this respect. In the context of urban poverty in the developing world, women have been found to have a higher unemployment rate than men (for example, up to 25% in Dhaka, twice the rate as among nonpoor women), with childcare a

major constraint on entry into the labor market (Baker, 2008). Teleworking is an example of a way to use ICTs, which provide a platform that supports women engaging in jobs from home. For example, the Malaysian Ministry of Women and Family Development has an e-Homemakers policy for a gender-sensitive teleworking environment. Positive experiences were also reported in West Bengal in India, where women at the Baduria ICT Centre reported that they gained respect in their communities after obtaining ICT skills that have enabled them to enter the job market with greater confidence (Jain, 2007).

The Internet, with its e-learning possibilities and wealth of information, can empower women. In Brazil, CEMINA integrates the Internet with radio to improve education on gender equality, health, and environmental issues and to empower women communicators through community radio telecenters broadcasting gender-relevant content (Frayssinet, 2011). The Internet can also be a tool to educate listeners on violence against women. FIRE, a feminist radio channel in Latin America, provides information and supports women's involvement in campaigns on sensitive issues such as women in conflict areas and child abuse (FIRE, 2009).

ICT Limitations

As economically and socially liberating as are the efforts noted above, access to ICTs is often constrained by the existing gender order. In contexts where it is not the norm for women to have a say over a family's resources or decision making, their access to ICTs can be limited. Equally, where ICT access is considered subversive of gender norms, women's access to ICTs may be denied. Women's mobile phone use was banned by an Indian village council for fear that women's access to communication would encourage elopements and endanger marriage norms (*The Guardian,* 2010). Research from four field sites in Malawi and Ethiopia (two urban, two rural) also revealed how across the sites the "gendering of daily life shapes the gendering of ICT use," with ICT ownership and use being understood by many interviewees as masculine, while carrying a social stigma for women (Geldof, 2011, p. 78).

ICT use and access can therefore reinforce rather than challenge gendered norms. Many of the examples in the "strengths" section above illustrate women accessing employment through ICTs. Yet

these same ICTs can replicate and reinforce gendered inequalities. The Malaysian case above particularly suggests telehome working as a promising employment prospect for women. However, this form of work reinforces women's positioning in the private sphere and the expectation that they will carry the "double burden" of homecare plus remunerated work. Moreover, the isolation and informality of remaining in the home while working separates them from colleagues and the possibility of becoming organized workers acting in defense of collective interests.

Goal 4: Reduce Child Mortality

The causes of child mortality are often common, preventable neonatal problems and childhood diseases such as acute respiratory infection, diarrhea, malaria, measles and HIV/AIDS (Keating, Chock, & Fischer, 2011). Despite the preventability of these diseases, the child mortality rate stood at 90 for every 1,000 births worldwide at the outset of the MDGs in 1990 (UNDP, 2013c). MDG4 commits to reducing this ratio by two thirds by 2015.

ICT Strengths
Globally, statistics for under–age 5 mortality suggest that rural populations across the developing world experience higher levels of child mortality than urban populations. However, in the context of the rapid urbanization currently under way, deeper mining of the statistics of population diversity and socioeconomic disparities in the urban world reveal that poor urban children are equally at risk of early mortality or health problems associated with malnutrition (van de Poel, O'Donnell, & Doorslaer, 2007).

ICTs feature in efforts to reduce child mortality by automating child healthcare records, providing support for monitoring treatments and patients, and delivering e-learning and information to healthcare professionals. One example of automated healthcare records includes Navayush in India, a Web application that manages personalized medical information and supports countrywide healthcare appointment booking. Medical professionals update health histories and diagnoses, ensuring up-to-date information for other medical professionals (Navayush, 2012). Timely communication is supported by SMS-messaging in Nigeria, where professionals speed the delivery of early infant HIV/AIDS diagnoses (Qiang, Yamamichi, Hausman, & Altman, 2011). Patient

monitoring is also well supported by ICTs. The Indian state of Gujarat's Health and Family Welfare Department has a name-based tracking system called E-Mamta that registers pregnant women, children aged 0–6, and adolescents to support ante- and postnatal care, immunizations, and nutrition delivery services (E-Mamta, 2012). E-learning and information provision through the Internet are also evident in efforts to reduce child mortality. For example, Kenya's African Medical and Research Foundation pioneered an e-learning program to upgrade nurses' skills (AMREF, 2013).

ICT Limitations
As discussed above, ICT-based e-health initiatives can lead to enhanced health information and more efficient service delivery. Yet similar criticism arises here as with MDG2 on education. Comprehensive health provision requires government policies, budgetary commitments, staff training and retention, infrastructure, equipment, public health education, and much more. ICTs may improve some aspects of this costly and complex scenario but they cannot replace the basics of a health service and the human touch of medical professionals. In many developing countries, public health services are severely underfunded and reeling from years of public sector cutbacks imposed by the international community on developing nations in the form of structural adjustment policies. Tellingly, a study of neonatal mortality in Nicaragua revealed that child mortality plummeted there between 1960–90 (from 120 deaths per 1,000 down to 40) due to the "pro-poor targeted and de-centralised public health service" of the Sandanista years. However, since then there has been an increasing equality gap in terms of infant deaths resulting from reintroduced privatized healthcare and "the precarious situation of the urban slums," where the population swelled after Hurricane Mitch in 1998 (Pérez, Peña, Persson, & Källestål, 2011). These examples point to the efficacy of relatively simple, targeted, public health interventions in tackling infant mortality, which ICTs can complement but never replace.

Goal 5: Improve Maternal Health

Closely intertwined with MDG4 is MDG5, improving maternal health. While the numbers are falling, maternal mortality rates still stood at 287,000 worldwide in 2010 (UNDP, 2013a). The global

inequalities behind these numbers are manifest, with the risk of maternal death in parts of Asia and Africa remaining as high as 1 in 31 (Keating et al., 2011). MDG5 aims to reduce this global travesty by three quarters through enhancement of women's access to reproductive healthcare. Sadly, this MDG remains the farthest from its target of all the MDGs as 2015 approaches (Scopaz, Eckermann, & Clarke, 2011).

ICT Strengths

ICTs contribute to improving maternal health similar to the ways they reduce child mortality, that is, through monitoring diagnostic support and disease tracking, e-learning for healthcare professionals, and general information provision. Many of these aspects of m-health provision are being integrated into UN health programs globally through the United Nations Foundation/Vodafone Foundation Technology partnership (UNF-VFT, 2009). Other examples of mobile technology providing maternal health–related information include MOTHER (Mobile based maTernal HEalth awaReness) in Telugu, India, which provides medical information, voice-call alerts, and advice (eIndia, 2012). The international TextToChange organization provides information through text messages, fact sheets, posters, etc., to disseminate maternal health information, increase service utilization, and obtain feedback from patients (TextToChange, 2012).

ICT Limitations

Paralleling concerns raised under MDG3, the high rates of maternal mortality are part and parcel of the consequences of gender inequality. Women's inequality in terms of power and resources are central to maternal mortality. In contexts where women are married early or where they lack control over family planning, equality in sexual relations, or access to contraception due to cultural or financial reasons, pregnancies are likely to be early and frequent. This constellation of factors, compounded by weak healthcare infrastructures, implies that high rates of maternal mortality cannot be redressed by e-health initiatives alone.

A study of maternal mortality rates in Lao PDR, for example, brings all these factors together to explain why Lao will not meet the MDG5 target. While there has been slow improvement, two or three women in Lao still die daily in childbirth and 50–75% of women lack access to contraceptives. The causes of these ongoing problems are low female literacy levels, teenage marriages, long distances to healthcare infrastructure, inability to pay healthcare fees, and family disapproval of contraception. In sum, women need both financial and social empowerment if they are to achieve maternal health (Scopaz et al., 2011).

Goal 6: Combat HIV/AIDS, Malaria, and Other Diseases

HIV, malaria, and a host of other, lesser-known tropical infectious diseases are termed the diseases of poverty (WHO, 2012). MDG6 therefore committed the international community to halt and reverse the spread of these diseases and ensure access to treatment by 2015.

ICT Strengths

ICTs can assist in combating malaria by enabling healthcare professionals to identify new outbreaks and collect data on affected households by phone, tablet, and GPS, as is done by the MEEDS (Malaria Early Epidemic Monitoring System) and Coconut Surveillance project in Zanzibar (Neat, 2013). Similarly, HIV/AIDS can be addressed through a range of m-health interventions such as enhancing disease monitoring and management, improving drug distribution systems, training healthcare providers, educating patients, and facilitating support networks for people living with HIV/AIDS and their carers (Kamel, n.d.).

The SIMpill electronic device, produced in Cape Town, monitors and reminds patients about when medicines are to be taken (SIMpill, 2012). And since fraudulently manufactured medicines are also a threat to patient health, the mPedigree system allows mobile phone users across Africa to check that batches of medicine are not counterfeit (mPedigree, 2013).

Exchange of knowledge is a key ICT strength, as discussion of these diseases often remains taboo. In the Youth AIDS Project in South Africa, the Internet provides a platform for young people to exchange accurate information and experiences among peers. The objective is to reduce the incidence of HIV/AIDS and sexually transmitted infections by promoting information-sharing by youth AIDS clubs (Voices of Youth, 2013). Similarly, the AIDSWEB project promotes ICT use to enhance HIV/AIDS education and prevention activities in several African countries (SchoolNet Uganda, 2007). The SEAMEO Project is an example of an approach to training teachers in

using ICT-based learning materials. The project targets around 8,000 in-school youths through interventions in schools in high-risk cross-border areas, community-based information programs, community learning centers, and peer education support (SEAMEO, 2013).

ICT Limitations

The examples above highlight ICTs' role in sharing information and promoting care in relation to these diseases. However, as mentioned above, malaria, HIV and other tropical infections are termed "diseases of poverty," and this designation reveals the underlying interaction of social, economic, and biological factors that drive their incidence and require a holistic approach to obtain effective responses. The risk of infection with these diseases is heightened by people's social, economic, and gender status as well as their conditions of life and work. Contracting these diseases compounds the poverty of those who become ill, their families, and their communities (WHO, 2012). The congestion of urban dwellings is also a high risk factor for the spread of diseases, with up to 200 million Africans living in malaria-endemic urban areas and HIV/AIDS prevalence rates exceeding 50% in some African cities (Baker, 2008).

Interestingly, WHO acknowledges that "innovative and new technologies," particularly in pharmaceutical research, have an important role to play in responding to these illnesses. WHO equally notes that where a profit is not assured, investment by the pharmaceutical industry is almost nonexistent. By way of example, "of 1393 new chemical entities introduced between 1975 and 1999, only 16 targeted 'tropical diseases' or tuberculosis" (WHO, 2012, p. 14).

There is hope that by facilitating information and social networking, ICTs aid in overcoming the isolation and stigma undoubtedly experienced by many disease sufferers, HIV/AIDS patients in particular. However, it is important to acknowledge that information is not neutral. There have been long-running disagreements over how AIDS is to be understood and responded to, such as the controversial views of a previous South African government or other faith-based responses. The dissemination of health information should be highly beneficial but who generates the information and how it is received and understood need to be scrutinized.

MDGs 4–6 all relate to issues of health, and it is worth noting in closing this section that the efficacy of many of these initiatives has not been subject to rigorous monitoring and evaluation (a problem noted about ICT4D initiatives in general; Heeks, 2010). A recent meta-analysis of studies of mobile phone use in health initiatives found that evaluation processes were usually poorly designed. Efficacy studies for m-health mainly occurred in affluent contexts, and efficacy for communities in poverty was then extrapolated. M-diagnosis in particular was often found to be wrong. Only in respect to the usefulness of reminders to patients to take their antiretroviral drugs were the findings positive (Free et al., 2013). There are also concerns that shifting data to digital forms, including personal information related to sensitive issues such as health, is happening in developing country contexts where data security has not been assured (Lock-Teng Low et al., 2011).

Goal 7: Ensure Environmental Sustainability

MDG7 on environmental sustainability includes many targets such as increasing commitments to sustainable development, reversing the degradation of environmental resources and biodiversity loss, ensuring access to clean water, and halting urban slum expansion.

ICT Strengths

The scope for ICTs to contribute to environmental sustainability is broad, ranging from technology support for resource conservation, to information provision, to enabling citizen engagement.

Smart grids are an excellent example of energy suppliers employing technologies to increase the use of renewable energies and to optimize the supply of and demand for energy. Software can control power systems so that the use of renewable sources is increased (Energinet.dk, 2012). This has significant consequences for the poor, as energy poverty is a substantial challenge for developing countries (Sagar, 2005). Citizen engagement is also important in addressing sustainability. Carpooling reduces traffic congestion, saves fuel, and reduces emissions. Using ICTs, carpooling can be organized citywide, as demonstrated by Koolpool, an SMS-based carpooling service in India. Ride-givers send an SMS to the system and receive a list of ride-seekers. Ride-givers earn points through an incentive system, and the points can be redeemed for fuel (1888

ARTICLES.com, 2008). An SMS system used in Kenya enables water vendors to provide information to buyers on water availability, when the water was tested, and its price. The system's goals are to reduce the time it takes consumers to find safe, clear water and to reduce costs (M-Maji, 2011).

ICT Limitations

ICTs are often assumed to be green technologies that in themselves will contribute to MDG7. They seem to offer cleaner manufacturing, reductions in paper use, and saving or pooling energy; however, this is something of a delusion. ICT manufacturing requires a plethora of natural resources, and mining often produces environmental degradation as well as worker exploitation. For example, in Bangka, Indonesia unregulated tin mining for smartphone and tablet manufacturing goes on at the expense of landscapes, farming, fish stocks, and coral reefs (Hodal, 2012). Some integral ICT resources are mined in conflict zones, such as coltan trading in the Democratic Republic of the Congo, allegedly bolstering the profiteering of armed factions (Pulitzer Center, 2011). Moreover, problems of waste are manifold when it comes to the disposal of old ICT hardware.

The target of improving the lives of 100 million slum dwellers by halving the number of people without access to a safe, sustainable water supply is one of the few MDG targets to have been met before 2015, but the profound environmental challenges of urban life related to pollution, industrialization, waste, transport, etc., remain. Overall, the failure of every round of global discussions to achieve a universally acceptable and equitable agreement to alter the balance of political, economic, and business interests in favor of long-term environmental goals (e.g., the limits of the Kyoto treaty) suggests that achieving the necessary fundamental shifts to attain the goal of environmental sustainability remains remote.

Goal 8: Develop a Global Partnership for Development

MDG8 acknowledges the problematic architecture that underpins much global inequality. The goal notes the need for reform of global trade, aid, financial systems, debt, and access to pharmaceuticals. It is the only MDG to mention the potential of ICT4D, calling for public–private partnerships to

make the perceived benefits of new technologies more widespread.

ICT Strengths

Global initiatives to create partnerships for effectiveness and accountability in the realm of ICT4D include the Global Alliance for ICT and Development (GAID) and the Open Government Partnership. Sponsored by the UN, GAID's goal is to support harnessing ICT4D across all the MDGs, providing a platform for ideas, and focusing on ICT access, connectivity, content, and education at a global level (Infopoverty, 2013). The Open Government Partnership has a membership of 58 countries and "aims to secure concrete commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance" (OGP, 2013). Reported successes include a citizencentric information portal in Mexico and the publication of a good governance and anticorruption plan in the Philippines.

Interestingly, ICTs have played a crucial role in enabling citizens' groups to monitor the fulfilment of governments' MDG commitments. Data on each country's progress are widely available, and ICTs have enabled NGOs to organize themselves into global campaigns such as the Make Poverty History and the Global Call to Action Against Poverty. Without ICTs, global accountability on the MDGs would no doubt be far weaker.

Another aspect of MDG8 is the call for public–private partnerships to spread the benefits of ICTs. Several large multinational organizations have engaged in programs to support such developments, including Intel, IBM, and HP. The Bangladesh Institute of ICT in Development uses the Intel Easy Steps Program for digital literacy to support development and promotion of ICT-based services. HP works with the Ila Trust, which provides free healthcare in the Delhi slums, to implement an electronic medical records system that includes patient health history, medical follow-up support, inventory management, analysis of symptoms, and early warning of disease outbreaks.

ICT Limitations

Public–private partnerships to promote development and ICT4D are a popular element of the liberal global governance and economic agendas of the contemporary world. As highlighted in several subsections above, however, contradictions arise

between the profit motive of private sector actors and needs for public goods of those living in poverty. Moreover, the liberal ideal of free markets and information has become complicated and compromised in the encounters between private ICT providers and authoritarian governments. To ensure market access, companies such as Google and Yahoo! have cooperated with undemocratic regimes at the expense of information freedom. The power of governments to censor the Internet or, indeed, to use ICTs to track human rights defenders is a shadow side to the freedoms enabled by ICTs (Front Line Defenders, 2012).

A further concern that resurfaces in the context of ICT limitations is that of power and equality in relationships between purported global partners. A critical study of the World Bank's Development Gateway (portal to share development information between experts and locals worldwide) notes that the portal is predicated on the idea that knowledge is imparted from North to South, with topics for discussion being decided in the North and expert responses written in English (Witjes, 2011). Demonstrating disregard for local knowledge and failing to engage people in an accessible way, the notion that partnerships should be equal is undermined by this framework. This final reflection prompts the question; where are the voices of people in the developing world in elaborating the vision of development or determining if or how ICTs may be useful to address that vision?

Conclusion and Looking Ahead

In the year 2000, world leaders came together, buoyed by optimism associated with the new Millennium. They agreed that the time had come to right the wrong of one billion people still living in poverty. The resulting MDGs articulated a global consensus on human development and provided an unprecedented "recipe" for the fight against poverty, a recipe based on clear targets and the principle of mutual accountability of states. Since then, much has changed in thinking about global poverty and even more has changed in the field of ICTs. By using the MDG framework, we have endeavored to demonstrate the potential of modern information technology in the fight against poverty, but we have also acknowledged its limitations. We conclude that ICTs play an important, but by no means sufficient,

role in the urgently required redoubling of efforts to achieve these MDGs and in informing thinking about the post-2015 framework.

Much of the discourse about ICT4D is optimistic, with a tendency to herald the arrival of new "silver bullets." Such undue faith in technology as *the* solution is destined to be disappointed because such optimistic faith fundamentally fails to understand the nature of poverty. As we suggested in our discussion of the concept of development at the outset of this article, poverty is an aggregation of political, social, and economic phenomena and it cannot be rectified by employing one-dimensional approaches. Poverty is not merely an absence of goods or information. Poverty is also about marginalization, discrimination, exclusion, and inequality. As several of the examples covered in this article show, access to and use of modern ICTs often replicate the social divides, for example, between slum dwellers and other urbanites or between men and women. However, if used creatively and sensitively, ICTs can help overcome divides and build the infrastructure for citizens to speak out and be heard. Here is one final example from Kolkata, India of an ICT project called "Addressing the Unaddressed" (2013). The project uses GPS to map houses in the Kolkata slums and then to assign addresses to the houses, giving slum dwellers the chance to obtain identity cards and register to vote, while also enabling healthcare and service providers to locate buildings more easily. The project shows that ICTs can be an enabler for realizing many of the MDGs by supporting developmental processes, delivering services, and promoting citizen participation.

By providing access to information and platforms for mobilization, ICTs have the potential to transform the way national and urban governments work. ICTs can promote policies that respond to the needs and priorities of poor people and improve government and institutional transparency. However, as Elnagger suggested in his study of unequal gender access to ICTs, the marginalization of women (and, by implication, other marginalized groups) from the ICT economy will only be overcome from "women-centred, local appropriation of ICT over time" rather than technical solutions driven by the supply of ICTs (Elnagger, 2008, p. 290). This concern that ICT4D should be "relevant, appropriate and effective" was raised in 2005 by Denis Gilhooly, then working for the UN's ICT Task Force and Mil-

lennium Development Project, when he noted that increasing penetration alone (of mobile phones, computers, etc.) did not demonstrate development impact, which remained constrained by ICT access inequalities. He called for a multistakeholder approach to planning the interconnections of ICT and development from the early stages of poverty reduction strategies, emphasizing the role of governments, villages, and cities as well as private businesses in planning "bottom up and holistic e-strategies" (Gilhooly, 2005, p. 13).

The evidence of our article suggests that the need for such holistic approaches remains unfulfilled, with the tendency Gilhooly identified for one-off ICT4D projects to proliferate without achieving scalability still evident, as the prolific but disjointed examples of ICT4D projects we cited in this article suggest. As the international community plans the role of ICT4D post-2015, multistakeholder holistic planning remains vital in order to draw out the strengths of ICT4D and avoid its limits. Important to this discussion, we would stress that this planning requires a commitment from the international community's development planners to listen to poor people as the key stakeholders. One conclusion of several decades of development thinking is that ending poverty requires the active involvement of poor people themselves and that poor communities must organize and empower themselves to chart their own course out of poverty. This should apply equally to urban and rural dwellers, online and off-line communities. The UN and many NGOs have recognized and advanced people's right to connectivity and are more consciously promoting the role of ICT4D. This is an important development in the thinking about human rights and a welcome addition to the many exciting ICT initiatives documented in this article. Information and communication are now recognized as vital ingredients in the recipe for a better world. As the international community gears up to articulate the post-2015 agenda, all of us who are passionate about people's capacities to access and use information to bring about a fairer, more equitable world should make it our cause to help shape the goals for the world we want. ∎

Acknowledgments

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