INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

Open ICT4D

[Working Draft]

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Abstract

The world is changing and new information and communication technologies (ICTs) are powerful contributors to this change. Society is moving from an industrial model with vertical hierarchical structures to a networked society with increasingly horizontal organizational structures. The change has been underpinned by the Internet and increasingly interconnected devices for computation and communication (such as mobile phones) that have greatly increased communication and collaboration opportunities. In this environment *Openness* is becoming an increasingly relevant concept for ICT for development (ICT4D) activities ("Open ICT4D"). We define Open ICT4D as a way of organizing social activities for development benefits that favour: a) universal over restricted access to communication tools and information; b) universal over restricted participation in informal and formal groups/institutions; and c) collaborative over centralized production of cultural, economic, or other content. Note that we view open ICT4D as a hypothesis. We hypothesise that there are many processes that can be made more open through the use of ICTs and that doing so will generate development outcomes that are accomplished: (a) in a more efficient and/or effective manner, and/or b) in ways that previously were not possible. This paper argues that openness is especially relevant at this point in time because policy choices made in the near term will shape future socities. Only with a proper understanding, both theoretically and empirically, can we hope to influence policy in a pro-development direction. This paper is a first step in improving our understanding of the concept of openness and its implications for ICT4D.

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1.0 Introduction

In the 2008 US presidential election, Barack Obama mobilized and coordinated an unprecedented number of people and resources through innovative uses of mobile phones and online social networking tools.[1] In early 2008, Georgia began disseminating information through Google blogs,[2] to counter a Russian denial of service (DoS) attacks against Georgian websites.[3] In 2001, more than a million Philippine citizens protested then President Estrada mobilized by waves of text messages eventually toppling the government (Rheingold, 2002). More recently, Egyptians have begun to organize through Facebook to protest the government.[4] Indian state governments (Tamil Nadu[5], Kerala[6], etc.) have mandated open standards and Brazil's public sector is now required by law to use non-proprietary, open source software.[7] In the Philippines indigenous communities are using a participatory geographic information systems methodology to claim their ancestral domain and manage their own human and natural resources in a more sustainable way.[8] In Mexico, participatory budgeting (a process through which citizens can influence or contribute to decisions on the use and distribution of public resources) has been facilitated by the growth of the Internet (Cabannes, 2004). Some of the world's greatest universities, such as MIT, have now made their curriculum openly available on the Internet.[9] Similarly, a consortium of 18 South African and international organizations work together to create freely accessible educational resources and course design guidance for teachers in Sub-Saharan Africa.[10]

What do all of these anecdotes have in common? First, they are all predicated on the emergence of new information and communication technologies (ICTs) that have greatly enhanced opportunities for communication and collaborative action. Second, all of these activities have taken advantages of a relatively open structure of technology and content to effect social change.

The world is changing and new information and communication technologies (ICTs) are powerful contributors to this change. Many aspects of society are shifting from an industrial model with vertical hierarchical structures to a networked society with increasingly horizontal organizational structures (Castells 2000; Benkler 2006).[11] This change has been underpinned by the Internet and interconnected devices for computation and communication that have massively improved communication and collaboration possibilities. As the cost of new technologies decreases these trends should continue – facilitating the diffusion of powerful (and smart) networked devices that can access the expanding network infrastructure.

In this environment we believe "openness" is an increasingly relevant concept for ICT development (ICT4D) activities. This perceived relevance emerges from three important sources: (i) inductive logic applied to our empirical observation, (2) the experiences of others, and (3) theory. First, as development practitioners engaged in ICT4D activities and research, we observe that new ICTs applied for development, or other purposes, are often leading to more openness in terms of structures and processes. Second, we have noticed through informal consultations and other venues that "openness" has been a recurring theme of interest for ICT4D practitioners and researchers, including some of our partners. Third, the focus on openness is particularly topical for two main reasons: (1) new ICTs enable a whole new range of open ICT4D activities

[1] http://www.iht.com/articles/2008/11/09/technology/carr.php, accessed: November 17, 2008
[2] http://blog.wired.com/defense/2008/08/civilge-the-geo.html
[3] http://blog.wired.com/defense/2008/08/georgia-under-o.html
[4] Wolman, D. (2008) *The Facebook Revolution*, Wired Magazine, November.
[5] http://www.zdnetasia.com/news/software/0,39044164,61981452,00.htm
[6] http://news.zdnet.com/2100-3513_22-152441.html
[7] http://onthecommons.org/content.php?id=543
[8] http://www.iapad.org/pafid/index.htm
[9] For example, see: http://ocw.mit.edu/OcwWeb/web/home/home/index.htm
[10] http://www.tessafrica.net/
[11] Note that we are not trying to imply that new ICTs are moving us beyond hierarchical organizations, not at all. Rather, there are some group activities for which non-hierarchical organization brings relative advantages (Shirky 2008).

and (2) policy choices made now will shape the future possibilities to use these open ICT enabled activities for developmental gain. Only with a proper understanding of the possibilities, both theoretically and empirically, can we hope to influence policy in a pro-development direction.

Given our primary understanding of the potential of Openness to inform ICT4D activities, this paper is a deeper exploration of these concepts and their appropriateness and applicability. As part of this conceptual exploration, we view openness (defined in section 2.2) and "Open ICT4D" as a working hypothesis. We do not assume *a priori* that all activities must be more open and that all open activities will lead to positive developmental benefits. We accept that different forms of Open ICT4D activities will be more or less appropriate given different developmental contexts and that there will undoubtedly be trade-offs between competing interests and values. This is especially true given the transformative potential of this paradigm that at times challenges traditional organizational and social structures and processes. Indeed, it is exactly these set of issues that motivates this paper: when, how, to what extent, and in what circumstances can the power of more open ICT4D activities be applied to achieve the developmental goals of poverty alleviation, improved health and education, increased equitable economic growth and deepened democracy? What are the tradeoffs?

The paper proceeds as follows. Section 2 provides one approach to answering two central questions: "What is openness?" and "Why Open ICT4D?" The first question requires a definition of the concept of openness. We then turn to answering the second question through a theoretical consideration of the links between ICTs, openness and human development; that is, how and when do more open ICT4D processes bring more social value than correspondingly closed processes? After establishing the theoretical foundations, Section 3 provides some empirical insight into the ICT4D, openness and human development linkages through a broad review of current ICT4D "open" activities. To organise our thinking we examine activities across (and the relationships among) different layers – social (socio-economic, legal-institutional), technological (Internet infrastructure, devices and standards), and content (e.g., open educational resources, information, cultural content). Then, drawing from the theoretical discussion and the particular open activities, we extract cross cutting issues for future research as well as threats to openness. Finally, we conclude by asking questions that have emerged from our study of Open ICT4D.

2.0 Open ICT4D

2.1 The Context: New Technologies and New Possibilities

Before we can move to the concept of Open ICT4D, it is helpful to place it in the context of a few recent trends. The first trend is the emergence of a new generation of information and communication technologies. There are two main platforms for these technologies. First are mobile phones that operate over the telephony infrastructure and employ applications such as SMS. Increasingly, devices such as mobile phones and handhelds provide access to the telecommunications and Internet infrastructure in the developing world context. The second technology is the Internet and the World Wide Web (Web) with the increasing availability of communication access-points and new web-based social tools (Web2.0 or Social Web). Web2.0, in particular, is a set of Web-based tools that allow for a more interactive and collaborative social activities. Note that as technologies increasingly converge, it may be that mobiles or handhelds, rather than the personal computer, will be the standard platform for accessing the Internet in the future. The second trend is the fairly consistent reduction in cost of digital content, arguably monotonically approaching zero. This is due to the increased ease and efficiency of copying and disseminating electronic content, in part enabled by new technologies such as peer-to-peer (P2P) sharing.

These two trends allow for a new range of potential social and creative activities. We discuss four, above and beyond what mobiles with SMS and the Internet with Web1.0 technologies provide (i.e., expanded voice and digital communication possibilities, sharing of digital content, etc.):

- **Increased coordination, organization, and mobilization of people**: Individuals, groups and organizations have an unprecedented opportunity to take advantage of the highly networked world to coordinate, organize and mobilize in ways that were heretofore impossible (Rheingold, 2002; Shirky, 2008). Previously, beyond a certain level of complexity, firms (institutions) were needed to coordinate group action. However even organizations had upper limits on their size due to transaction costs for coordinating that exceeded the benefits from organized action. Now, however, the technology has changed the rules by lowering the costs of coordinating group action: "most barriers to group action have collapsed, and without those barriers, we are free to explore new ways of gathering together and getting things done (Shirky, 2008). This includes a wide range of activities: documenting the 2004 tsunami, impromptu flash mobs,[12] large scale political rallies, interest group meet-ups and the massive sharing of latent CPU processing cycles among others. People are able to connect with others with the same sets of interests across the world. This is especially significant for those who have niche interests who might otherwise find it difficult to connect and share experiences with like-minded people.

- **Peer production (Open Source Collaboration):** Peer production is a new form of production that takes advantage of this new form of coordination to harness collective intelligence that does not rely on traditional market or state-based organizational forms (Benkler, 2002; Bollier, 2007; Tapscott & Williams, 2006). This new "third-form of governance" (see Table 1) uses the new coordinating potential of ICTs to achieve "serious, complex work, taken on without institutional direction" (Shirky, 2008). The power of peer production lies in its capacity to coordinate and harness the energy and creativity from many people with "many and diverse motivations, towards common goals in concerted effort" (Benkler & Nissenbaum, 2006). This form of collaboration effectively overcomes Brooks' law – that coordination costs should rise as the square of the number of workers – through an effective intellectual division of labour and modularisation of the activities (Langlois & Garzarelli, 2008). These activities operate with normative incentives such as shared ideals, social sharing and moral commitments rather than economic incentives.

	Market-based	**Non-market**
Decentralized	Price-system	Social sharing & exchange
Centralized	Firm hierarchy	Government; non-profits

Table 1- Modes of Content Production

Of course, there are times when harnessing the wisdom of crowds might not be preferable to another organizational form of decision making or production. There are numerous successful examples of peer production such as Wikipedia, an online encyclopaedia with the same levels of accuracy as the Encyclopaedia Britannica.[13] However, there have been failed attempts. For example, an attempt to manage a baseball team through online voting in Illinois was not a successful experiment, at least in the short-term (Bollier, 2007). Thus, a crucial question remains:

[12] http://en.wikipedia.org/wiki/Flash_mob
[13] http://networks.silicon.com/webwatch/0,39024667,39155109,00.htm

In what circumstances does commons-based decentralized peer production have an advantage over market or state-based production?[14]

- **User-generated content**: One of the most wide-spread aspects of new Web2.0 applications currently on the Internet, besides the social networking software, are the sites that provide a space to place user-created content. Web logs (blogs) and YouTube are possibly the most well known, but the field of user-generated content extends into almost any domain of social life that can be imagined. The intensely lowered costs of production and dissemination through ICTs has enabled individuals to share their own creative work with the world.

- **User-driven innovation**: A related phenomenon to peer production is the "democratization" of innovation in which the users of products and services innovate for themselves (von Hippel, 2005), or at least participate in the co-creation of products and services. This is another form of harnessing collective intelligence that taps into the 10-40% of user-innovators – those users who engage in developing or modifying products (Henkel & von Hippel, 2003; von Hippel, 2005). The terms "prosumer" (producer + consumer) and "prosumption" (production + consumption) have emerged – to describe new business approaches that incorporate customers into the value production process (Bollier, 2007).

A final point should be made here. While new emerging ICTs do provide a platform for social coordination, it is the total innovations environment that we are concerned with here. This environment extends well beyond the boundaries of the hardware communications infrastructure and personal computing devices. Crucially, as we will see, the possibilities for sharing, organizing and mobilizing collaboration and innovation are a function of the interaction of the digital environment (technical infrastructure, hardware devices, standards and content) with the social (economic, legal, political, cultural) environment within which the digital environment is embedded and which plays a large role in determining the availability of access and (re) usability of goods (Lessig, 2001).

2.1 From Open(ness) to Open ICT4D

The term openness, or open, is often applied as a descriptive adjective appended in front of a variety of structures (e.g., open government, open architecture, open society) and activities/products (e.g., open access to education materials, open source software). Note that openness is not a novel concept, especially with respect to development theory. For example: democracy and participation represent an opening up of decision processes to more people; and transparency and accountability are about opening up organizations, people and processes to scrutiny and feedback. We propose a concept of openness that is a generalized abstraction from these particular instances of openness.

Openness is a way of organizing social activities that favours:

a) universal over restricted access,

b) universal over restricted participation, and

c) collaborative over centralized production.

[14] Note that we do know something about what components are necessary for successful peer production. Benkler (2002) lists three attributes of successful commons-based peer production activities: (i) Projects must be modular; (ii) The granularity of the modules should be predominately fine-grained – allowing for the project to capture contributions from large numbers of contributors with low motivation levels. Also – "a project will likely be more efficient if it can accommodate variously sized contributions." (iii) Low-cost integration (including quality control) – for example, through automated integration (software) and iterative peer production of integration. Note that loosely coupled modules are probably also crucial as this helps to deal with complexity and issues of dependency.

At the core of our concept of openness are two important concepts: egalitarianism and sharing. Egalitarianism suggests an equal right to participate (access, use and collaborate). Sharing is embedded in the idea of enhanced access to things that were otherwise normally restricted. This enhanced access is often motivated by the normative desire to share – whether through an obligation to contribute to the common good or to participate in a coordinated or collaborative activity.

Open ICT4D is the use of new ICTs to engage in "open" processes to achieve development gains. More specifically, open ICT4D is a way of organizing social activities for development benefits that favour:

a) Universal over restricted access to communication tools and information. For example, access to the telecommunications infrastructure through a mobile phone, or access to an online content such as MIT's Open CourseWare (OCW) or government information.

b) Universal over restricted participation in informal and formal groups/institutions. For example, the use of SMS to mobilize political protests, or new e-government implementations that provide increased transparency and new accountability arrangements.

c) Collaborative over centralized production of information, cultural content, and physical goods. For example, collaborative production of school textbooks, co-creation of government services, or mesh networks.

At an abstract level, one way to understand these three components of Open ICT4D is to see them as part of a continuum, where each prior component is a pre-requisite for the following one. Access (and its associated infrastructure and skills) is a pre-requisite for participation that in turn is a pre-requisite for collaborative production (See Figure 1 below). For these reasons, generally speaking, as we move from access to participation to collaboration, we are increasing the complexity of the enabling pre-requisites required for the activity. Indeed, it may be that for true "open" collaboration new institutional forms will be necessary. A good example that is discussed more below is the range of e-government activities that moves from simple presentation of information on a Web-site, to more interactive e-services, and eventually to participatory e-services (see Table 2 for a list of activities from more closed to more open). This final move is considered transformative because it requires major back-end changes to the public sector bureaucracy that is not built to handle truly participatory or collaborative activities.

Recall that we view Open ICT4D as an hypothesis. This is not an argument that ICTs will lead to increased openness and will lead to positive development outcomes. Rather, it is an hypothesis that:

There are many processes that can be made more open through the use of ICTs and that doing so will generate development outcomes that are:

a) **Incrementally better**: i.e., in a more efficient (e.g., faster, cheaper) and/or effective manner (e.g., better leveraging of local knowledge, contextually-appropriate innovations, more local buy in through transparency and participation), and/or

b) **Novel/Transformational**: i.e., in a manner that without an open ICT approach is impossible (e.g., novel innovations, new forms of participation, mobilization, or organization).

There is a corollary to this hypothesis: different activities will function optimally (directly or indirectly generating social value) with greater or lesser degrees of openness.

Consequently, as ICTs spread and these social platforms become more prevalent, the central research question is: *how, in what contexts, and to what extent does the opening up, through ICTs, of information, communication, participation and collaboration lead to more positive social outcomes?*

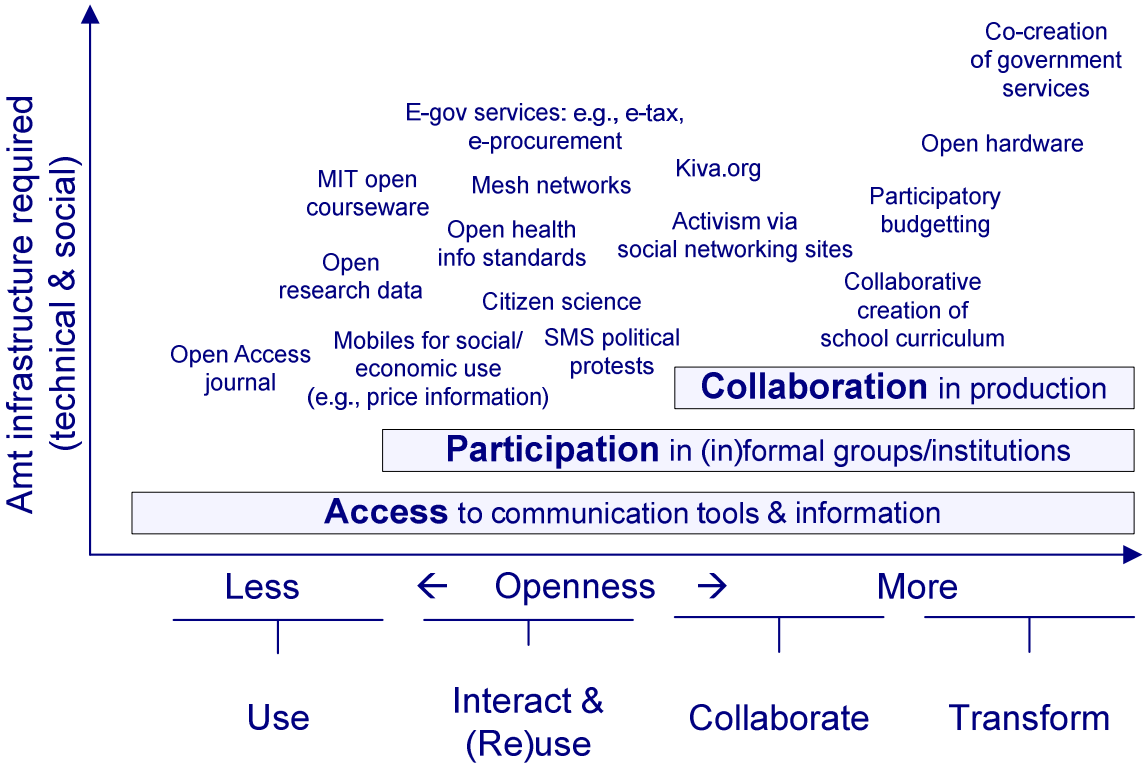

Figure 1 Different ICT4D activities on a scale of openness, from more closed to more open. Generally, as you move from more closed to open the activities move towards increased participation and ultimately collaboration. Also, the tendency for activities, as they increase in openness, is to require more technical and social infrastructure to support the activities.

Activity/Good	Less	← Openness →	More
Open Society	No freedom or limited right to assembly	Freedom to assemble	SMS & Social networking sites (e.g. Facebook) as political organizing tools
Media	State controlled media	Corporate controlled media	Independent or distributed media (e.g., blogs)
Cultural content	Books / Radio / Television		Collaborative production of content (youTube, open source movies)
Government decision making	Centralized decision-making	Provide information and perhaps some forms for feedback (email address etc.)	Participatory budgeting
Government Information Provision	Provide data in paper format for those who can come in and get it E.g., government owned/collected spatial and demographic data	Provide data online. E.g., publicly available spatial data (aerial imagery, municipal boundaries, aggregated census data, etc.)	Provide (re)useable data online or collaborative development of data E.g., Participatory GIS using government sponsored spatial data
Government service provision	Provided by offices	Office & e-services	Collaborative creation of services
Software development/provision	Proprietary software	Software APIs	Open source collaborative development
Software use	Use proprietary software	Use open source software (e.g., open source in government, open source e-voting)	
Personal communication	Phone lines	Mobile phones	
Devices	Proprietary/patented hardware	Open software devices (e.g., Open Moko)	Open Hardware
Science/Research	Pay science journals	Online open journals	
Science/Research	Proprietary research data	Open research data	
Education	School books	School books online/free	Collaborative development of school curriculum
Information	Reference books, etc	Encyclopaedia (Information) free online	Collaborative information development Forums, Wikipedia, etc…
Access	Dial-up	Broadband cable and/or licensed spectrum wireless	Open wireless / mesh networks

Table 2 Different social activities, on a scale from less to more open. In particular, the more open activities are made possible by new ICTs.

2.3 What Open ICT4D is Not

We do not include in the definition of openness the concepts of property (proprietary and non-proprietary), public goods or the commons. An alternative approach to defining openness would be one that focused on these issues directly. Benkler, for example, takes this focus with his notion of "commons-based development" (Benkler, 2006). Benkler is concerned with when, how and why commons-based (non-market or state-based) management and production using ICTs might be good for development. However, we have opted not to follow this path for the following two reasons:

1. **It is controversial:** Sometimes (but certainly not always) the arguments for openness can take on (or be perceived as taking on) a more ideological position – for example, as a direct challenge of the notion of property rights in many domains. Rather than taking this position *a priori*, we are looking to establish an empirically informed position regarding the benefits of open processes for ICT4D and what legal-institutional arrangements are best for achieving developmental outcomes.

2. **It is an overly narrow definition:** Our focus is on understanding when, why, and how ICT4D processes have increased value when employing open processes that may come from market, state or commons-based methods. Given the different nature of the goods we are dealing with (technologies and content) different combinations of property regimes are probably required in diverse contexts to maximise developmental benefit – and to limit the discussion to those that are commons-based development would thus limit the range of potential applications that we consider.

This is not to say that these concepts are not important to understanding the role of openness. Indeed, our understanding is that the nature of property rights regimes used to manage resources plays a crucial role in determining openness. It is not, however, openness itself. This is because, as discussed above, openness of some good (content, decision-making or production process) will generally depend upon a variety of different property regimes operating concurrently. For example, content may be freely available while running on proprietary software over an open wireless spectrum. Thus, we are agnostic as to organizational and proprietary regimens through which content or technology should be produced and managed, be it through a market, state or commons-based property regime. For example, a well-functioning and sustainable production and management scheme that is mostly proprietary but provides relatively open content is arguably preferable to a non-sustainable system that is commons-based.

Furthermore, openness also is not about competitive or liberalized markets or trade regimes, or open competition (Wunsch-Vincent, Reynolds & Wyckoff, 2007). To reiterate: the existing configuration of property regimes and organizational forms that produce, disseminate and maintain certain goods are essential components of the social environment that determine the relative openness of a particular good. Indeed, it was through the market liberalization and increased competition in the telecommunications sector that access to the Internet has been opened up to a broader public. However, such a situation provides the platform upon which more openness is made possible, but is not itself openness.

2.4 Determinants of Openness

For analytical purposes, it is useful to delineate the three central dimensions that determine the relative openness of a good: Who produces the good (and how)? Who owns the good? Who can access and use and reuse the good? Note that these dimensions should not be thought of as binary; they represent ranges of openness from completely open to completely closed. Also, these dimensions refer to a broad notion of "goods" that moves beyond the traditionally physical. Our notion of goods includes information and knowledge (e.g., research findings, cultural content, educational resources), technologies (e.g., telecommunications infrastructure, open hardware), as well as decision-making (e.g., government) and

production (e.g., businesses, open source) processes. The following is a closer look at the three dimensions, which all interact at various levels to produce a particular level of openness:

1. **Who produces the good?** This refers to the openness of the good at the stage of production. Production can be thought of as a continuum from closed to open production. This continuum starts from those goods that are more closed, i.e., produced by a restricted group and available for read/use-only (e.g., Internet infrastructure, wireless spectrum, television, radio, subscription journals, Web1.0). In the middle are goods people can read/use-and-comment thus adding something to the good (e.g., blogs, photo and video sharing applications, online newspaper comment sections, e-government service complaints). Finally, there are the more open forms of production. This includes those goods that are can be altered in some way, for example, through user-innovations, producing a new good (e.g., open software platforms, open hardware architectures). Also, there is participatory/collaborative production (e.g., wiki, open source software, participatory budgeting). The continuum from closed to open production can also be thought of as a movement from centralized to de-centralized (and perhaps non-collocated) production.

2. **Who "owns" (and how they own) the good?** The openness of a good is a function of (among other things) property rights ranging from proprietary (owned and controlled) information to open (a public good/commons). The nature of the property regime (copyright, fair use, creative commons, etc.) determines the legality of access to and use of this good.

3. **Who can access and use the good?** Who can access and use a good refers to the factors that underlie an individual's or a group's ability to access and make meaningful use of a particular good. This is, of course, dependent upon a multitude of factors, social and technological (see section 4 for more discussion). To provide just one example, open standards make it possible for a good to be disseminated via the network architecture and underlying net neutrality keeps market bias out of the information flows.

2.5 Related Concepts: Public Goods, Excludability and Rivalrousness

To facilitate our understanding of openness, it is helpful to consider it in light of other related terms. There is a useful typology of goods: pure public, commons, club and private goods (see Table 2). A public good, or collective consumptive good, was originally defined as a good that is non-rivalrous (also known as non-subtractable or non-depletable). These are goods where "each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good" (Samuelson, 1954). A pure public good is one that is non-excludable, that is, that it is impossible to exclude anyone from using or consuming these goods (they are available to all). Club goods (collective or artificially-scarce goods) are non-rivalrous and excludable.

Table 3: Typology of goods: modified from Introduction: Hess, C. and E. Ostrom (2007), pg. 9

	Non-rivalrous	**Rivalrous (subtractable)**
Non-excludable (public goods)	***Pure* Public Goods** Radio, Television, Air, National Defence, Useful knowledge	**Common Goods (Common-pool resources)** Water, Fish, Libraries; *subject to the tragedy of the commons*
Excludable	**Toll or Club Goods** Bridges, Web-sites, Software, Journal subscriptions, Wireless Spectrum, Internet backbone	**Private Goods** Computers, cars, mobile phones

(Hess & Ostrom, 2007)Private goods on the other hand are rivalrous and excludable; not only can people be excluded from using them, but one person's use subtracts from others using that good. A commons-based good is rivalrous and non-excludable and is the type of good upon which the tragedy of the commons is based (Hardin, 1968).[15] Given this typology, one can see how different aspects of technology, from the Internet backbone and wireless spectrum to the content, have different attributes with respect to their rivalrousness and excludability.

To make this discussion more concrete, we consider here different types of goods that make up the core of the digital environment of openness: the communications infrastructure (both the Internet and mobile phone networks), physical devices and digital content.

1. **Internet infrastructure:** The Internet backbone, for example, currently can be viewed as rivalrous since there is limited access and/or congestion due to limited bandwidth in developing countries as well as in the rural and remote areas of both developed and developing countries. Given recent technological advancements, however, this characteristic of the backbone can and should change. For example, as bandwidth increases Internet connectivity should move from rivalrous to non-rivalrous, thus changing the fundamental context of crucial social policy questions (net neutrality, for example, is predicated on the assumption that the backbone be maintained as a commons to minimize the deleterious effects of broadband access, which is discussed further in Section 4 of this paper). In this same way, the wireless spectrum which was once rivalrous is now effectively non-rivalrous with the introduction of smart hand-held devices that can differentiate between signals on the same frequency. Of course, this does not address the fact that geographic distribution of access will not grow evenly, it will favour urban and more economically successful areas both between and within countries and contexts.

2. **Physical devices:** Physical devices are generally seen as private goods – rivalrous and excludable. Sometimes, however, they are provided as a collective good (telecentres, public access points) so that people can use them to access the Internet. The development of physical goods also has the quality of being, in general, fairly expensive such that it is only through market (or state) based production mechanisms that they can be developed and produced. As the cost of these devices falls, or is mitigated through public subsidies, these devices will become increasingly non-excludable.

[15] Common-pool resources require an appropriate institutional arrangement to manage these goods to avoid the tragedy of the commons.

3. **Digital content:** As mentioned, the difference between the access to technologies and digital content is one of different constraints.[16] Ideas and knowledge expressed digitally are non-rivalrous. They also have a few other important qualities. First, the production of many types of information and knowledge do not necessarily require great capital input that can generally only be accumulated through market or state-based mechanisms. Second, the spread of ideas and knowledge can generate positive externalities. Given the non-rivalrous nature and these positive externalities, it becomes easier to argue that such goods should be delivered in an "open" rather than more exclusive, proprietary manner.[17] Such an approach would avoid the tragedy of the "anticommons" – which is the underuse of this knowledge (Hess & Ostrom, 2007).[18] Note that effectively universal access would arguably move content from the excludable to the non-excludable.

In effect, our notion of openness may be expressed as a shift of certain goods from excludable to non-excludable or making certain private goods (e.g., mobiles) so ubiquitous that they are effectively non-excludable. These would be goods (ICTs and content) that bring both direct human development benefits and maximize positive externalities.

The different characteristics (rivalrous and non-rivalrous) of the different components of ICTs (infrastructure, devices and content) imply that different social policy solutions and institutional arrangements are required to deal with these different components. A central consideration is what is the most appropriate form of producing, delivering and managing different goods in different contexts in order to maximise the public value derived from that good? This question is one that is commonly asked of new technological inventions that arguably supply positive externalities through increased distribution, but that will potentially be underprovided by the market, especially for those at the bottom of the pyramid. For example, many governments argue that access to the Internet is such a good – and thus provision is augmented through publically subsidized public access points (e.g., telecentres, computers in schools) to maximise the social benefit. Whether or not the state should have a role in supplying these goods depends, however, not just on the good, but also on the local context, including the capacity of the state providing the good.

2.6 Openness: At the Crossroads?

We have already briefly alluded to the relevance of openness to ICT4D at this point in time. Here we spell out the argument in more detail. There are two central reasons why an Open ICT4D paradigm, as defined above, is relevant for ICT4D research and development in the short, medium and potentially even long-terms:

1. The Open ICT4D paradigm suggests that the potential of ICTs combined with open processes could greatly magnify access and use of fundamental human development resources - mainly information, knowledge, people (their knowledge and coordinated and collective action), platforms for participation and collaborative, and computational power – that can be mobilized for development activities. Thus, the total available resources are magnified directly by the network effect (i.e., networks can tap into other networks from the personal and local scales to truly global scales). The conditions for this have not existed previously, but future possibilities

[16] "Open access to information is a horse of a much different color than open access to land or water. In the latter case, open access can mean a free-for-all, as in Hardin's grazing lands, leading to overconsumption and depletion. With distributed knowledge and information the resource is usually non-rivalrous" (Hess & Ostrom, 2007).

[17] Another issue regarding information goods is the fact that sometimes there is uncertainty with respect to its value to society before it is consumed. Thus, pricing that good is difficult if not impossible, potentially leading to market failure with respect to that information good (Wikipedia: http://en.wikipedia.org/wiki/Information_good)

[18] When considering the appropriate institutional configuration for the knowledge commons, it is important to keep in mind the three main threats: commodification or enclosure, pollution and degradation, and nonsustainbility (Hess & Ostrom, 2007).

should only increase as we move towards smarter, cheaper and more pervasive mobile devices and deeper penetration of broadband throughout the developing world.

2. Openness is not a guaranteed state of being; rather, it is the outcome of a series of human choices (policy decisions, institutional arrangements and so forth); it could be otherwise. As new forms of organization and production begin to threaten incumbents a battle over the openness landscape is inevitable. This battle places us at a crossroads: policy choices are changes to the social environment that determine the level of openness, with the effect of either constraining or enabling future openness possibilities (Benkler, 2002; Lessig, 2004; Shirky, 2008). For example, the current trend towards developing tougher copyright legislation[19], enforcement and practices[20] in Northern countries bodes poorly for the viability of a social environment conducive to openness. As developing countries often follow the Northern examples (although with respect to IP laws there have been significant diversions), the issue becomes an even more pressing concern.

3.0 Open ICT4D: Why Should the Congolese Care?

> *"Intuitively, these problems seem too fundamental to be seriously affected by the networked information economy – what has Wikipedia got to do with the 49 percent of the population of Congo that lacks sustainable access to improved water sources?" (Benkler, 2006) (Benkler, 2006)*

Benkler's quote above is a variation of a common question that often gets asked of ICT4D activities: What do new ICTs have to do with human development and basic needs? Indeed, this is especially relevant as many of the concepts developed above have emerged from activities in the Western context. Thus, before we move to theory linking Open ICT activities to development, we first consider issues of the development context.

There are, of course massive differences in the realities between the developed and developing world, just as there are between and within developing countries. Perhaps the most obviously critical contextual factor is the massive diversity in the relative "connectedness," in terms of connections to the telecommunications infrastructure through mobiles or fixed-lines and to the Internet. Thus, we would expect variety in the range and focus of the Open ICT4D activities. For example, countries such as Chile who are among the top 30 e-ready countries in the world have a greater starting potential for the more complex collaborative activities. In Asia and South Africa, with its high levels of mobile phone penetration, we would expect the many activities to based on mobile phones related technologies, such as SMS. Sub-Saharan Africa, with its poor telecommunications infrastructure, however, is even more challenged, and activities may be limited, at least for a while, to voice applications. Here, issues of infrastructure and ICT policy are still paramount. Obviously, this discussion brings the basic issue of access (and the digital divide) to the fore, as the activities discussed can only occur when people have sufficiently good access, and the abilities and appropriate environment for performing meaningful activities with these technologies (this is discussed further in section 4.1).

A secondary issue is that many of the theoretical potentials of openness have not yet been realised, even in the developed context. For example, how to apply ICTs for truly participatory governance is something that is in general not well understood – in any context. The wide range of potential activities and the diverse development contexts means that elaboration of what may or may not be feasible in different contexts is impossible at this point. However, one can get a better idea of what is plausible now, and perhaps what might

[19] Such as the Digital Millennium Copyright Act in the US

[20] Including the growing prevalence of Digital Rights Management software, which are essentially digital locks on content

be in the near term, by examining the different types and qualities of the open ICT4D activities that are occurring in the development context, as explored in Section 4.

With these contextual caveats in mind, in the next few subsections we develop theoretical linkages between new technologies, openness as an underlying principle and human development aims. Here we explore these connections at a high (abstract) level. Later, when we discuss the details of the social and digital environments as well as particular Open ICT4D activities, we move to more concrete considerations of the causal connections with development outcomes.

3.1 Linking Open ICT4D and Development

New technologies and openness principles allow for new possibilities for who can access, use, make and distribute information, knowledge and culture – all of which are core inputs into human welfare and development activities (Benkler, 2006). For example, consider the Human Development Index (HDI). Each of the indicators in the index is "a function of access to information, knowledge, and information-embedded goods and services" (Benkler, 2006) (see Figure 2). An open process regarding the access and use of these resources is especially relevant in the development context where individuals, organizations and states are constrained in their ability to access information, knowledge and information-embedded goods and services, if they are delivered at cost.

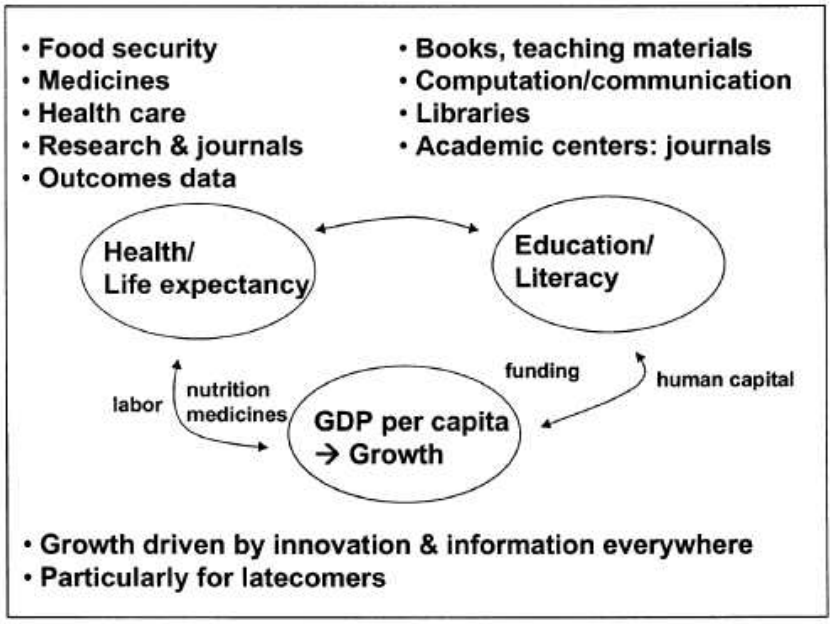

Figure 2 - The relationship between commons-based activities and the HDI (Benkler, 2006).

These connections become more clear when considering more specific Open ICT4D activities that link information and information-embedded goods to development. There are many potential applications: educators and students have the potential to improve the educational experience through access to a open education materials through internet enabled computers in schools; ICTs in the public sector can increase information flows, enhancing transparency and helping to reduce government corruption, or more efficient delivery of information services, resulting in a more effective governance; and the list goes on (we consider some of these in more detail in section 4). Mobile phones can act as a communications device to receive time sensitive information such as disaster warnings or market prices, as a communication means where landline infrastructure is poor, or just simply as a substitute for face-to-face interactions that require travel and time

costs. Consequently, it is not surprising that macro-level empirical evidence shows that the diffusion of mobile phones are associated with increased economic productivity in developing countries (Jensen, 2007; Waverman, Meschi, & Fuss, 2005)(Jensen, 2007, p. 881; Waverman, Meschi, & Fuss, 2005).

Openness can also spur development specific innovation. Access to information and other content as well as to the technologies necessary for innovative tinkering, collaboration, and peer production are crucial inputs that drive local innovations. Heeks (2008) writes of three types of innovation: "*pro*-poor" (on behalf of the poor), "*para*-poor" (along-side of the poor), and "*per*-poor" (by the poor). Increased openness predicated on open technology platforms will arguably allow for highly contextualised per-poor innovations that were not previously possible. Such an approach to innovation (and development, broadly speaking) takes advantage of local knowledge that exists at the community level. In this way per-poor innovations have a massive informational advantage. External "pro-poor" projects suffer from the difficulties of extracting local-needs information, as well as the intricacies of the social context. Para-poor projects try to overcome this through participatory approaches, but are still subject to the stickiness of information (i.e., difficult to extract).

The relevance of local information to appropriate innovations has a parallel in development thought concerned with the epistemic problem that development projects entail. The economist William Easterly (2006) divides development workers into two groups: searchers and planners. Planners attempt to impose from above via top-down plans and structures. In contrast, searchers are the ones close to the ground who search for solutions to local problems. It is only through searchers, Easterly argues, that locally appropriate innovations can emerge. Here we posit that the enhanced spread of information and opportunities for innovation should – theoretically – enable (provided the other contextual supporting aspects are available, for example, bank credit) more opportunities for this type of local searching and innovation.

This is not to argue that different approaches will not be relevant at different times. Indeed, Sen (2006) points out that Easterly's contrast of planners and searchers is an oversimplification and that the actual impacts of international aid are far more complex. For our purposes, it is crucial to identify the situations, if possible, where each type of innovation is most effective.

3.2 Open ICT4D and Capabilities

Another high-level way to conceptualise the relationship between openness, new ICTs and human development is through Sen's notion of development as the expansion of capabilities (Sen, 2001). From this perspective, one's access and capacity to understand, act upon and participate in different activities that one has reason to value is what makes up an individual's capabilities (or individual autonomy as Benkler describes it). Benkler (2006) elaborates on the ways that the networked information economy has the potential to increase this freedom: (i) an increased range and diversity of things that individuals can do, (ii) an increased range and diversity of available information and (iii) reduced power of proprietary providers over individuals. Note that these capabilities include a large range of activities that are enabled by the goods (content, technologies and processes) that are more openly useable and re-usable.

This notion of capabilities need not necessarily be wedded to the highly individualistic notion that is traditionally associated with the capability approach (Gasper, 2002; Stewart, 2005). The notion of capabilities can be extended to include the capabilities of groups or collectivities (Evans, 2002; Ibrahim, 2006). Indeed, as discussed, some of the most powerful aspects of new ICTs are their role as enabling social activities, including facilitating the formation of coordinated group activity around specific objectives or interests. These activities effectively form new groups, and perhaps new forms of social relations and social capital, that fall outside of the traditional notions that draw from strong bonds of family relations or community associations. That is not to say that the process of new group formation and coordination might not also be enhanced by already existing forms of social capital. Rather, in some domains, an increasingly open social and digital environments with the appropriate enabling ICTs allows for the dynamic creation of new sets of coordinated group activity from which a whole new range of group capabilities emerge. Furthermore, these group capabilities function

with important causal impacts. Witness one of the first shots over the bow: in 2001, Manila residents, angered by a perceived injustice, organized a protest using SMS that lead to the fall of the Estrada presidency in four days (Castells, Fernandez-Ardèvol, Qiu, & Sey, 2007, p. 187).

The capability approach provides a potentially useful high-level conceptualisation for a variety of reasons beyond its popularity in development circles. First, it dovetails nicely with the perspective on openness and the enabling role of ICTs. Second, the notion of capabilities is cross-cutting as it necessarily includes a variety of dimensions – economic, cultural, social, technical, etc. Third, capabilities are conceptually useful because they highlight the importance of process; capabilities are both a means and an ends of development. Note that the notion of capabilities comes at a very high level of abstraction. In order to understand in a more concrete manner exactly how new ICTs and openness processes lead to enhanced capabilities, it is necessary to move to a lower level of theory – one that coincides with the actual ICT implementations that exist.

3.3 Open ICT4D and Gender

To the extent that our definition of openness is informed by the concept of egalitarianism, it exposes new spaces to advance feminist and social justice movements within the information society. The definition of openness outlined here parallels the common definitions[21] of gender equality – the focus not being on sameness but rather on the equality of opportunities to participate in the Information Society, particularly as it relates to inclusion and citizenship at household, community, national, and transnational scales within the increasingly networked global world. In the past, gender and ICT debates have been framed around discussions of the "gendered digital divide," limiting much of the engagement to questions of access and to interventions which aim for equity of services but do not necessarily challenge underlying social norms and practices that lead to inequality. Working from within an openness paradigm, which organizes social activities favouring universal access, participatory decision-making and collaborative production, the debates about women in the information society can be reframed in terms of "digital equality"[22] as opposed to the binaries of the "haves" and the "have nots", "users" and "non users."

This orientation raises questions about the ways that women and men participate in the information society. For example, how are public spaces redefined through ICTs? Given the prevailing normative association of female-private sphere and male-public sphere, does the potential for the public sphere to be redefined in an information society challenge these gender norms or reinforce them, and to what effect? Here the focus is on the quality of participation and inclusion which allows feminist and development researchers to examine how social relations of power are reconstituted through the information society and therefore address strategic gender considerations.

3.4 Towards Development 2.0?

New ICTs pose a challenge to the standard approaches to development. New ICTs and their potentials for open (transparent, participatory and collaborative) activities invite the possibilities for a "more plural and collaborative Development 2.0" (Thompson, 2007). The Open ICT4D hypothesis argument developed here poses the same critique and possibilities to development thinking as Thompson's Development 2.0 paradigm. The only potential difference between the two is that openness is not reliant on a particular technology, but is another expression of a movement from a vertical to a horizontal organizational structure with increasing participation of those who receive the benefits of development itself (although this appears to be what Thompson is arguing). In this way, Development 2.0 and Open ICT4D both highlight the possibility of applying more horizontal stakeholder relationships with highly distributed information and enhanced

[21] "Gender equality, or equality between women and men, consists of equal enjoyment by women and men of socially valued goods, opportunities, resources and rewards. … Equality will not mean that men and women become the same, but that their opportunities and life chances will not depend on their sex" (Schalkwy, Woroniuk, & Thomas, 1997, p. 1).

[22] See: DiMaggio & Hargiatti (2002) for a discussion on the difference between digital divide and digital inequality.

possibilities for feedback loops and coordination over distance in the management and implementation of ICT4D activities.

4.0 The Social and Digital Environments

Openness as we have defined it is not guaranteed; rather, it is the outcome of a combination of policy choices interacting with already existing institutional arrangements and network infrastructure, among other factors. In this section we explore these different factors that determine the relative openness of any particular good. We break up the components into two major categories: the social and digital environments. The social environment is the social layer that consists of the institutional, cultural, political and economic structures with their unique characteristics whose activities maintain and sometimes change those structures. The digital environment consists of the networks, devices and standards as well as the content that are embedded within the social environment.

4.1 The Social Environment

The social environment provides the social, economic and legal environment in which the technological layers operate. We restrict our discussion to two highly relevant components of the social layer: socio-economic factors and legal-institutional.

4.1.1 Social and Economic Factors

The most fundamental aspect of ICTs is "not so much the availability of the computing device or the Internet line, but rather people's ability to make use of that device and line to engage in meaningful social practices" (Warchauer, 2003). It is the process of applying a particular literacy (such as reading, numeracy or technological literacy) in a social context as well as the social development that is intertwined and co-constituted along with an increase in a particular literacy that determine a person's capacity to interact with these technologies (Warchauer, 2003). Issues of literary also pertain to the dominant language(s) used on the Internet (English, Chinese, etc.). Translation into local languages remains a critical step to lowering the barriers to entry for people of developing nations, and also raises technological challenges such as incorporating local languages meaningfully into links, tags and URLS (currently the URL system employed on the Internet cannot even handle accents in Western script).

Other critical social issues pertain to gender, race, class and culture. Especially in developing countries this includes issues of access for marginalized or disempowered groups within a society based on their gender or class relative to the empowered groups. Finally, there is a psychological component to openness. As openness moves towards increased participation and collaboration, there a shift from control to trust as a means of social organization. Not only is this reflected in organizational forms, but it might require a particular psychological disposition and value set in the people who are participating.

4.1.2 Legal-institutional Factors

The legal-institutional factors determine the basic social understanding of how content can be used, shared, and appropriated and the degree to which these legal rights protect or favour the creator versus the consumer of content. The central idea here is intellectual property (IP). IP law was developed to provide incentive for creativity and innovation by protecting creative works from unlawful appropriation. However, applied excessively, intellectual property laws can stifle creativity and innovation by locking up access to ideas and innovations upon which others can build and adapt in new creative and innovative ways (Lessig, 2001).

Indeed, the history of inventions, science and culture is one of standing on the shoulders of giants – reusing or building upon the work of previous creators and innovators in new ways.

The recently developed Creative Commons license regime provides an alternative system of intellectual property rights. Content licensed under Creative Commons licenses is sometimes referred to as "open content" since certain Creative Commons licenses (also referred to as copyleft protection) explicitly place the content into the commons. Creative Commons licenses have been adapted to various jurisdictions internationally, including African and Asian countries such as South Africa, China, India, Malaysia and Taiwan. As of July 2008, there are over 130 million licensed works under a form of Creative Commons license.[23]

Creative Commons has also created a specialized "developing nations" license that provides a legal means for copyright holders to allow free uses of their work in developing nations while reserving traditional copyright protection in developed countries. Gauguier and Douine (2005) believe that "by creating a public domain of creative works, creative commons offered developing countries significant raw material with which to build local content". Finally, the Creative Commons movement, which sets an international standard, is an excellent example of how the Internet crosses legal and institutional boundaries.

4.2 The Digital Environment

In this section we explore the range of technological hardware and content that constitute the digital environment. To guide the discussion of the technological layers, we adapt the model pioneered by Benkler – three critical layers; the underlying infrastructure of the network (layer0); the logical design that defines the network's laws or rules (layer1); and finally the content (layer2), the knowledge, information, art, media, etc, that is produced, disseminated, shared and collaborated on over this network structure.

4.2.1 Infrastructure (Layer0)

The network society is built directly upon the physical infrastructure of the networks (both Internet and mobile phone which can overlap), dominated by the ultimate network of networks - the Internet (Benkler, 2006; Castells, 2005). This physical infrastructure is a complex system of wires (telephone, cable television, and undersea cabling), which is also increasingly extended and/or substituted by satellite (such as VSAT in Africa), personal and local wireless (such as Wi-Fi and community wireless networks), mobile devices (using GPRS technology and other untethered forms of local and wide area network connection (Lessig, 2001). The Internet operates by streaming data in packets over these physical and untethered pathways from source general purpose computers and/or devices to destination computers and/or devices.

Discussions on ICTs tend to focus almost exclusively on the Internet, despite the fact that the mobile phone network had faster penetration rates in some parts of the world (especially Africa). In fact, Internet use is not growing as quickly in the developing world as in the developed world. By the end of 2007, less than one out of five people in the developing world were online, compared to 45% using mobile phones.[24] While most mobile phones now offer Internet connectivity via GPRS, there are still millions of mobile phone users who get their mobile phone service over networks that do not connect with the Internet. As a consequence, these mobile phones, while useful at more local levels, are limited only to voice service (i.e., they cannot be used to share or exchange other types of content such as data). However, despite this seeming limitation, for some parts of the world, such as Africa, voice is still the killer application. Thus, while it is important to understand the context and usage of mobile phones, the discussion here will focus on the Internet infrastructure as it is this infrastructure which enables the widest degree of openness of content we are focussing on in this paper.

[23] Fitzgerald, B. "Open Content Licensing (OCL) for Open Educational Resources" http://oer.wsis-edu.org/MALMOE/malmoe-Fitzgerald.pdf

[24] http://www.itu.int/ITU-D/ict/statistics/ict/index.html

Openness is an organizing principle of the Internet. The Internet is based on end-to-end communications transacted over an open transport network with intelligence at the ends, not within the network itself (Benkler, 2006). This particular choice of an end-to-end design is especially significant: it does not make any requirements of the data sent through the network allowing for a maximal degree of flexibility in terms of the range of activities and content that can flow over the network. It is the intelligence of the end units that determines the range of activities possible. This has allowed for unintended uses of the network architecture, unexpected innovation and creativity of the content and applications that are delivered over it and unforeseen reorganizations of human and social networks.

Importantly, the structure of the Internet could have been otherwise. The Internet originally utilized the public telephone infrastructure to connect non co-located computers for the exchange of non-voice data. Although entirely owned by governments or corporate entities, the telephone infrastructure-based Internet was able to foster innovation and create an open, equitable and neutral commons (Lessig, 2001). These characteristics of the early Internet were largely the product of the end-to-end design as well as a policy decision by the US government to define the public switched telephone network (PSTN) as a public good and to designate the owners of the telephone wires as "common carriers." The designation of "common carriers" allowed telephone companies to use their wires for their own voice services and to charge for use of their wires by competitors without controlling the content that was transmitted over them. This was an important part of telecommunications public policy that mitigated the cost of developing a geographically dispersed network and circumvented legal issues such as getting rights of access to telephones poles and other holdings. Most importantly, it was considered more important to increase connectivity to a common network than it was to allow for market competition. This was due to a legitimate concern that competitors would pursue only lucrative customers, effectively limiting the viability of the communications network. Thus, even though the telephone infrastructure was (and still is) entirely owned by governments and private entities, the policy effectively created a commons of information and communications flows upon which the Internet (and eventually the World Wide Web) would eventually be delivered (Lessig, 2001).

This notion of a public good has not extended to the cable Internet infrastructure, however, despite the fact that cable can be used for both upstream and downstream Internet voice and data delivery (in precisely the same way as the telephone wires can). Successful lobbying by cable providers ensured that the basic definition of the cable service was never changed and thus despite evolving into a two-way communication infrastructure the cable wires are not treated as a public good. This means that as more and more users (in both developed and developing countries) move to cable broadband service for Internet access, the control of the network (not only ownership of the wires, but control over the internal logic of the network as will be discussed in the next section) falls increasingly into the hands of private and corporate for-profit entities. These entities are subject to less regulation from national governments, are less beholden to the public interest and increasingly are subject to less competition due to corporate mergers (a problem of vertical integration which will be explored further later in this manuscript).

Even more worryingly, broadband Internet delivered via the radio spectrum has been deliberately architected for control:(Lessig, 2004) not only is ownership of spectrum itself auctioned by governments and paid for by private corporations – the purchasers are also given the authority to determine how the spectrum will be used. The reasoning behind this arrangement is the dubious argument that spectrum, like diamonds, is scarce, and thus of great commercial value (which effectively makes spectrum a rivalrous and exclusionary good). However, spectrum is not scarce. The scarcity of spectrum is based solely on the inability of dumb devices to differentiate between signals on the same frequency (i.e., your car radio) – a situation remedied by the introduction of smart devices which can easily differentiate between signals on the same frequency (i.e., the iPhone, Smartphone, Pocket PC, etc.).

Thus, instead of treating spectrum as a scarce resource, the argument can be made that it is better to make the spectrum available to all as a commons, an approach known by many names, including open spectrum. Open spectrum allows for more efficient and creative use of the precious, but not scarce, resource

of the airwaves: it has the potential to enable innovative services, reduce prices, foster competition, create new business opportunities, and bring our communications policies in line with our democratic ideals (Werbach, 2006). Open spectrum at the personal and local area wireless network level, in particular, can address last mile problems in areas where Internet infrastructure does not currently exist, or in areas where instability and socioeconomic issues make the development, maintenance and upkeep of physical infrastructure problematic. These approaches could also alleviate the situation, particularly in Africa, where mobile phone use is penetrating at a faster rate than Internet use. While voice and SMS are dominant, these users are locked out of the larger Internet and all its associated benefits.

These last mile opportunities in open spectrum are particularly applicable for the developing context. According to the International Telecommunications Union (ITU), for example, there were 192.5 million mobile phone subscribers in sub-Saharan Africa in 2006 – concentrated in urban areas. Broadening the spectrum commons would allow a proliferation of additional wireless systems to penetrate the underserved rural and remote communities, as well as offer true competition to expensive VSAT options in both urban and rural areas (Werbach, 2004). Wireless communications networks (especially community-access wireless networks) also have the potential to allow community members to act collectively and to foster social formation and a heightened sense of community (Cho & Hanna, 2008). This leads to retention of local people, such as giving teachers the chance to connect to distant family members, reducing the need for them to leave the community. Finally, wireless networks drive innovation and creativity in developing the network structure, building local capacity and skills through technical support and entrepreneurship, and finally experimentation (Cho & Hanna, 2008).

Recently, especially in developing countries, local alternatives are being sought to address last mile issues and to increase local access to the Internet and to mobile phone networks. Innovative models such as wireless mesh networks[25] and mobile ad hoc networks offer strategies for connecting more people at a lower cost at the local level. An example of developing wireless mesh networks is The Wireless Roadshow,[26] a project which enables local communities and non-profits in developing countries to plan, deploy and maintain local, sustainable network infrastructure to enable voice and data communications, both at the local community network scale and over the Internet as well. Less recently, are the telecentre and other access point initiatives which provide the last piece of Internet infrastructure to offer Internet access to those who cannot afford a computer and/or private access. These public access facilities arguably fill a need that is underprovided by the market in areas of scarce resources where people cannot afford private Internet access points.

4.2.2 Logical (Layer1)

The logical design (the code law that operates the network of nodes and ends) of the Internet is what defines how the Internet works. The Internet was originally designed without any internal intelligence: the nodes of the network did not care (or even attempt to know) what content was communicated across them, they attempted only a best-efforts approach to transmitting packets of information from one end (the originating node or device) to another (the receiving node or device) via non-predetermined pathways. What enabled this approach was adherence to openly published standards and protocols for the transfer of these data packets across the network such as the TCP/IP suite of protocols, and the layers of protocols that were established by the Open Systems Interconnection (OSI) Basic Reference Model.[27]

This logical model, known as the *end-to-end* model, in conjunction with adherence to open protocols (namely, the TCP/IP suite) produced a network that was fundamentally open, equitable and neutral (Lessig, 2001). It was open in the sense that users needed only connect their computers to the network to share or receive content; equitable in the sense that the design was not optimized for any particular content or user

[25] http://www.communitywireless.org/
[26] http://wire.less.dk/wiki/index.php/Main_Page#Wireless_Roadshow
[27] http://en.wikipedia.org/wiki/OSI_model

and thus the network was open to uses and users that it was not originally designed for; and neutral in the sense that the network was incapable of discriminating against specific content. This final aspect of the original Internet model is the foundation of "net neutrality" that is currently threatened by new technologies and legal-institutional frameworks.

An alternative logical model, which is now increasingly embedded into the current Internet structure, and is becoming rapidly more attractive in an era of large scale corporate mergers within and between telecommunications providers and mass-media content deliverers, is the asynchronous transfer model (ATM). This model is moving the intelligence from the ends of the network to the middle giving the owners of the infrastructure (the wires and increasingly the spectrum), as well as the Internet service providers (ISPs; the gatekeepers) the control to dispense with "net neutrality" when it benefits their particular interests (i.e. to favour the content, applications and traffic of their corporate partners over those of competitors or independents). Thus, layering intelligence onto the neutral TCP/IP suite leads to serious concerns over government transparency (think North Korea), the viability of a free and independent media (think China), and of course security and privacy (think the Patriot Act of the United States).

Standards are also a crucial component to enable content level applications and services. These standards, that are open, such as XML and its extensions (the geography mark-up language, GML, for example), allow data and information to be exchanged and shared between software and applications users and devices. These open standards fuel the interchange of data and information that underlie the services provided over the Internet, thus making collaboration and production of new content possible. Defining domain-specific standards is also increasingly important for the filing, cataloguing and sharing of the domain-specific information.

4.2.3 Content (Layer2)

In the following sections we discuss several domains of open content that have emerged. Each section provides an explanation of the domain, its relevance to development and gives examples (where possible) of Open ICT4D activities in these domains.

4.2.3.1 Open Source Software

It is not common knowledge, in light of the market dominance of corporations such as IBM and Microsoft that the core of the Internet is and has always been built on both the concept of openness (as described previously) and open source software. Fully half to three-quarters of Internet activity is transacted over open source software – Linux and Apache in particular are used widely in functions critical to industries from banking to telecommunications.

Despite being known by the acronym FOSS ("free and open source software"), open source software should not be confused with free software; these two terms denote very different philosophies of the role of software in the information economy (despite some areas of overlap). The term free software is used by the Free Software Foundation[28] (FSF) to denote software that is not only available at no charge (*gratis*, or "free as in beer"), but software that is also available without legal or copyright limitations on its use and distribution (*libre*, or "free as in speech"). This does not mean that the end user has access to or the right to alter the source code of the software. Open source software specifically refers to software for which the source code is open to editing and modification by anyone, but its *libre* or *gratis* availability is dependent upon the licence the source code is distributed under. Most open source software is distributed under a variant of the GNU general public licence[29] however, making it both *libre* and *gratis*. The acronym FOSS (or FLOSS[30]) rightly

[28] http://www.fsf.org/
[29] http://www.gnu.org/copyleft/gpl.html
[30] http://www.flossworld.org/

applies to software that is provided both *gratis* and *libre* to the end-user and for which the source code is also available for editing.

Free and open source software has had a significant impact on the developing context in the last decade. The advantage of FOSS is not only freedom from proprietary licensing and update costs, but also greater access to information and local capacity building. With proprietary software the power over the program stays with the vendor – determined largely by the requirement to use proprietary file formats, or purchase suites of software to get specific functionality. Free and open source software, on the other hand, not only provides the o code, but also additionally supports further development and changes by an invested user community which can support localization, local language support, etc.

The promise suggested by the positive and continually reinforced educational outcomes from FOSS development is that software innovations can and should come from developing countries (Weber, 2006). Emerging and developing markets need not be dependent on software transferred from the developed world. The open source process of software development offers developing markets a chance to have their own champion users who pull technology development towards applications that fit specifically the indigenous needs and demands of their own markets. In other words, the design principles pioneered in the developed world are not directly transferable to the developing world. Enabling those in the developing world to solve their own problems by developing their own tools and software (or adapting existing open source software) fits the per-poor model of development.

Examples of FOSS success in the developing context range from operating systems to translation software to support non-Western scripts. For example, Edubuntu,[31] an Ubuntu distribution designed specifically for school environments, provides a free operating system developed specifically for classroom use by children. Edubuntu is based on the principles that that software should be available free of charge, that software tools should be usable by people in their local language, and that people should have the freedom to customise and alter their software in whatever way they see fit. Another example, the Translate.org.za[32] project, is an African project which aims to translate open source software like Open Office and Mozilla Firefox as well as a number of Linux desktops into 11 official South African languages.

4.2.3.2 Open Government

Open Government consists of a range of activities including information provision to various forms of participation, interaction and collaboration. Note that we do not include here the ideas of open source in government, open standards or open formats.[33] These activities may or may not be used to promote "Open Government" as per our definition, but they are not Open Government activities themselves.

The common understanding of e-government overlaps with Open Government (in the same way that web2.0 is used as a close synonym to openness). In general, it is thought that the implementation of e-government occurs in stages of increasing complexity. These stages can be seen as a movement towards increasingly open processes: it starts with centralized provision of information, generally through a web presence or perhaps SMS; then there are some new forms of interactions and transactions; and eventually (theoretically) come the more transformative changes where interaction and service delivery is done through a more horizontal and decentralized processes, such as new forms of democratic participation and the co-creation of services (e.g., Bellamy & Taylor, 1998; Silcock, 2001; Weare, 2002; West, 2004, 2005).

Open government allows for a range of activities: increased information provision (including commercial, non-commercial, cultural, etc.), increased information provision for accountability purposes, enhanced participatory governance and co-creation of public services. Empirically, e-government implementations

[31] http://edubuntu.org/
[32] http://translate.org.za/
[33] See, for example: http://go.worldbank.org/OPRW4CL1N0

across the world remain mostly in the early stages (web presence and limited interactions) rather than advancing to the transformative stages (Snellen & Thaens 2008). Countries have not yet begun (nor is it well understood how) to tap into the true transformative potential of open government – moving towards more participatory inclusion in service delivery and democratic processes. Forward thinking, citizen-centred strategies will take more time as requires a rethinking of the current structure of public sector bureaucracy so that it is capable of engaging in its activities in a more inclusive and participatory manner enabled by the use of new ICTs. Especially difficult, and unexplored, are ways of engaging in true e-Democracy (participatory governance).[34]

Examples of open government activities include:

- The Philippine Department of Labour provides job seekers with relevant job information via SMS. The Philippines Civil Service Commission (CS) set up a system (TXT CSC) that allows citizens to report, via SMS, improprieties when dealing with government transactions.

- The Seoul municipality OPEN (Online Procedures Enhancement for Civil Applications) system publishes a list of the civil applications that most frequently cause irregularities, citizen inconvenience, etc, as well as information about required paperwork and how applications are processed making the decision-making processes and actions of individual civil servants more transparent (Bhatnagar, 2004).

- E-procurement systems, such as in Chile and Brazil, publishes public sector purchasing information online and generally (depending upon their level of development) requires online open bidding. The system acts as a check (and a physical constraint against) corrupt (or poor) purchasing practices.

4.2.3.3 Open Education

The open education movement is founded on the established tradition of sharing good ideas with fellow educators and the collaborative, interactive culture of the Internet. It is built on the belief that everyone should have the freedom to use, customize, improve and redistribute educational resources without constraint (Casserly & Smith, 2006). Open Educational Resources (OER) are teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others (Atkins, Brown, & Hammond, 2007). The advantage of OER lies in its potential to engage teachers, learners and other stakeholders in an interchange of ideas and expertise for collaborative knowledge building.

OER contributes to making education more accessible especially in developing countries where educational resources are scarce. They also nourish the kind of participatory culture of learning, creating, sharing and cooperation that rapidly changing knowledge societies need. Furthermore, opening up education resources can act as a transparency and accountability mechanism (through exposing the courses of the responsible academics to outside peer scrutiny) to ensure good quality content.

There are many examples. MIT's Open Courseware[35] provides open and free access to ~1800 of MIT's courses. Other tertiary institutions are also now moving towards a more open paradigm. The Open Courseware Consortium is a collaboration of more than 200 higher education institutions and associated organizations from around the world creating a broad and deep body of open educational content using a

[34] As Lucio Stanca of Apen Institute Italia said, "We don't fully understand the full implications of using technology in the democratic process" (quoted in: Lasica, 2007, p. 36).

[35] See: http://ocw.mit.edu/OcwWeb/web/home/home/index.htm

shared model.[36] Another example is Teacher Education in Sub-Saharan Africa (TESSA) – a research and development initiative which creates open educational resources for teachers and teacher educators working in the region.[37] It produces materials aimed at developing and improving access to local school based education and training for teachers. TESSA materials are developed as modules and focus on classroom practice in the areas of literacy, numeracy, science, social studies and the arts and life skills.

4.2.3.4 Open Health

The concept of Open Health operates at several levels: (1) open sharing and collaboration amongst health professionals to enable patients and their care providers to have access to vital and reliable medical information;[38] (2) between medical health professionals and patients answering medical queries in online forums or sharing of treatments and recovery strategies; and (3) online communities of patients and people with health concerns sharing information, experiences and remedies (including alternative and natural remedies). One of the main perceived benefits of open health is the sharing of preventative strategies and information to help people live healthier lives, thus negating the need for expensive or risky medical procedures and medicines. A second perceived benefit is access to information in the absence of a nearby medical clinic or facility (including cases where the clinic may be closed or unstaffed due to a shortage of medical health practitioners).

Open health also includes open pharmaceuticals. Pharmaceutical production mirrors software production: initial investment into research and development and marketing is expensive, but manufacture and distribution are relatively cheap.[39] An open pharmaceutical system would respond to this model by allowing for more generic drug production with direct benefits including research and development being set by public health priorities (not marketing) and more competition on production and distribution. The main obstacle to an open pharmaceutical model however is the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement which forces all but the least-developed countries to honour 20-year patent rights, discourages experimentation with alternative financing models and hurts developing countries by denying them access to affordable & effective generics.[40]

One of the main concerns in open health is the storage of patient medical and health data and concerns over privacy of these records. Online services such as OpenHealthRecord[41] (OHR) provide an anonymous and secure database where you can store personal health information and the means to share it with only those people and medical professionals you choose. A secondary benefit of a system such as OHR is a growing database of freely available information for medical researchers to mine (the medical data are anonymous so that no researcher can link any particular information back to an individual).

4.2.3.5 Open Knowledge/Science

Science is fundamentally a communal activity with sharing as a central norm; good research is almost always based on others results and theories and should contribute back to the community as new knowledge. It is also not surprising, given our discussion of leveraging collective intelligence, that more openness of scientific research will better advance the field. For example, Lakhani et al. (2007) found that broadcasting a particular scientific problem to a community yielded effective solutions and was a more effective means of solving scientific problems than the closed approach. Interestingly, it was mostly those on the periphery of a domain who most often found the solutions. Of course, reality is never the ideal, and for a variety of reasons,

[36] http://www.ocwconsortium.org/
[37] http://www.tessafrica.net/
[38] For example: http://www.openhealthtools.org/, http://www.oscarcanada.org/ and http://www.open-health.ca/
[39] http://www.bioinformatics.org/franklin/2004/stein.ppt
[40] ibid
[41] http://www.openhealthrecord.org/

researchers often do not subscribe to the openness that is required to fully and transparently participate in the scientific community (Lakhani, 2006)

Another form of opening up scientific research and results is generally called "Open Access". Open access typically refers to the free availability of scientific journals over the Internet (Willinsky, 2006), although Open Access Archiving (OAA) provides access to a wide range of literature including unpublished works, thesis, etc.[42] Open access emerged in response to the restrictive access to knowledge in scholarly and scientific journals imposed by commercial publishing houses via subscription fees, license fees or pay-per-use fees. Over the years, academic journals have become the principal means of dissemination of research outputs. However, the increasing cost of subscription for these journals has been of great concern to libraries and institutions that have to contend with limited and sometimes dwindling funds. This is of special concern to developing countries that have little or no funds to subscribe to these publications. Arguably, this increased availability of scientific knowledge through open access journals and OAA has greatly improved the outlook for the development of research capacity in developing countries who earlier could not afford access (Chan et al., 2005). This happens through both the access of developing country researchers to international research output, but also through international access to developing country research.

The approach to open access is often broken down into two paths: (1) the "golden road" to open access which is a model of publishing which makes journals available to the public immediately on publication, and (2) the "green road" which is a process that encourages researchers and academics to make digital pre-print or post-print copies of their research work or publications available in open access repositories or archives. Recently, Harvard has adopted the green road, requiring its professors to allow the university to make their scholarly articles available free online.[43]

4.2.3.6 Open Society

An open society is one where the scope of information sharing and communication creates the opportunity for greater political freedoms and a more inclusive society. Information, communication and knowledge are often considered pillars of human progress, well-being and democracy. The idea is that individuals, armed with better information, can become more aware of the issues that concern them which can potentially bring broader political and social reforms. Furthermore, the increased possibilities of social mobilization and organization around issues of interest provide a new means of cultural and political expression, a key component of an open society. These increased possibilities are predicated on the social networking technologies within the digital environment.

There is a wide range of Open Society activities predicated on new ICTs. For example, consider the example given previously of the 2001 protest in the Philippines. New technologies facilitated not only the spread of information but also the coordination of human action with profound political consequences. Indeed, this combination is so powerful that some governments, when they perceive a potential for protests, will temporarily disable mobile phone communications. Or, take the case of Mzalendo – a volunteer run project whose mission is to "keep an eye on the Kenyan Parliament."[44]. This project is an example of an activity promoting the flow of information that relies on technology and the Internet and is accessible to many Kenyans. The project was started by two young Kenyans who were frustrated by the fact that it is difficult to hold Kenyan Members of Parliament (MPs) accountable for their performance largely because information about their work in Parliament is not easily accessible. Some of the new forms of communication possibilities are even potentially transformative to the whole structure and functioning of democracies as we

[42] "Open Access Archives (OAAs) are electronic repositories that may include already-published articles (post-prints), pre-published articles (pre-prints), theses, manuals, teaching materials or other documents that the authors or their institutions wish to make publicly available without financial or other access barriers" (Chan et al, 2005).

[43] http://chronicle.com/news/article/3943/harvard-faculty-adopts-open-access-requirement

[44] http://www.mzalendo.com/about/

currently know them. For example, new social communication tools, such as blogs, and craigslist.com are undermining contemporary forms of media such as the local newspaper, arguably a cornerstone of a functioning democracy.

4.2.3.7 Open Business Models

Open business models are an approach that companies can take to let more external ideas and technology flow in and more internal knowledge flow out (Chesbrough, 2007). Increasingly firms are looking outside their boundaries for ideas and intellectual property (IP) they can bring in, as well as license their underutilized home-grown IP to other organizations. The open business model represents a break from traditional corporate ethos where the emphasis was on protection of intellectual property and information resources. The business world is realizing that useful knowledge is no longer concentrated in a few large organizations and companies that keep their intellectual property too close to the vest risk missing out on critical business innovations that idea-sharing could generate. By adopting these models, organizations can bring innovations to market more quickly and less expensively, thereby securing a competitive advantage in an increasingly dynamic global economy. Popular and well known examples of business models include Linux Red Hat (which adds value in the form of user and technical support to the basic Linux distribution) and Google Ads.

4.2.3.8 Open Capital

Open capital refers to new micro-scale economic systems which utilize the Internet to provide greatly increased means for the flow of capital between individuals and small businesses for development activities. For example, Kiva.org provides an online peer-to-per micro-lending application that collects funds from small-scale lenders and passes them to microfinance partners worldwide who distributes the funds to selected entrepreneurs. As of September 2008, Kiva has $42,356,160 in loans from 333,737 lenders with a total of 59,467 loans funded (Kiva.org). Although currently Kiva is supported by sponsorship and donations from its users, it is expected to be self-sustaining by the end of 2008. Activists armed with tools like Kiva can use it to fundraise for a political or social event and mobilize funds during disasters or emergencies. In sum, these innovations provide a greater ability to take advantage of mobilizing social networks and their economic resources that was otherwise not available in many developing countries.

5.0 Threats and Issues to Openness

This section explores a few of the important issues that have emerged in the above discussion: emerging research issues, threats to openness, and the downside of open ICT4D.

5.1 Emerging research issues

- **Education:** If a central area of future ICT4D activities is based on open activities involving sharing, mobilization, collaboration and innovation, then the extent and success of that venture will be dependent upon the skills and networks of individuals in developing countries to engage in these activities. Furthermore, as new innovations and adaptations arise the importance of critical thinking skills and flexibility become ever more essential. These skills will be needed to harness the value of new social capital networks that have both economic and intellectual value. This raises important questions concerning what type of education are best and how should we deliver that education?

- **Socio-economic divide:** Given the crucial role of social factors, it is clear, as would be anticipated, that the social, political, and economic factors that determine different individuals'

relative resource sets and capacities for action will be influential in determining their ability to take advantage of these networking possibilities (for example, one's social capital). While the increased ubiquity of mobiles might make universal access a possibility, these other constraints will still play a major role. What social-economic factors are most critical for realising Open ICT4D activities to generate the maximum social benefit?

- **Institutional change:** A movement from closed to more open and participatory institutions (such as with e-government and open business models) generally require fundamental changes to organizational processes and structures. For example, universities originally sought to develop proprietary models of courseware distribution over the Internet, until MITs Open Course Ware (OCW) finally broke the mould. This was radical shift requiring universities to see the value in open-educational resources and to institutionalise the process of online courseware provision and all that entails (Atkins, 2007). How can institutions best negotiate these institutional changes? What forms will the new institutional structures take?

- **Sustainability/new business models:** As many "open" ICT4D activities involve content production outside of the typical funding models of the market and state, issues of funding/incentives/and sustainability become increasingly important. Thus, central questions for future open activities are: What are the sustainable business models for content production and provision? What types of content should/could be provided by the government or market? What are the pitfalls and benefits of market or state based hosting of information? What sacrifices are made if hybrid models are used, for example, supporting free content through private sector advertisements?

- **Intellectual property rights:** The fundamental and changing role of property rights in the digital and network era cannot be overlooked. Evidence is emerging that property rights, as currently conceived, do not work as theorised (especially with respect to digital content), and even might be constraining innovation. One of the main reasons for this may be the complexity of content in the digital era: openness is not a binary concept, it is scalar; content is neither open nor closed, rather it ranges from highly open to highly closed depending upon who makes it, who accesses or uses it, and how it is owned. What property rights regimens are best suited for particular Open ICT4D activities?

- **Openness and complexity:** Openness is not a binary concept, it is scalar; content is neither open nor closed, rather it ranges from highly open to highly closed depending upon who makes it, who accesses or uses it, and how it is owned. The degree of openness determines the amount of flexibility you have with a particular piece of content (broadly defined). For example, software APIs are partially open whereas open source is more open. This is potentially a significant understanding for the following two reasons: (i) Understanding the level of openness potentially helps us to anticipate what types of outcomes are possible (the less open the more constrained, the more open the more possibilities); (2) This suggests that there are different levels of complexities related to different open activities. This has implications for research, for example, that the greater the complexity the harder it might be to generate big effects making research focusing on outcomes more difficult.

- **Filtering and accreditation:** The movement towards more horizontal structures of organization brings a different set of issues to the fore, such as how and who will validate, filter and organize data? For some activities, intermediaries in the hierarchical structures with special expertise/skills may still be necessary (e.g., for certain government services, or for peer micro-lending) while some may be possible without intermediation by replacing expertise with collective intelligence such as peer rating systems. Both of these situations require further

research: for what technologies and in what circumstances do different approaches to peer-based validation of content work (or not) and how do we avoid the downsides (such as the spread of mis- or dis-information)?

5.2 Challenges/Threats to Open ICT4D

- **Incumbent resistance:** The current trend of ICT policy and IP laws are biased against openness. While the original development of the Internet was founded on libertarian principles that embraced open processes, mainstreaming and commercialization of this "cyberspace" by those with vested interests in the older industrial economy has become very apparent. Sometimes the shift is embraced (as with MIT's Open Courseware), but more often it is fought. The first battles can be seen in the IP laws/music industry suits (RIAA) and the net neutrality debates. This should not be surprising as these changes represent "formidable challenges" for many companies to shift from "old organizational structures to new ones that can leverage decentralized co-creation" (Bollier 2007).

- **Vertical integration:** One of the more prevalent threats to Openness comes from a vertical integration of ownership through the horizontal framework of the network. Vertical integration such as mergers between AOL, Time and Warner lead to service providers choosing what content to favour, produce and allow access to over their networks. Thus, the limitations to Openness from such mergers lead to serious reductions in consumer choice, and produce creativity and innovation. Vertical integration also raises the spectre of censorship. For example, Wal-Mart increasingly dictates a lot of the 'creative' process in Hollywood based simply on what titles they will and will not stock – forcing media producers to edit their content to fit Wal-Marts corporate mores. Clearly this approach to content production is a massive disincentive to creativity. With respect to access to knowledge, Willinksy (2006) notes that as more and more journals become concentrated in fewer and fewer publishers, there is an increased opportunity for devious practices such as bundling journals together into no-cancel subscriptions limits libraries ability to get access to the journals their students need.

- **Cloud computing:** Cloud computing is one potential future technological configuration of the Internet (Bollier, 2007). Cloud computing refers to the centralization of computational power to offer all computing services and data – while the end units are reduced to access terminals. This has potential benefits by making the end units cheaper. However, given our understanding of openness and the architecture and digital environment that underpins it – this would be the antithesis of openness. It represents two central moves that threaten the open architecture of the Internet: removing the power from the ends, and making the network intelligent. Ultimately, it would constitute a movement back to a centralized form that would have incredible control over the content delivered. Such a system is one that is ripe for abuse, especially if under the control of less democratic governments or subject to the incentive system of the open market.

5.3 The Downside of Open ICT4D

The openness paradigm magnifies access and use of resources that can be mobilized for a wide range of activities, good as well as bad. This is no surprise in the world of ICTs as they amplify the range and magnitude of social activities – but do not necessarily pre-determine the social activities themselves.

- **The surveillant state/loss of privacy:** Essential to the efficient functioning of a modern nation-state is the collection of information upon which the organized activities of the state are predicated (Giddens, 1990). In this way, effective modern governance is increasingly dependent upon observation and information collection to achieve goals such as reducing fraud, improving

efficiency and maintaining citizen safety (Webster, 2002). A by-product of this information gathering is the increased potential of the development of a surveillance society (Bellamy & Taylor, 1998). Such a situation is even more pressing a concern in countries such as Singapore and China, or politically unstable democracies, where surveillance and control over information flows and the Internet effectively erodes the public sphere (Anderson, 2004). The outcome of these processes is not yet known, and certainly not pre-determined. What is clear, however, is that the issue of privacy will certainly be an increasingly important one in the future. Lasica (2007) notes that "privacy will be harder to maintain in the new order". Indeed, as we move towards a geo-semantic web, with the combination of personal data and usage patterns linked to personal location raises obvious concerns. As we become increasingly connected, how much personal transparency will be required? How can we achieve the benefits of network effects and personalised services without sacrificing anonymity or privacy? Where is the balance? Will and how should people have the choice over what information is collected and shared by government agencies or ministries and how it is used?

- **Internet addiction:** Increased access to the Internet and games has led to a concern of Internet addiction in Asia. What other personal/psychological impacts does being constantly connected and on-line bring?

- **Information quality:** The shift from more traditional vertical to networked horizontal forms of content production and dissemination begs several questions, such as who is best placed to generate factual or informative content? And, what constitutes importance or necessary content? Examples can be found in the fields of health (where patients offer advice on care or prevention to others with similar medical conditions), education (where students answer each other's questions), and even in more traditionally technical fields, such as the advent of the neo-geographers. The term neo-geographers is commonly applied to the usage of geographical tools (such as Google Maps) for personal and community activities or for utilization by a non-expert group of users (usually embedded into a personal or community website). The question becomes, to what extent can these peer and non-expert sources of information be verified? How will we judge quality of information in the age of information explosion?

6.0 Emerging Questions

As the goal of this document is to generate new questions rather than answer old ones, we conclude with a few of questions that have emerged throughout our exploration of Open ICT4D:

1. What are the best ways to avail the enabling resources so that people can mobilize, collaborate, participate and innovate? Content needs to be produced and maintained; people need a way to connect/share/interact. This raises a set of cross cutting issues such as the sustainability of open content providers (relevant business models), and IP law.

2. How do we facilitate people to take advantage of these resources? (What other enabling resources are needed - access, time, cognitive)?

3. How can we mitigate the potential negative outcomes of openness while not overly inhibiting the benefits? What institutional compromises must be made?

4. If development consists of per-poor innovations and peer collaborations – what does this imply for development and development research? Most likely, this is an acceptance of a loss of

control, and an increase in trust in the process – that is, the process of openness to lead to relatively unpredictable (hopefully positive) development outcomes.

5. How can we facilitate the communication and acceptance of local knowledge to achieve developmental aims that respects existing power imbalances?

6. What might the role be for new international standards for Internet governance that promote an "Open Internet"?

Appendix A – ICT4D Openness Activities

Acacia Openness Activities

1. **African Copyright and Access to Knowledge Network (ACA2K)** (Project No. 104501; 2007 – 2010). The African Copyright and Access to Knowledge Project (ACA2K) seeks to build the capacity in Africa to research and better understand the copyright environment that would facilitate citizen's access to digital and hard copy learning materials. Bringing together a research team from Egypt, Ghana, Senegal, South Africa, and Uganda, the project will analyse whether national copyright legislations are taking advantage of the exceptions and limitations allowed by international copyright treaties.

2. **Wireless Africa** (Project No. 104477; 2008 – 2010). This project is to develop the replicable and sustainable business models of community owned wireless networks in Africa and test them in ten countries by providing integrated solutions for Voice over IP and for wireless Internet service provisioning.

3. **Enabling Affordable Access to Fibre Infrastructure for Institutions of Higher Education** (West and Central Africa) (Project No. 104466; 2007 – 2009). The general objective of this project is to enable the provision of affordable bandwidth for African higher educational institutions (HEIs) in West and Central Africa through sensitisation and lobbying at highest levels supported by research findings and benchmarking. To compile key facts on the state of connectivity in West and Central African HEIs and to compare that connectivity with those of HEIs in other parts of the world (Europe, North America, Asia and Latin America); To investigate on available dark fibre in West and Central Africa and to assess the regulatory arrangements for accessing unused capacity; To raise awareness of high-level policy and decision-makers on the necessity for special measures aiming to facilitate access to more and cheaper bandwidth for African HEIs.

4. **Access to Knowledge Southern Africa: Open Approaches to Research in the Internet Age** (Project No. 104503; 2007 – 2008). Access to Knowledge Southern Africa (A2KSA) seeks to understand better the different constraints to access to knowledge for research and teaching in universities in Southern Africa. The project; a research collaboration between the Southern African Regional Universities Association (SARUA) and the Link Centre; will explore opportunities for the creation of a SARUA regional open access network based on an open knowledge charter. A2KSA will investigate how open access approaches to research could increase the availability of academic and other relevant research publications to students and researchers and promote new approaches to knowledge production and dissemination.

5. **Good-to-Great Open Source Software Development in Africa** (Project No. 104744; 2007 2008). The project provides an opportunity for reflection and learning about how to develop successful Open Source (OS) initiatives in Africa. This will be done through a workshop that will be participant-driven and that will review OS developments and the implication of these. The workshop will be carried out through expert facilitation geared to providing knowledge on the existence of OS software and the examination of the feasibility and conditions for success of adopting OS development approach/solutions by projects.

6. **Open Architecture, Standards and Information Systems (**OASIS) for Healthcare in Africa (Project No. 104508; 2007 -2008). The overall aim of the project is to promote development in low- and middle-income African countries by (i) promoting in-country capability to develop and

maintain low cost, sustainable health information systems, and (ii) using the information systems to understand better and address health-related issues within the country both at an individual facility level and at a public health level.

7. **Free and Open Source Management Information Systems and Microfinance** (Project No. 104509; 2007 - 2009). The project involves deployment of an open source management information system (Mifos Vanilla) in two microfinance institutions and one savings and credit cooperative; development of an offline module (Mifos Light) and pilot in two savings and credit cooperatives; and capacity building in one savings and credit cooperative support institution.

8. **Support for the Organization of the Fourth Open Access** Workshop (Project No. 104251; July – September, 2007. The project brought together academics, policy makers and other stakeholders from different countries to the 4th International Open Access Conference (Stockholm, 12 to 14 December 2006) to discuss the challenges and future of Academic Networking with a special focus on Africa. Faced with a changing environment due to economic and technical reasons, universities have to reconsider their strategies and practices and adapt their networks for an open and wider access at the national, regional and continental levels.

9. **Strengthening Scholarly Publishing in Africa:** Assessing the Potential of Online Systems (Project No. 103885; 2006 – 2008). The project aimed at researching the viability of establishing On-line Scholarly Publishing Sites (OSPS) in African universities in collaboration with research librarians and journal editors.

10. **Internet Backbone in the Democratic Republic of Congo (RDC): Feasibility Study and Advocacy** (Project No. 103846; 2006 – 2008). The project aims to study the feasibility of establishing an Internet backbone in RDC. Researchers will identify suitable technological and policy alternatives for developing the infrastructure and managing it using open access software. The results of the study will be proposed to the government, the private sector, the universities, the media, nongovernmental organizations (NGOs) and the donor community by way of an advocacy campaign.

11. **Developer Network: Open Source Personal Digital Assistant Software for Health Data Collection** (Project No. 101974; 2006 – 2008). To evaluate the feasibility and sustainability of designing, developing and maintaining an inexpensive source software application for health data collection on handheld computers for developing countries. It will test the hypothesis that it is possible to develop and maintain an inexpensive electronic data application for health data collection on handheld computers that will be used by at least five research groups in three developing countries (including South Africa).

12. **Idlelo: First African Conference on the Digital Commons** (Project No. 102239; 2003 – 2004). The objective of the project was to support university executives to meet and discuss the options of improved bandwidth purchasing through collective regional and African interaction such as forming an African bandwidth purchasing consortium. To improved access to creating and delivering open content applications for higher education in Africa.

13. **Comparison Study: Open Source versus Proprietary Software in an Africa Context** (Project No. 101550; 2002 -2005). To fully examine the implications of the choice between open source and proprietary software in an African context. The study looked in particular at the impact that software choices have on community access to information and communications technology (ICT), both in terms of ground level implementation in computer labs, and the costs and benefits at the national policy-making level. The goal is to provide an unbiased analysis and

raise awareness about the issues at stake in order to inform decision making processes at both levels.

PAN Asia Openness Activities

1. **OpenNet Initiative: Digital Censorship and Surveillance** (Project No. 104332; 2007-2009). Digital censorship and surveillance - notably with respect to the Internet and mobile phones - are growing around the world, both in scale and sophistication. It is in Asia where the potential of ICTs for citizen empowerment confronts state and corporate control of access to information, for example in China and Burma. Against this backdrop, OpenNet Initiative - Asia (ONI-Asia) seeks to understand the technical and social aspects of digital censorship and surveillance across different countries in South and Southeast Asia.

2. **International Open Source Network Phase I & II** (Project No. 101223 & 103015; 2007-2008). The project aims to conduct research on various aspects of free/open source software in order to address gaps in knowledge and further strengthen the network of free and open source software (FOSS) researchers and practitioners in the Asia-Pacific region. One of the expected outcomes is to accelerate the adoption of FOSS by governments and those agencies that uses public funding as well as Civil Society Organizations.

3. **Toward Détente in Media Piracy** (Project No. 104333; 2007-2011). The project seeks to research and better understand the nature and extent of media piracy in India, South Asia, South Africa and Brazil. This project is based on the premise that piracy remains a development rather than a criminal issue, i.e. the fact that knowledge commodities in the developing world are primarily - and in some cases exclusively - mediated through pirate markets.

4. **PAN Distance Learning Technology (Asia)** (Project No. 102791; 2004-2011). Distance education supported by ICT offers Asian countries the possibility of providing equitable access to post-secondary education. This grant will allow researchers in distance education institutions in several Asian countries to investigate the effectiveness of distance learning technology (DLT) under different conditions of ICT access. The objectives of the project include developing access models and shared resources (including software) for distance education provision.

5. **Conference on Moving the Free and Open Source Software Agenda for Health: Setting the Framework for Interoperability** (Project #104351; 2007). PAN has supported the conference called "Moving the FOSS Agenda for Health: Setting the Framework for Interoperability" to help The Open Source Health Care Alliance (OSHCA). OSHCA is a legal entity registered in Malaysia with a mandate to promote the use of free and open source software (FOSS) in health care, particularly in developing countries.

6. **Scoping Study on Digital Privacy Issues in Asia** (Project No. 104911; 2008-2009). This activity is meant to serve as a scoping exercise that will help to identify key Asian partners and issues in an overall process of promoting privacy protection in Asia. It will identify the state of law by researching the legal situations in a number of countries across developing Asia. The objective is not so simply to identify specific laws but rather assess the real state of regulatory protections (e.g. the jurisdiction and powers of the regulators) and legal protections (e.g. jurisprudence).

ICA and CEA Openness Activities

1. **Open Source Software and Small and Medium Enterprises in Latin America and the Caribbean** (Project Number 104407Start Date 2007/05/03). Small and medium enterprises (SMEs) in Latin America and the Caribbean (LAC) face significant barriers to market access that could be surmounted using open source software (OSS) tools and platforms. Early results indicate that some OSS-based applications can lower administration costs for SMEs, increasing competitiveness. However, there is a need for business models that support this tendency. This grant will allow a consultant to prepare and help facilitate a two-day technical meeting of key experts and organizations in OSS to be held in Montevideo, Uruguay, in July 2007. Building on the findings of an earlier applied research project on OSS in LAC (102201), the participants will identify potential partner institutions, key regional priorities and lines of action.

2. **CLACSO's Open Source Virtual Library** (Project Number 102771; 2004/08/25). The *Consejo Latinoamericano de Ciencias Sociales* (CLACSO) groups more than 5 000 social scientists in 159 institutions from 21 countries in Latin America and the Caribbean (LAC). Since 1989, CLACSO has made use of information and communication technology (ICT) in innovative ways to strengthen academic networking in the region. CLACSO now has a virtual library of more than 4 000 full-text documents available online, but would like to decentralize production and dissemination using a more participatory approach. This grant will allow CLASO to develop and test open source software to manage its virtual library. With this software, CLACSO members will be able to manage the virtual library in a more cooperative way and the general public will be able to do full-text and metadata document searches. The improved virtual library will widen the scope and impact of this important electronic resource.

3. **Open Source Software in Latin America and the Caribbean** (Project Number 102201; 2003/09/30). Open source software is no longer a marginal activity of computer enthusiasts but an increasingly strong alternative to proprietary software. Open source can be a powerful tool to assist development efforts in Latin America and the Caribbean (LAC). At the same time, open standards are increasingly important to make collaboration and information sharing easier. Bellanet is an International Secretariat funded by IDRC and other donors that promotes and facilitates effective collaboration within the international community, especially through the use of ICTs. This grant will allow Bellanet to investigate who is doing what in open source and open standards in LAC; how this work can be brought closer to the needs of the development community, and how this interaction can be strengthened so that the development community can take advantage of these tools. Materials concisely presenting the opportunities offered by open source will be prepared for public dissemination.

4. **Universal Access: a Case Study of Costa Rica** (Project Number 101616; 2002/09/23). Costa Rica's *Comunicación sin Fronteras* (Communications without Borders) was established during the 1998-2002 presidential period with a view to making the Internet available to every Costa Rican citizen. This grant aims to capture the lessons learned from the experience in a case study and disseminate it within the region. Specifically, the case study will examine what has been achieved by Communications without Borders; identify the contextual elements that allowed Costa Rica to develop the program; identify the basic requirements to replicate the experience in other countries of the region; assess the consequences of local access to information and communication technology (ICT); and draw lessons (positive and negative) from the experience.

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