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ICT for Development: sustainable technology-supported participatory development for poverty alleviation in the context of digital divides

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1. Introduction and objectives

> *"By the end of 2008, an important milestone in the ICT development race was achieved: over 4 billion mobile cellular subscriptions worldwide, translating into a penetration rate of 61 per cent. At the same time, ITU estimates that the world had 1.3 billion fixed telephone lines – or 19 per 100 inhabitants – and that almost a quarter of the world's 6.7 billion people were using the Internet." - ITU (2009), p. 3.*

Despite the recognized potentials of ICTs[1] for alleviating poverty, still they are not equally accessible, leaving the poorest people behind (von Braun, 2010). There is a set of interrelated and continually unfolding factors influencing the field of ICT and its role in development (Chambers, 2010):

1. Change in the dimensions that define ICT and development has accelerated, not only in communication technologies and the expansion of 'web 2.0' (the read/write web) but also in the awareness and aspirations of those living in poverty
2. Following on from the relatively open and participatory approaches in the aid sector during the 1990s, an emphasis on control, accountability and impact assessment has developed in recent years
3. Paradoxically, at the same time there has been a multiplication and diversification of participatory methodologies in the development field
4. Evolving theoretical understandings of the nature of complexity and of technology have afforded additional conceptual tools for the theory and practice of development
5. There is an increased acknowledgement of the significance of power relations in development.

In the field of ICT for development (or ICT4D as it is commonly known), as in all development work, there are thus multiple complexities at play. Complexities include:

Ontological: whenever ICT is conceived and implemented in service of development goals, there are multiple human, technical and physical elements in diverse interrelationships in social, economic, political, infrastructural and ecological dimensions, which also evolve in a non-linear, unpredictable way.

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[1] We have chosen to adopt the definition of ICTs used in the most recent United Nations Development Program research paper on information and communications technology for development:

> The paper understands ICTs as tools or techniques that allow recording, storing, using, diffusing and accessing electronic information (World Bank, 2002). This paper also accepts more broadly that ICTs are "tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means" (UNDESA-GAID, 2009: 5).

(Hamel, 2010, p. 1)

Analytical: data about the elements and their interrelationships is incomplete and mechanisms of interaction often unknown, while dealing with problems in a discipline-based way often further fragments our understanding.

Societal: there are multiple actors and groups involved in the contexts in which decisions about ICT and development are made, who often see development problems and goals differently and who bring conflicting interests in ICT and development into the decision-making process.

(Mollinga, 2010).

Within these complexities, contested and evolving ICT4D 'boundary concepts' (Mollinga, 2010) such as 'poverty', 'digital divide' and 'participation' work to define the space in which theory and practice are created. This can be assisted through the creation and use of 'boundary objects', such as frameworks and participation processes, to represent the elements and interrelationships at play (Mollinga, 2010).

While ontological and analytical complexity necessitate 'interdisciplinary' approaches to research and problem-solving in a field (Mollinga, 2010), the societal complexity that is also present in most development fields (including ICT4D) means that a 'transdisciplinary'[2] approach is recommended.

Research on the relationship between ICTs and poverty, however, suffers from a lack of theory and a lack of even interdisciplinary research. Specific concerns include:

- an apparent disconnection between academic scholarship and the needs of practitioners
- an overly utopian and zealous belief in the role that ICTs play in development
- a lack of linkage into the overall discourse regarding poverty alleviation
- investigation of 'ICT' in isolation from 'development'
- investigation of the ICT and development ideal in isolation from other relationships
- a tendency for some research to lack academic rigor

(Brown and Grant, 2010).

In this paper we will review recent literature and consider elements and boundary concepts that constitute the ICT4D field. Our goal is to review boundary objects (frameworks and participation processes) that have so far been created to aid ICT4D understanding and decision-making, and seek to synthesise these into a framework that goes at least some

2"Transdisciplinary research is interdisciplinary research with interest groups (so-called "stakeholders") involved in all phases of the research" (Mollinga, 2010, p. S-2)

way to addressing the concerns expressed above. The structure of our approach to this is outlined below.

In section 2 of the paper, a review of different conceptions and measures of poverty is presented and the most suitable conception of 'poverty' as a target (and means of assessment) for sustainable technology-supported participatory development to alleviate poverty is considered. This is followed by a review of the notion of digital divides and how these relate to ICTs and development in section 3, and a description of some of the ways in which ICTs have been implemented for development and poverty alleviation is presented in section 4. In section 5, the rationale for participatory and sustainable development using ICTs is considered. Section 6 presents a review of existing ICT4D frameworks and processes, and from these a comprehensive framework for sustainable technology-supported participatory development to alleviate poverty is constructed. Section 7 contains the conclusions of the paper and recommendations for future research.

2. Poverty, capabilities and ICTs

> *"We cannot accept poverty. It is a denial of choices. We have to enable people to make choices, to make something better out of their lives" Muhammad Yunus (ZEF, 6 November 2010)*

How poverty is defined and measured determines who is defined as poor, how we think about poverty's causes, and our evaluation of measures to alleviate it (von Braun, Vargas-Hill, and Pandya-Lorch, 2009). If we are to consider how we might address poverty with the help of technology-supported participatory development, we need to be clear on our conception of poverty and how we will assess such attempts to alleviate it.

2.1. Conceptions and measures of poverty

2.1.1. Income poverty

For many, 'development' has long been equated with increases in production and wealth, usually measured as gross domestic product (GDP) per capita. This commonly-held conception of poverty is one of a lack of money, and to alleviate poverty therefore means finding ways to deliver increased incomes to the poor (UNCTAD, 2010). The World Bank has accordingly defined poverty with reference to a threshold of $1.25 per day at 2005 purchasing power parity; those seeking to manage on less than this sum are living in 'extreme poverty' (Ravallion, Chen, and Sangraula, 2009). The World Bank proposes four reasons why measuring poverty is important:

- To keep poor people on the agenda
- To be able to identify poor people and so to be able to target appropriate interventions
- To monitor and evaluate projects and policy interventions geared to poor people

• To evaluate the effectiveness of institutions whose goal is to help poor people.

(Haughton and Khandker, 2009, p. 1)

The choice of the single indicator of income is justified in part because it is seen as closely correlated to other dimensions of poverty: "Inadequate income is a strong predisposing condition for an impoverished life" (Sen, 1999, cited in von Braun et al, 2009).

2.1.2. Poverty indices

With the aim of moving the poverty focus from economic factors to broader conceptions of human well-being, beginning in 1990 other measures such as the Human Development Index (Fukuda-Parr, 2003) and Global Hunger Index (IFPRI/ Welthungerhilfe, 2006) have been conceived. These incorporate indicators such as life expectancy, literacy and participation in education, and hunger (von Braun et al, 2009). However these are also not free from controversy. The dimensions selected for the United Nations Development Program (UNDP) Human Development Index (living standard based on GDP per capita, health based on life expectancy at birth, and education based on adult literacy and school enrolment) are criticised because they omit other dimensions such as human rights and political participation, inequalities, gender issues, the environment, governance and corruption (Schimmel, 2009). In addition, the annual Human Development Report released by the UNDP, which has been supplementing the Human Development Index with a growing number of other poverty dimensions (eg see UNDP, 2010), has been criticised for focusing on human deficits.

> UNDP equates poverty with disease, high infant mortality, low life expectancy, malnutrition, hunger, lack of access to water, education, knowledge, public and private resources, housing, clothes, and security … in other words with lack and deficiency. It contemplates exclusively what poor people do *not* have and what they are *not*.

(Schimmel, 2009, p. 95)

2.1.3. The livelihoods approach

The livelihoods approach to assessing poverty evolved from the late 1980s, with particular reference to concerns regarding "production thinking, employment thinking, and poverty-line thinking" (Chambers and Conway, 1992, p. 2). The definition proposed was

> a livelihood comprises the capabilities, assets (stores, resources, claims and access) 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.

(Chambers and Conway, 1992, p. 6)

The livelihoods approach to poverty pays particular attention to the vulnerability of the poor within their particular context, in a multidimensional way. By considering use of available assets (human, natural, financial, social, physical) and how these gain meaning and value in the context of institutional structures and processes (such as government, laws and markets), it is possible to better understand how those in poverty make use of livelihood strategies to pursue their own objectives (UNCTAD, 2010). Insights into the ways in which people's livelihood strategies are being thwarted, ie that they are being impoverished, can thus be gained to an extent that an income poverty or poverty index approach does not enable.

2.1.4. The capabilities approach

While the notion of individual 'capabilities' is incorporated within the livelihoods approach (Chambers and Conway, 1992), a more explicit focus on human freedoms and capabilities takes "one further step away from the idea of poverty as being just about money" (UNCTAD, 2010, p. 5). The 'capability' approach (Sen, 1982) can be distinguished from other economic approaches to poverty and development in that it considers the "means to achieve", "freedom to achieve," and "actual achievement" of goals an individual values (Zheng, 2009). Sen uses the notion of 'freedom' as the basis for his capability approach, and describes freedom as "central to the process of development" (Sen, 1999, p. 4) for two reasons:

1) the evaluative reason: assessment of progress has to be done primarily in terms of whether the freedoms that people have are enhanced;
2) the effectiveness reason: achievement of development is thoroughly dependent on the free agency of people

(Sen, 1999, p. 4).

Freedom is thus both the means and the end of development. It is enacted in five distinct forms that contribute to the capability of a person to develop and to be developed:

1. Political freedoms
2. Economic facilities
3. Social opportunities
4. Transparency guarantees (meaning arrangements enabling interaction with others based on basic presumptions of trust)
5. Protective security (meaning institutional measures to protect those who are vulnerable when they encounter situations which may cause them further deprivation)

(Sen, 1999).

There is a positive interdependence of these multidimensional freedoms in influencing an individual's situation in context with others:

> Political freedoms (in the form of free speech and elections) help to promote economic security. Social opportunities (in the form of education and health facilities) facilitate economic participation. Economic facilities (in the form of opportunities for participation in trade and production) can help to generate personal abundance as well as public resources for social facilities. Freedoms of different kinds can strengthen one another.

(Sen, 1999, p. 11).

Having considered various conceptions and measures of poverty, the next step is to consider which is most useful for our purposes.

2.2. What is the most suitable conception of 'poverty' as a target (and means of assessment) for sustainable technology-supported participatory development to alleviate poverty?

Harris (2004) poses the question, "What is poverty, where is it, and how does it look when it has been alleviated?" (p. 7). In discussing this he notes that even World Bank reporting goes beyond simple income measures of poverty, to include factors such as "powerlessness, voicelessness, vulnerability, and fear" (Harris, 2004, p. 7). Furthermore, he notes the European Commission's assertion that poverty should include factors such as "deprivation of basic capabilities and lack of access to education, health, natural resources, employment, land and credit, political participation, services, and infrastructure" (p. 7). The latest UNDP Human Development Report (UNDP, 2010) has attempted to address these gaps to some extent by extending its assessment of poverty to include three new measures: an Inequality-adjusted Human Development Index, a Gender Inequality Index, and the Multidimensional Poverty Index (MPI) (Alkire and Foster, 2009). The MPI is "grounded in the capability approach" (UNDP, 2010, p. 94).

When considering the multidimensionality of poverty, information, communication and knowledge are also key:

> "The poor are not just deprived of basic resources.They lack access to information that is vital to their lives and livelihoods: information about market prices for the goods they produce, about health, about the structure and services of public institutions, and about their rights. They lack political visibility and voice in the institutions and power relations that shape their lives. They lack access to knowledge, education and skills development that could improve their livelihoods… They lack access to, and information about, income-earning opportunities."

(Marker et al, 2002, cited in UNCTAD, 2010, p. 3).

The development studies literature also reveals that the capability approach is beginning to make a contribution to development of robust theory underpinning the impact of ICTs on development (Heeks, 2010; Kleine, 2010; Hamel, 2010). One example of such an approach is found in research that used the capability approach to assess the impact of ICTs on the quality of life of people in rural communities in Uganda (Kivunike, Ekenberg, and Danielson, 2009). Using as dimensions the three most significant elements of freedom proposed by Sen (1999) (economic facilities, social opportunities, and political freedoms), the researchers operationalised these using a range of indicators. The majority of these indicators related to information, communication, and knowledge. The researchers concluded,

> This study confirms that the capability approach is a valuable framework that can facilitate the investigation of the potential impact of ICT on the QoL [Quality of Life] of people in terms of what they can do... Unlike QoL concepts that focus on satisfaction with life, what SCA [Sen's Capability Approach] provides is an objective list of life's aspects that can be influenced by policy. As such an analysis on the potential and actual ICT contribution towards people's QoL establishes gaps which are vital for the state and policy makers.

(Kivunike et al, 2009, 'Concluding remarks' section)

We therefore consider that the capabilities approach to poverty and poverty assessment provides a sound foundation for conceptualising and evaluating sustainable technology-supported participatory development to alleviate poverty. The capabilities approach enables us to consider *how ICTs can support and promote sharing of information, facilitation of communication, and construction of knowledge to expand the political freedoms, economic facilities, and social opportunities that people enjoy; in other words how ICTs can promote participation, empowerment, health, education and income of people individually and in community.*

3. ICTs, digital divides and the need for multi-dimensional approaches

> *"Information is critical to the social and economic activities that comprise the development process. Thus, ICTs, as a means of sharing information, are a link in the chain of the development process itself." (International Labour Organization, 2001, cited in Harris, 2004. p.10)*

The term 'digital divide' was first used in the 1990s and originally referred to the differences in access to technology, between those who have access to technology and those who do not. Then, the existence of a gap separating individuals who are able to access computers, the Internet and new forms of information technology from those who have no opportunity to do so was recognized (Harris, 2004; van Dijk, 2006). As such, the first research on the matter focused on the factors determining the differentiated physical access to ICTs such as computers and the availability of a network.

When there is a digital divide, part of the population is excluded from accessing information and networks that could be used to expand their capabilities and freedoms, therefore providing access to information to those at the bottom end of the gap is thought of as an element to alleviate poverty.

In the context of analyzing information as a source of exclusion and inequality, van Dijk (2006) synthesises that, in the literature regarding the existence of a 'divide' between people or organizations with differentiated access to information, difficulties in accessing information can be a basis of inequality, as information can be a *primary good* or input, a *positional good* or a *source of skills*.

As mentioned earlier, information is a crucial resource for good decision-making and can determine the extent to which a person can have access to different kinds of services, goods and markets. It is a source of opportunities and thus difficulty in accessing information or the lack of possibilities to access it is a source of inequality in different spheres of human development. Information is now considered a primary good that is essential for the survival and self-respect of individuals (van Dijk, 2006).

Information is also a positional good when some positions in society "create better opportunities than others in gathering, processing and using valuable information" (van Dijk, 2006, p. 231). This occurs in particular in the context of a network society, in which the lack of a position in a digital network constitutes a form of social exclusion. In this context, those who do have access to information may be considered an information elite, with more power, capital and resources, amplifying even further the inequalities already initiated by differences in physical access to ICTs.

The inequality in terms of skills resulting from differences in access to information comes mainly from the conclusion reached by Nathius and de Groot (2003) who found empirical evidence of there being a skills premium in having ICT skills that explains increasing

income inequality between countries with differences in the appropriation of ICTs (Nathius and de Groot, cited in van Dijk 2006, pg. 231).

Even though ICTs have the potential to reduce the digital divide within and between countries and regions, ICTs and their benefits are not yet reaching poor countries at the same scale as they reach developed countries, particularly poor rural areas within countries (Torero and von Braun, 2005).

A look at the figures for access and usage of ICTs per region shows that, despite the growing penetration of mobile telephones in developing countries, big differences in access to this technology still persist. In 2007, mobile penetration was 28% in Africa and 38% in Asia, while in other parts of the world such as the American continent, Oceania and Europe it was 72%, 79% and 110% respectively. The gap is much wider when access to the Internet is observed: less than 5% of the population in Africa and less than 15% of people in Asia use the Internet, while 43% and 44% of the population use the Internet in Europe and in America (ITU, 2009).

Harris (2004) also pointed out the extent of the digital divide in the world. He highlights, that, at the time of his writing, all the developing countries owned a mere 4 percent of all the computers, there were more web hosts in New York than in all of continental Africa and more in Finland than in Latin America and the Caribbean combined. Further, more than 85 percent of the world's Internet users were in developed countries, where only about 22 percent of the world's population was living (Harris, 2004).

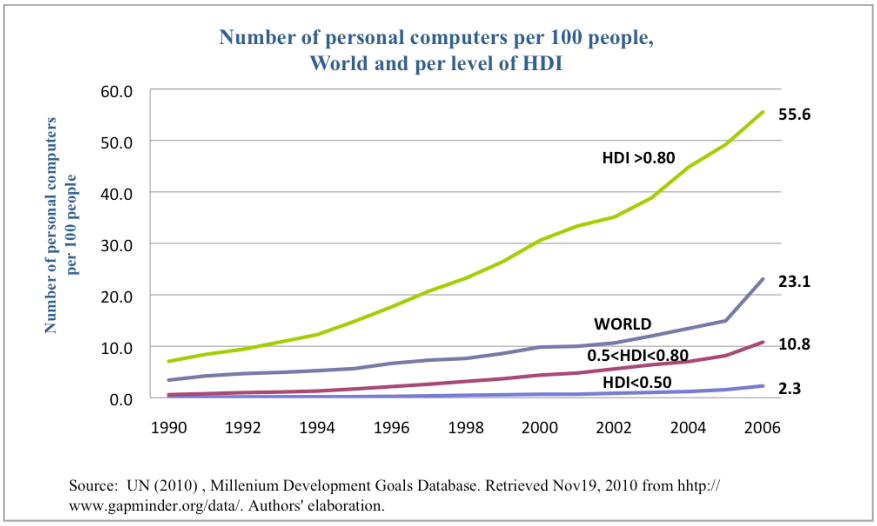
A digital divide in access to ICTs can also be observed between countries with different levels of development, measured by the Human Development Index (HDI)[3]. Figures 1 through 4 show the evolution of the rates of internet penetration, mobile and fixed telephone subscription and number of personal computers per 100 people, for countries with low HDI (below 0.5), intermediate HDI (between 0.5 and 0.8) and high HDI (above 0.8), during the decades 1990-2000.

A widening of the gap in the number of personal computers per 100 people, in countries with a high HDI and an intermediate HDI can be observed between 1990 and 2006. While in 1990 the number of PCs per 100 people was not so dissimilar between the two categories, in 2006, the number of personal computers per 100 people in countries with a high HDI was almost 5 times the number of PCs found in countries with an intermediate HDI.

[3]Index developed by the United Nations Development Program, measuring countries' level of "human development" with data on life expectancy, education and per-capita GDP (as an indicator of standard of living). Starting 2010 the HDI combines life expectancy at birth, mean years of schooling and expected years of schooling and GNI per capita (PPP US$).

The gaps in access to internet and PCs per 100 people between different levels of development are not closing. The difference is even greater when compared to the number of personal computers in countries with a very low HDI below 0.5. This gap seems to have begun to become slightly more narrow between 2005 and 2006, but the number of PCs in countries with high HDI is still growing at a steady rate, making it seem difficult for this gap to close in the coming years.

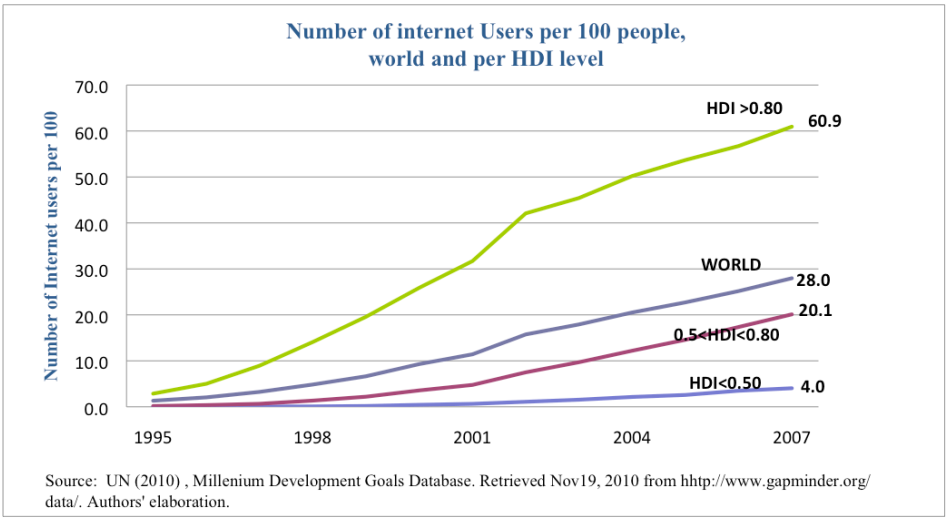
Figure 1. Number of personal computers per 100 people, world and per level of HDI



Source: UN (2010) , Millenium Development Goals Database. Retrieved Nov19, 2010 from hhtp:// www.gapminder.org/data/. Authors' elaboration.

The gaps in number of internet users per 100 people is not as wide as that of PCs per person, given the possibility of more than one person accessing the Internet through one computer. This gap is, however, still widening, especially between the countries with the lowest and highest HDIs.

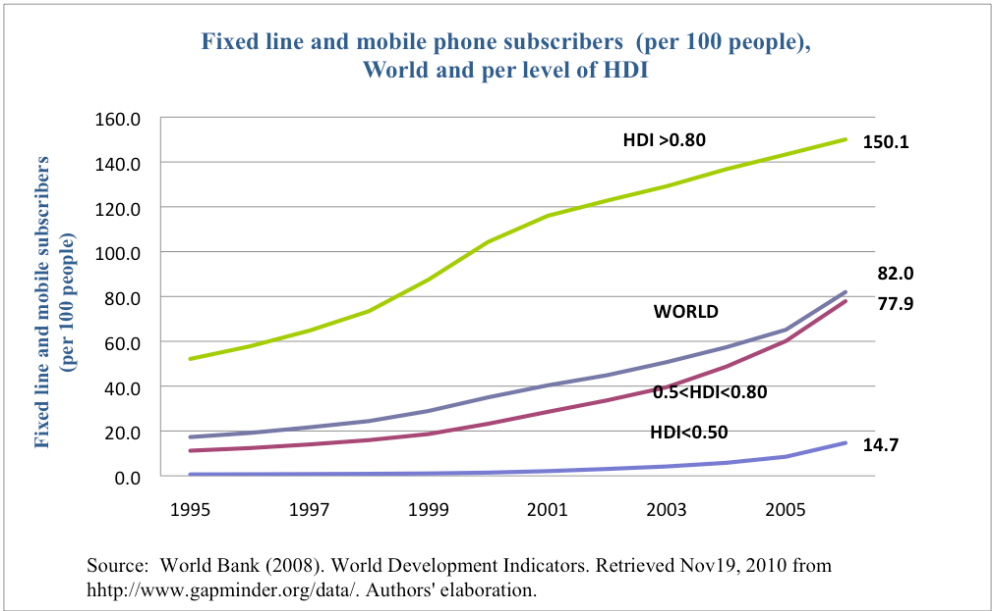
Figure 2. Number of Internet users per 100 people, world and per level of HDI



Source: UN (2010) , Millenium Development Goals Database. Retrieved Nov19, 2010 from hhtp://www.gapminder.org/ data/. Authors' elaboration.

The gap in terms of access to fixed telephone lines and mobile telephones is still very broad in 2006, being at the higher end of the gap10 times as much as at the bottom end. This gap appears to be closing slightly with the recent rapid growth of mobile phone users in countries with low levels of development in terms of the HDI. The gap in access to fixed and mobile telephones is receding between those with highest development and the countries with a medium HDI between 0.5 and 0.8. Here, however, the gap between countries with an intermediate level of development is converging with the number of mobile subscribers per 100 people calculated for the world. This points to the potential of mobile technologies in bridging the digital divide, given the increasing rates of penetration of mobile phones and mobile subscribers, and the potential of mobile technologies to scale up the role of ICTs that could help connect people when physical infrastructure is insufficient and provide dynamism where institutions are weak (von Braun, 2010).

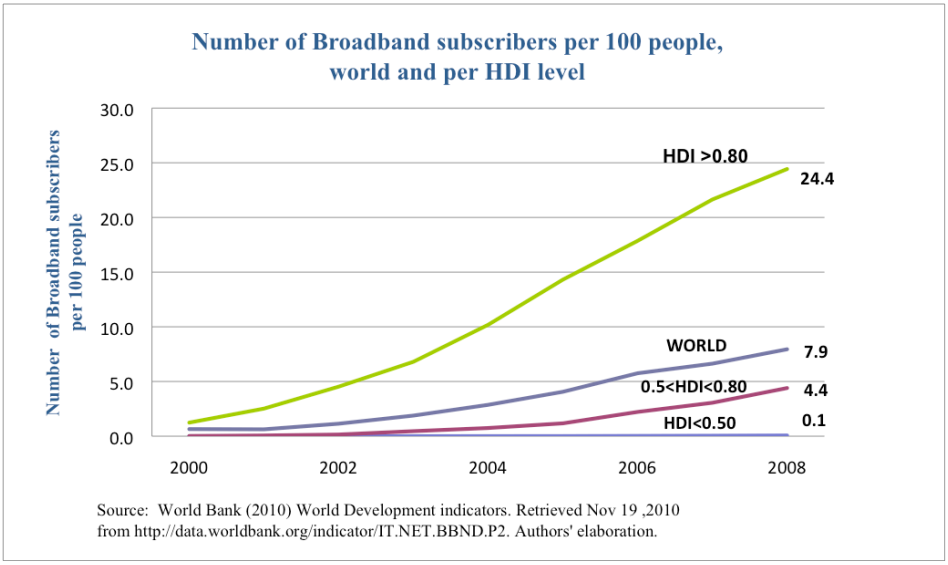
Figure 3. Number of fixed line and mobile phone subscribers per 100 people, world and per level of HDI



Source: World Bank (2008). World Development Indicators. Retrieved Nov19, 2010 from hhtp://www.gapminder.org/data/. Authors' elaboration.

The availability of broadband for information and communication services is very important for development in information technology, since the services and applications that can foster development, such as e-commerce, e-government and e-banking are only available through a high-speed internet connection. The number of broadband users in developed countries grew 8-fold between 2000 and 2008, while the number of broadband subscribers in those countries with HDI between 0.5 and 0.8 only grew at half the rate, with only 4.4 Broadband subscribers per 100 people in 2008. The number of broadband subscribers is still extremely low in countries with a low HDI, at just 0.1 per 100 people.

Figure 4. Number of Broadband subscribers per 100 people, world and per level of HDI



Source: World Bank (2010) World Development indicators. Retrieved Nov 19 ,2010 from http://data.worldbank.org/indicator/IT.NET.BBND.P2. Authors' elaboration.

Digital divides within countries also exist, between those people or communities that due to availability of ICT infrastructure, economic or social reasons have access to technology and networking and those that in the same country, do not. Rural access to communication networks is much more limited than it is in urban areas and the inequality of access to ICTs is even greater within developing countries and that the digital divide continues to widen between urban and rural areas (Harris, 2004; Torero and von Braun, 2006). Evidence has also been found on there being intra-national social divides between rich and poor and a democratic divide within the online community, between those who do and who don't use Internet to actively participate in public affairs (van Dijk, 2006).

As an example of this divide, a particular case study by Chong, Galdo and Torero (2009) in Peru finds a large disparity in the use of technologies between households in the top and bottom quintiles: based on household surveys, the average number of telephone calls for the bottom quartile is 0.5, while the figure for the top income quartile is of 6.9 (cited in von Braun, 2010, p. 8).

3.1. Multidimensionality in the digital divide

A number of dimensions make up the digital divide, including differences in service availability, awareness to use ICTs, opportunity to learn and use new data, mastering of technologies, experience, skills, support, attitudes, content, cultural attributes, disability, linguistic, gender and empowerment of civil society (Harris, 2004). The digital divide is not only a matter of access but also a matter of being able to use the information technologies and having the skills to make the most of accessed information. It has thus been acknowledged that the needs of those at the bottom end of the digital divide cannot be covered simply by providing people with more technologies, in an attempt to catch up with the other end of the gap by 'leapfrogging' there.

Thus, the study of the digital divide, which had initially focused on technological inequality and was concerned with the physical access to computers, networks and other technologies, has recently shifted to studying the importance of improving the capabilities and skills of who will use the technology, with the aim of maximizing the impact of the provision of new technologies.

This has lead to the need to express the digital divide as more than access to the technology, and technological devices, to express it in terms of the multiple dimensions that have also contributed to the existence of this divide. These are inequalities in access to social, cultural and information capital and other resources. The review of research about the digital divide in van Dijk (2006) finds, for example, 10 potential inequalities that can be related to the concept of 'digital divide'. Van Dijk (2006) classified these into 5 types: technological, immaterial, material, social and educational.

Type of inequality	**Inequality**
Technological	Technological opportunities
Immaterial	Life chances Freedom
Material	Capital (economic, social, cultural) Resources
Social	Positions Power Participation
Educational	Capabilities Skills

Source: van Dijk (2006)

The efforts aimed at bridging the digital divide need to be subordinated to strategies to solve poverty and the other divides within which poverty has been fostered, such as in access to education, health services, and political participation.

The need to address the differences in access and use of ICTs from a multidimensional perspective has also been acknowledged by the International Telecommunication Union (ITU)[4]. From the premise that ICTs can be a development enabler if applied and used appropriately, the ITU constructed and calculated in 2009 an ICT Development Index (IDI) (see Box 1). The goal of the IDI is to measure the development of ICT in different countries and relative to other countries, the level of advancement of ICTs in all countries and the digital divide, i.e. differences among countries with different levels of ICT development and the development potential of ICTs in each country (ITU, 2009).

Box 1. The Information Development Index (IDI)

This measure includes access, use and skills measures toward ICTs within a conceptual framework in which countries' evolution towards information societies goes through 3 stages:

- Stage 1: ICT readiness, reflecting the level of networked infrastructure and access to ICT,
- Stage 2: ICT intensity, reflecting the level of use of ICTs in the society, and
- Stage 3: ICT impact, reflecting the result of efficient and effective ICT use (ITU, 2009).

The indicators used for the first stage (ICT infrastructure and access readiness) include some previously used to measure access, i.e. fixed telephone lines per 100 inhabitants and mobile cellular telephone subscriptions per 100 inhabitants, with additional measures regarding infrastructure such as international Internet bandwidth (bits per second) per Internet user, and to measure home access to technology such as proportion of households with a computer and proportion of households with Internet access at home.

The second stage (ICT intensity of use) is measured with data about Internet users per 100 inhabitants, fixed broadband Internet subscribers per 100 inhabitants and mobile broadband subscribers per 100 inhabitants.

ICT impact, the third stage, is not measured directly but through the measurement of skills for the use of ICTs, based on the presumption that ICT skills are needed to make the best use of ICTs and are critical for the potential impact that ICTs can have on development. Skills in the use of ICTs are captured in this index through proxy measures, while data that more directly measure ICT skills is available for many countries. These proxy measures are the adult literacy rate, the secondary education gross enrolment ratio and the tertiary education gross enrolment ratio.

Source: ITU (2009).

[4]The International Telecommunication Union is a United Nations agency that regulates information and communication technology issues worldwide (Source: Wikipedia).

4. ICTs, development and poverty alleviation

> *"ICTs, if conceived and accommodated in locally meaningful ways can provide a platform for advancing development agendas in ways that are sustainable in the longer term." Maiye and McGrath (2010), p. 2.*

We have already considered conceptions and measures of poverty in relation to ICTs. We have also reviewed the nature of digital divides and their impact on poverty. What then is the role of ICTs in development and in poverty alleviation?

By reducing the costs of information sharing, improving its timely availability and providing the opportunities to create networks between people sharing particular interests or information needs, ICTs have the potential to contribute to the improvement of socio-economic conditions in developing countries.

Despite proven effectiveness in helping to reduce rural poverty, priority has not been given to the development of ICTs in rural areas. Demand for ICTs is not perceived as urgent as demand for primary infrastructure and social services, when "[a]ctually the poor are hungry for ICT, knowing well that information serves access to education, markets and health services" (von Braun, 2010, p. 4).

The impacts of ICTs for rural households include savings in time and other resources, access to better information leading to better decision making, improvements in efficiency, productivity and diversity (Leff 1984; Tschang et al. 2002; Andrew et al. 2003, cited in von Braun, 2010, p. 5), information on new technologies and expanded market reach (von Braun, 2010).

Chapman and Slaymaker (2002), also refer to the potential of ICTs to facilitate and improve the already existing exchange of information that takes place in rural communities. This and the use of ICTs strategically to serve community development needs can facilitate the indigenous development of rural communities through pluralistic or participatory approaches.

> To establish the role of ICTs in supporting and building the capacity of indigenous knowledge systems, the mechanism for information sharing must initially be assessed within the local context. ...ICTs have the potential to initiate new rural networks of information exchange but their use in the first instance will need to be determined locally, according to local choices.

Chapman, Slaymaker (2002, p.25).

Successful experiences in the application of ICTs in marginalized and rural areas have shown how ICTs enable access to markets, by providing information about prices that

improve the informed position of rural producers for decision making, and by facilitating the connection to complete transactions. Jensen (2007) empirically demonstrated how the access to information by fishermen through the use of mobile telephones in the Indian state of Kerala had an effect on market performance, improving the welfare of the people deriving their income from this economic activity. This impact was measured by observing the changes in the dispersion of prices in 15 fish markets along the coast of Kerala. Through the use of mobile telephones, fishermen were able to share information about prices in the different markets along the coast and make a decision about where to sell their produce. This resulted in a more efficient allocation of the catch along the markets and a decrease in the dispersion of the prices.

ICTs have also proven successful in the provision of services such as banking and health and the creation of knowledge networks between universities in India and Africa to support open, distance and e-learning institutions. They have also proven useful as a source of multimedia entertainment and edutainment, providing information that raises awareness regarding health issues such as AIDS (von Braun, 2010). The use of ICTs such as fixed phone lines, mobile phones, access to radio, television and mobile banking services have been shown to have improved the livelihoods of poor people living in rural areas of developing countries (von Braun, 2010; UNCTAD, 2010).

The impacts of ICTs on a poor household, i.e. the benefits of ICTs for poverty alleviation, can be measured "by gains in welfare, under the assumption that monetary improvements eventually bring about non-monetary welfare improvements" (von Braun, 2010, p. 5). An example of how this could be done is by measuring the compensating variation of the use of an ICT, such as mobile phones, compared to another means of transmitting the information, such as giving it personally or sending a messenger. These kinds of exercises can provide an idea of how much more resources per capita can be available for other activities when costs of access to information and sharing of information are reduced.

Despite the known advantages in the use of ICTs for addressing development issues, many developing countries and especially their poorest inhabitants still do not have access to the benefits of the information society. Attempts to remedy this have ended up in failure when developing countries have introduced information systems "without explicit consideration of the concept of development being advanced or the processes through which it may be achieved" (Maye and McGrath 2010, p. 1). In the provision of ICTs, private sectors involved in the ICT business have been well-provided with possibilities to expand their markets in developing countries. However, there were number of failures as a result of attempts to implement ICT projects, especially those following the rural telecentre model, which was extensively implemented without consideration of the local realities of the context they were being placed in (Heeks, 2010).

Also, experiences from early attempts to utilise communication technologies for the improvement of livelihoods in developing countries have been characterised by cycles of "heavy over-promising followed by noticeable under-delivery" (Heeks, 2010, p. 629).

These failed attempts caused donors to lose interest in ICT initiatives, while ICT policies, ICT agencies and ICT investments have continued to expand in developing countries, fostered by their governments. Still, given the previous failures, the role of ICTs for development have not yet fully regained recognition of their value for the accomplishment of development goals (Heeks, 2010).

Research in the relationship between ICTs and development has now largely moved from examining *if* there is a causal relationship between technology and development to trying to understand *how* to maximise the benefits that ICT use and adoption may provide to meet development purposes (Brown and Grant , 2010). Various approaches have emerged in trying to optimise the application of ICTs to accomplish advancements in development, especially with the aim of alleviating poverty. Harris (2004) sees ICTs as an ingredient to solving poverty when the potential of information is understood as a strategic development resource that should be incorporated as a routine element into the development planning process. However, as Brown and Grant (2010) warn the academic community, in order to accomplish this, researchers have to first be aware of the dichotomy that exists between researching ICT *in developing countries* and ICT *for development*.

5. Participatory and sustainable development using ICTs

> *"Development strategies, including ICTs for development, should serve growth and the needs of the poor, as they perceive them" (von Braun, 2010, p. 4)*

As lack of progress in addressing poverty in the decades after the second world war led to dissatisfaction with the modernist, production- and income-focused conception of development associated with the 'income' concept of poverty described earlier (Leys, 2006; UNDP, 2010), new approaches began to emerge from the 1980s onward. These included the notion of "sustainable development"(United Nations, 1987) and "participatory development" (Chambers, 1997).

'Sustainable development' was initially defined as development "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, paragraph 2). It has also come to have an associated meaning (and sub-discipline, 'sustainability science' (Mollinga, 2010)) that focuses on the nature of communication and relationships surrounding development and the way in which development can be self-sustaining without ongoing external inputs (Harris, 2004; Horton, Prain and Thiele, 2009).

'Participatory development' (and 'sustainable development' in the latter sense) grew out of a recognition that knowledge is embedded within language and practices that are locally situated, and that lasting development can only be achieved through consensus, namely "communication, social interaction, dialogue, and mutual understanding" (Chapman and Slaymaker, 2002, p. 7).

We should look more deeply at the ideas that create the dichotomy between development founded upon participation and sustainability on the one hand, and development focused on capital and income growth on the other. This will better enable us to create a sound framework to assist in creating and evaluating sustainable, technology-supported participatory development.

When ICT is deployed in service of development goals, this is usually done in one of two ways:

a) as a top-down, local or state government-led project
b) as a bottom-up "grass roots" initiative led by local communities or non-governmental organisations

(Harris, 2004).

Correspondingly, it has been suggested that the theory and practice associated with IT and ICT have an essentially functionalist rationale ("what *is* and what *can* be achieved"), while ICT for development (ICT4D) has a "profoundly moral agenda" ("what *should* be done and *how* we should do it") (Unwin, 2009, p. 33). We might therefore broadly classify the approaches as functionalist/top-down, and humanist/bottom-up. In keeping with this, Chambers (2010) characterises the dichotomy as one of 'things' and 'people':

Point of departure and reference	**Things**	**People**
Mode	Blueprint	Process
Keyword	Planning	Participation
Goals	Pre-set, closed	Evolving, open
Decision-making	Centralised	Decentralised
Analytical assumptions	Reductionist	Systems, holistic
Methods, rules	Standardised, universal	Diverse, local
Technology	Fixed package (table d'hote)	Varied basket (a la carte)
Professionals' interactions with local people	Instructing 'motivating'	Enabling, empowering
Local people seen as	Beneficiaries	Partners, actors
Force flow	Supply-push	Demand-pull
Outputs	Uniform, infrastructure	Capabilities
Planning and action	Top-down	Bottom-up

Source: Chambers (2010), p. 12.

As previously mentioned, a parallel dichotomy has also been viewed as a fundamental flaw in the research relating to the link between ICTs and development, regarding the lack of recognition of a distinction between research that is about implementation of ICTs "in developing countries" – which has a predominantly functional, technology-related focus – and research that is about implementation of ICTs "for development", which is directed at empowering marginalised populations (Brown and Grant, 2010).

While it is still early days in the building of a robust body of evidence regarding the effectiveness of ICTs used to support development, already early this century the experience was that "bottom-up approaches to the design of information systems for community development are superior to alternatives" (Harris, 2004, p. 49). A corresponding and far more recent view is that "many of the errors and failures of development policy and practice have stemmed from the dominance of the things paradigm" (Chambers, 2010, p. 13).

But participatory development cannot be seen as some kind of 'cure all' for the challenges and complexities inherent in ICT4D. As Zheng (2009) cautions,

> Participatory development may disguise or even strengthen incipient articulation of power embedded in social and cultural practices, hence the "tyranny of participation" (Cooke and Kothari, 2001), as it is possible that participatory methodologies may reify existing inequalities and affirm the agenda of elites and other more powerful actors (Kothari, 2001).
> (p. 77)

There are calls, from past and present, for clearer guidelines for development and evaluation of ICT4D projects:

> There is a need for a methodology that will enable field workers involved with ICT projects to mobilize communities towards achieving optimum outcomes from them. If a detailed methodology can be formulated, tested and documented, then large numbers of field operatives can be trained to implement it across many communities. Such a capability would enhance the likelihood of optimal development outcomes from a nationwide implementation, effectively incorporating the benefits of focused small-scale grass-roots projects into a large-scale national programme.
> (Harris, 2004, p. 41)

> ICTs can enhance capabilities for human development when applied with foresight, clear objectives, a firm understanding of the obstacles that exist in each context and proper policies that establish an institutional framework that promote the use and benefits of ICTs for the poor.
> (UNDP, 2010, p. 4).

Below we review and synthesise a range of evidence-based ICT and development approaches to provide an overall development framework and evaluation 'toolkit' for ICT4D projects.

6. A comprehensive framework for sustainable technology-supported participatory development to alleviate poverty

"Technology goes where you want it to go" Muhammad Yunus (ZEF, 6 November 2010)

In order to carry out effective ICT4D work, we are in need of suitable boundary objects: "devices and methods that allow acting in situations of incomplete knowledge, nonlinearity, and divergent interests" (Mollinga, 2010, p. S-4).

There are two broad categories of boundary object that can assist us in our objectives: assessment frameworks as learning and decision tools, and participatory processes and people to negotiate boundaries (Mollinga, 2010). Frameworks are useful because they link science, policy, and varied knowledge domains in a practical way to aid decision-making and learning. Participatory processes ensure that the socio-political power relations inherent in resource planning and knowledge development are taken into account (Mollinga, 2010).

There are a range of frameworks and participatory processes that can assist in our aim of providing an overall development framework and evaluation 'toolkit' for ICT4D projects to alleviate poverty. These are summarised below.

6.1. e-Development capability approach framework and research questions (Zheng, 2009

Mirroring the dichotomy between the 'things' versus 'people' approaches to ICT4D (Chambers, 2010), and ICT "in developing countries" versus "for development" (Brown and Grant, 2010), Zheng (2009) expresses concern that "'e-Development" is often pursued with a lot of thinking on the 'e' and little on the 'development'" (p. 66).

In order to address this, he uses Sen's capability approach to propose an overall capability approach perspective of ICT for development, along with a set of detailed e-development research questions to guide ICT4D based on elements of the capability approach:

A Capability Approach Perspective of ICT for Development

Means and ends of development	• Considers substantive individual freedom as the ends of development • Essentially concerned with ICT's contributions to people's capabilities to achieve a valuable life • Concerned with effective opportunities for people to use ICT for what they consider valuable
Human diversity	• Questions what conversion factors are in place to

	generate potentials to achieve, and to allow people the freedom of choice to realize the achievement • Attention to diversity of and discrepancies in human conditions
Agency	• Concerned with not just "haves" and "have nots," but "cans" and "cannots" • Emphasizes the agency of ICT users, therefore taking into account their aspirations and needs • Accommodates and critically evaluates the design of social arrangements and cultural values in relation to individual capabilities
Evaluative spaces	• Questions in which space should ICT projects be evaluated • If we are concerned with equality in e-society, equality of what?

Source: Zheng (2009), p. 74

e-Development Research Questions Generated from the Capability Approach

Elements of the CA	**Research Questions for e-Development**
Means and ends of development	• What kind of "development" is ICTs supposed to promote? • How do ICTs help people to achieve what they consider to be valuable?
Commodities, capabilities, and human diversity	• What capabilities can potentially be generated from a certain type of ICT? • Are they appropriate for local conditions at this stage? • What conversion factors (personal, social, environmental) need to be in place for capabilities to be generated from a certain type of ICT? • What decision mechanism affects the actual adoption of a certain type of ICT, or the selection of certain characteristics of a type of ICT over other characteristics? • How does ICT interact with these decision mechanisms (and their changes)?
Agency and restricted agency	• What are the needs and aspirations of the potential ICT adopters?

	• What are the rationales behind those needs and aspirations? • What conditions enable or restrict the "agency" of the ICT adopters? • How does ICT interact with these conditions?
Evaluative spaces	• What essential capabilities are deprived? • Who may be disadvantaged by the deprivation of these capabilities? • What are the relationships between different types of capability deprivations?

Source: Zheng (2009), p. 75.

Zheng's (2009) capability approach framework and research questions aim to ensure ICT4D is focused on expansion of human freedoms and capability:

> Seeing development as the expansion of capabilities of humans to lead a life as they value, ICT should be viewed as means to achieve such a goal in the process of development, in which a whole set of conversion factors are required to be in place. Addressing these conversion factors, which affect the well-being freedom and agency freedom of individuals, is as important (if not more important) than ensuring the availability of technology.
> (p. 79).

6.2. Adaptive Methodology for Ecosystem Sustainability and Health (AMESH) (Waltner-Toews and Kay, 2005)

This framework is based on a methodology developed over many years and tested in projects in Nepal, Kenya, Canada and Peru that integrates complex systems theories and community engagement into sustainable development projects (Waltner-Toews and Kay, 2005). It has five phases:

1. A 'presenting situation' or problem is raised by local people, researchers or a third party agency. This is seen as situated within an existing social, political, economic, physical and ecological context.
2. Those who respond work to understand the situation by considering the interaction of stakeholders and their viewpoints, the governance structures that exist, and the multiple social, political, economic, physical and ecological issues that are relevant.
3. Local stakeholders and researchers work together to identify systems-based alternative options for action at various scales and from various perspectives;

stakeholder narratives are the primary focus, supplemented by other qualitative and quantitative data that can assist decision-making.

4. Stakeholders choose a course of action, develop a plan that incorporates collaborative learning for all involved, start implementation, and ensure that governance, monitoring, and management all co-evolve as the situation changes.
5. Developments in the situation are fed back into the second phase so that the process can continue to evolve to achieve stakeholder aims in relation to the presenting situation.

AMESH treats each development context as an holistic ecosystem, specifically integrates researchers as stakeholders, and "supports the full participation of local people and the inclusion of nonexpert perspectives to shape and inform our understanding of the ecosystem" (Waltner-Toews and Kay, 2005, 'Applying the heuristic' section).

6.3. Framework for ICT intervention and evaluation (Urquhart, Liyanage and Kah, 2008)

This framework is the result of reflection on ICT implementation for poverty reduction in a wide range of development projects in Asia and Africa (Urquhart, Liyanage and Kah, 2008). The researchers have sought to provide a theoretical foundation for how ICTs can help build human capacity for poverty reduction based on social capital and knowledge management theories, and soft systems methodology.

Social capital comprises both human capital (with a predominant focus on development of an individual's skills and capabilities) and the social capital inherent in the relations between people (Coleman, 1988, cited in Urquhart et al, 2008). Any project that seeks to leverage information and communication to produce knowledge to address root causes of poverty will be limited by a lack of social capital (or by situations of mistrust that constitute 'negative social capital'): "the weaker the social capital, the harder it is for the knowledge and human capital to grow in a community, thereby perpetuating poverty" (Urquhart et al, 2008, p. 205).

Urquhart et al (2008) propose an ICT intervention and evaluation framework comprising four stages:
ICT development: this is the strategic planning and needs analysis stage, and draws heavily on soft systems methodology (SSM). SSM was developed to apply system theory to difficult problem situations with significant socio-political elements (Checkland and Scholes, 1990, cited in Urquhart et al. 2008). A key component of SSM is CATWOE analysis:

C: 'Customers': the victims or beneficiaries of T
A: 'Actors': those who would do T
T: Transformation process: the conversion of input to output
W: Weltanschuung: The World View that makes this T meaningful in context
O: Owners: those that could stop T

E: Environmental constraints: elements outside the system which it takes as given

(Urquhart C., Liyanage S., MO Ka M., 2008, p. 208).

ICT intervention/ICT infrastructure/ICT capacity building: The CATWOE analysis conducted during the development stage also informs the ICT intervention stage. This is bracketed with both ICT infrastructure and capacity building because they are viewed as essential for the success of any ICT intervention. The CATWOE analysis should highlight whether available and planned infrastructure and social capital is likely to support the intervention. The analysis can also clarify roles in the project, and help the important consideration of how power relations may influence outcomes.

Evaluation of the ICT intervention: The intervention is evaluated for its social, cultural, and economic impact, which are all considered necessary for the intervention to have a positive impact on social capital development. As an aid to evaluation, there is a review of three dimensions of social capital (ability, opportunity, and motivation) and how they are represented in the *community* in relation to information, communication, and knowledge, and likewise how these three dimensions of social capital are represented in the *ICT intervention* in relation to information, communication, and knowledge.

Poverty reduction: This final and most contested stage seeks to consider a set of holistic poverty measures relating to access to information, social networks and knowledge creation, and their effect on access to education, health and other services, and income.

The researchers make it clear that their framework is not intended to be a comprehensive framework that alone will ensure that an ICT intervention in a developing country will be effective. Rather, it is intended as a 'sensitising device' to prompt mindful use of ICTs to reduce poverty.

6.4. VALuation for Sustainable Environments (VALSE) (O'Connor, 2000)

Although the VALSE project was conceived "to demonstrate effective social processes for valuation of environmental amenities and natural capital for conservation and sustainability policy purposes" (O'Connor, 2000, p. 165), it incorporates a 'multiple criteria decision analysis' (MCDA) method that also has the potential to help overcome the complex power relations and collective choice challenges that are inherent in ICT4D projects.

> All choices, individual and collective, can be seen as value statements (implicit and explicit)... Valuation practices have a greater chance of social legitimacy and policy usefulness when they are implemented with awareness of the deep social and institutional dimensions of value formation.

(O'Connor, 2000, p. 165)

The steps in the MCDA method can be summarised as follows::

- Clarify the problem
- Determine the stakeholders
- Determine possible options for action
- Determine the performance criteria for the options for action
- Create a multi-criteria impact matrix and rate the options for action in relation to the performance criteria
- Create a multi-criteria impact matrix and rate the options for action as perceived by the stakeholders.

VALSE is not intended to produce 'answers' to difficult collective choice problems. Rather, it serves as a means of highlighting points of conflict and bringing value judgements to the surface to focus discussion and negotiation by the stakeholders involved. It also helps make transparent the political components of such choices so that the process of decision-making is itself subject to deliberation (O'Connor, 2000).

6.5. Good practice for ICT4D project implementation (Heeks, 2010)

This framework is presented against the backdrop of a retrospective look at the changing focus of ICT4D research over time, from a 'readiness' phase focusing on infrastructure and digital divide, through 'availability' and 'uptake' phases, to the latest 'impact' phase focusing on outcomes and development contribution (Heeks, 2010). The framework represents a successful ICT4D project as the outcome of a range of conditions and inputs conceptualised under three categories:

1. Governance and actors: multi-stakeholder partnerships, and an open and competitive environment
2. Design: participation of local users, appropriate technology mix to match local realities, alignment to local development goals, and consideration of project risks
3. Sustainability: financial and social sustainability, development of local capacities and use of local institutions, and local ownership

(Heeks, 2010, p. 636).

Heeks (2010) also calls for more theory-based evidence about the impact of ICTs on development: "too little is understood either through macro-level research or the aggregation of micro-level research about the actual contribution that ICTs are making as a result of current investments" (p. 636).

6.6. Multidimensional Poverty Indicators (Alkire and Foster, 2009; Urquhart et al, 2008; Kivunike et al, 2009)

We described the Multidimensional Poverty Indicator (MPI) developed by Alkire and Foster (2009) earlier in the paper. They emphasise that the MPI is "very adaptable to different contexts and purposes in that different dimensions and indicators can be selected depending on the purpose at hand" (p. 79). This means that for an ICT4D project or group of projects, poverty indicators could be chosen that relate to information, communication, and knowledge and the particular context of implementation, as well as the particular focus of the evaluation.

Further, we also referred above to a set of holistic poverty measures used by Urquhart et al (2008) as part of their framework for ICT evaluation. These are framed as questions and relate to access to information, social networks and knowledge creation, and their effect on access to education, health and other services, and income. The authors describe their intention

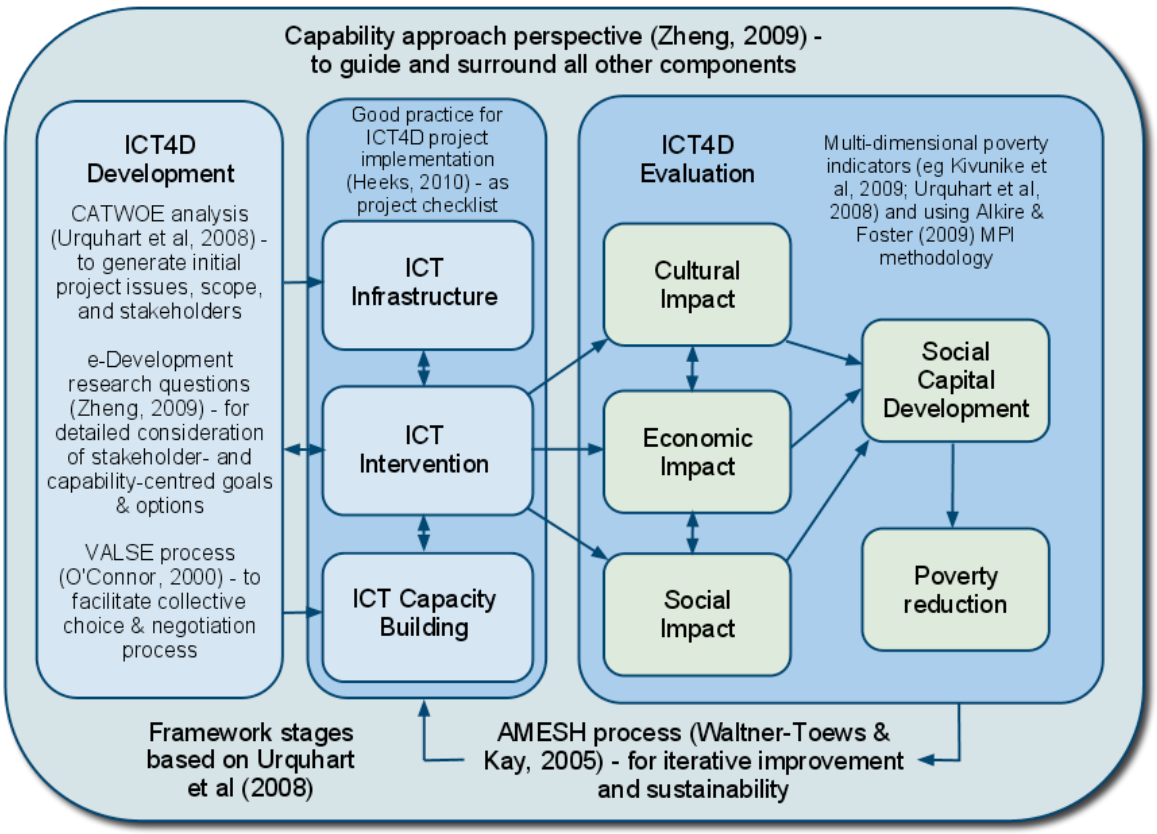
> to formulate measures based on the idea that some poverty is caused by lack of access to information and knowledge, and other resources such as networks of contacts. The measures have been developed specifically for use with the [framework for ICT intervention and evaluation] and thus assume that an ICT network has been implemented. (p. 209).

In relation to the capability approach (Sen 1982) and the multidimensional freedoms that underpin it (Sen, 1999) outlined earlier, we also described how Kivunike et al (2009) used these concepts as the basis for evaluating the potential impact of ICT on the quality of life of people in rural communities in Uganda. Using multidimensional indicators that they had generated that related mainly to information, communication, and knowledge and their concrete impact on the day-to-day lives of those in the communities, the researchers evaluated the positive impact of ICTs on quality of life. Given the criticism levelled at the UNDP poverty indices that these focus only on human deficits (Schimmel, 2009), Kivunike et al (2009) can be said to have successfully demonstrated a converse approach.
The work of Urquhart et al (2008) and Kivunike et al (2009) thus demonstrates the inherent need for multidimensional indicators to more meaningfully evaluate the impact of ICT4D projects on poverty alleviation, while Alkire and Foster (2009) provide a generic (and more theoretically robust) template that can enable creation of such multidimensional poverty indicators driven by the desired evaluation goals for ICT4D projects.

6.7. A comprehensive framework for sustainable technology-supported participatory development to alleviate poverty

The 'boundary objects' (Mollinga, 2010) described above all provide valuable perspectives and tools to guide and evaluate development and evaluation of ICT4D aimed at alleviating poverty. However each addresses only part of the ICT4D for poverty undertaking. We consider that there is much to be gained by synthesising the frameworks and participatory processes we have outlined into a comprehensive framework that can serve as a development and evaluation 'toolkit' for ICT4D projects to alleviate poverty. This should be of benefit to communities, groups and agencies involved in ICT4D, as well as researchers and policy makers. Our comprehensive framework is depicted in Figure 5.

Figure 5. Comprehensive framework for sustainable technology-supported participatory development to alleviate poverty



This framework as depicted provides a 'bird's eye' view of the core stages and components of a transdisciplinary ICT4D development and evaluation process to alleviate poverty. This can assist all stakeholders involved in an ICT4D project to work from a common understanding of the process, researchers to conceptualise their research focus and questions, and policy-makers to address policy gaps. The sub-components from which the framework has been synthesised provide the concrete methods and tools that can

support sound development and evaluation of ICT4D projects that seek to alleviate poverty. The framework's grounding in the people-centred capability approach to poverty, along with good practice and sustainability guidelines for ICT4D projects drawn from lessons learned in development projects over many years and in varied contexts, provide solid guidance to maximise the likelihood that ICT-related projects will be effective in alleviating poverty.

7. Conclusions and recommendations for future research

The application of Information and Communication Technologies (ICTs) for development is now a primary focus of the development agenda.

We began this paper by defining the notion of poverty which we could use in order to be able to choose a development and assessment approach for its alleviation. Poverty, as seen through the capabilities approach, refers to constraints on individual freedoms that hinder or prevent full development of human capabilities. Freedoms can thus be seen as both the means and the end of development. Freedom to access information, networks for communication, and lifelong learning to enable creation of knowledge are fundamental in determining the possibilities of a person or community to develop to full potential.

In considering the nature and limitations of such information, communication and knowledge freedoms, the unequal access to information and communication technologies has been referred to as the digital divide, which exists both between and within countries. Developing countries that have been left behind in this digital aspect have felt an urgency to 'catch up' with more advanced countries. Efforts have also been undertaken to try to advance rural communities that have lagged behind more developed urban centers in terms of access and use of ICTs. In doing so, project implementers and researchers have used a range of approaches, which initially tended to focus on top-down projects for providing physical infrastructure: ICTs 'in developing countries'. More recently, the discussion about ICTs and development has turned to deal more explicitly with the human development impacts of ICT implementation: ICTs 'for development'. In this view, the target is human development strategies, with ICTs being only one ingredient.

There is already a growing body of evidence to show that sound implementation of ICTs does benefit development goals. However these benefits are still far from reaching those who are most impoverished. In part, this lack of effectiveness is attributed to a lack of clarity in the theory and practice of ICT4D as referred to in the Introduction to this paper:

- an apparent disconnection between academic scholarship and the needs of practitioners
- an overly utopian and zealous belief in the role that ICTs play in development
- a lack of linkage into the overall discourse regarding poverty alleviation

- investigation of 'ICT' in isolation from 'development'
- investigation of the ICT and development ideal in isolation from other relationships
- a tendency for some research to lack academic rigor.

We have sought to address these concerns by reviewing a range of frameworks and participation processes that have been used to support sustainable development projects with multiple stakeholder interests. All of these have a contribution to make to sound planning, implementation and evaluation of ICT4D projects to alleviate poverty, however we sought to integrate the best elements of each to provide a comprehensive framework with an overall 'capability approach' focus. We consider that this framework offers an easily understandable step-by-step approach to ICT4D projects, yet is based on a growing empirical research base, and points to detailed and concrete methods and tools to facilitate effective practice. By ensuring that stakeholders are central to the process right from the beginning, the framework is intended as a tool to facilitate grassroots innovation and achievement of community goals.

Further, by ensuring that human capabilities are central to the framework, not ICTs, we also consider that it can in fact serve as a useful tool in any development project.

Although we have sought to base our framework on research derived from extensive ICT4D practice in the field, we acknowledge that it has not yet been tested. As a next step, we encourage those involved in ICT4D practice and research to consider projects that they have worked on, and to review them against the framework that we have synthesised. If the framework and its underlying methods and tools help to highlight project elements that either contributed to or hindered project success in alleviating poverty, then we will know that it is serving the purpose that we intend.

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