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ICTs and Development, What is Missing?



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Abstract

A review of literature indicates that most approaches emphasize bridging the digital divide, an approach focused solely on material gaps. However, the digital divide is perhaps the last of many, preceded by social, educational, economic, knowledge, and motivational divides. This stems from an incomplete assessment of the underlying characteristics of Information and Communication Technologies for Development (ICT4D), which helps to perpetuate positivist approaches to technology deployment between social groups inside countries, as well as between countries. ICT4D is therefore seen as a misnomer that puts undue pressure on developing countries and neglects the responsibilities of actors in developed countries. The application of the notions of freedom, as presented by Sen and Stallman, in the analysis of ICT4D prompts for a more thorough consideration of the characteristics of technology being pushed for use in developing countries. This leads to the conclusion that common ICT4D approaches could reinforce developing countries' dependence on foreign actors and delay or entirely prevent the development of locally relevant and empowering solutions.

Keywords: ICT4D, Free Software, Development as Freedom

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1 INTRODUCTION

In the currently highly interconnected world all activities are interdependent, as proposed by Castells and Cardoso (2006). The question explored here is if the field of Information and Communication Technologies for Development (ICT4D) takes into account interconnections between the phenomena it seeks to influence, namely, the use of ICTs for development purposes in developing countries. How does the literature on ICT4D frame development? What concepts drive it? What is its focus when on the ground? Castells and Cardoso's questions "where, by whom, for whom, and for what purpose information and communication technologies are used" (Castells and Cardoso 2006) are the primary instigators of a review of literature to answer the previously presented questions.

Most articles on the role of Information and Communication Technologies (ICTs) state that it is no longer a question whether ICTs and Information Systems (IS) are relevant when discussing development. The questions currently being asked are related to the way in which ICTs and IS are relevant across different spheres (public, private, NGO) and sectors (education, health, finance, etc.) (Andersson et al. 2012; Thapa et al. 2012; Walsham et al. 2007; Walsham and Sahay 2006).

This begs the question if the ramifications of the increasing use of ICTs in developing countries under the current technological paradigms, legal framework, and underlying characteristics of the technologies being employed in extending ICT use (free or proprietary) are being taken into account. Let us first look at definitions of ICTs and approaches to ICTs in developing countries as a means to lead to the main point and discussion. The article is composed of four parts. The next section discusses common definitions, roles, paradigms, and issues studied in ICTs in relation to development, ending with a categorization of ICT projects in development. Section 3 delves into the different divides that compose the so-called digital divide, how these are affected by software paradigms, and how these paradigms have a direct effect on development for developing countries. The underlying characteristics of software are connected to Sen's concept of 'Development as Freedom'. Section 4 concludes the article by projecting the effects of paradigm choices from individuals, to organizations, to countries.

2 DEFINITIONS AND ROLES OF ICTS

Avgerou (2008:133) provides a definition for 'research in Information Systems' and another definition for 'IS innovation' in the area of Information and Communication Technologies for Development (ICT4D). In order not to repeat the same terms again and again, it would be simplest to add to that the most commonly used definition of what constitutes ICTs (Brown and Grant 2008:02), variants of which can be found in various articles on the matter (Akpan 2003; Cecchini and Scott 2003; Thapa et al. 2012). Avgerou's two definitions, and Brown and Grant's, can be put together as follows: "the pace and direction of the development and implementation of any technology that facilitates the production, gathering, distribution, consumption and storage of information, and concomitant organizational change". As Avgerou explains, her definitions do not necessarily entail original development of a previously unknown system or technology; technology may or may not be entirely new in a specific developing country setting; what matters is the adaptation of existing technology to that socio-economic setting, which represents an innovation in that context and entails some organizational reorganization. This implicitly takes into account the situation of developing countries, most of who do not develop entirely new technology but may adapt non-local technologies for their own purposes. We will return to this definition to clarify its implications.

Since the main subject of this area of study is ICTs and development, it is necessary to see how ICT for Development (ICT4D) is defined and characterized in the IS and ICT4D literature. Walsham and Sahay (2006:09) posed four questions to lead researchers working on ICT and development, of which two apply to the paper at hand (quoted):

- What is the "development" to which ICTs aim to contribute?
- What are the key issues being studied related to ICTs?

Therefore, the next sections answer these questions.

2.1 What is understood by development in ICT4D?

According to Byrne and Jolliffe (2007), Tettey (2000), Gigler (2011), and Akpan (2003), there are two views of ICT4D:

1. a positivist view that sees ICTs as basic tools and a direct relationship between ICT use and socio-economic development, and
2. those who see the lack of access to ICTs as a primarily social and economic divide that leads to a technological divide, and fear that social and economic inequalities powered by ICTs may exacerbate the difference in opportunities between and within countries, the "socio-techno" divide (Byrne and Jolliffe 2007:03).

However, all authors and both views agree that ICTs have become part of the daily lives of people for their usefulness and that their expansion in use and coverage needs proper study and accompanying policies.

The first view of ICT4D mentioned above is that ICTs can be used to bridge the gap between the haves and the have nots, distributing ICTs as a means to allow people to access information, communicate, decrease transaction costs, bridge the socio-economic and technological divide, and include more people in the market society that would allow them to reduce their poverty (Byrne and Jolliffe 2007). This is argued by some researchers and organizations, where there is at least an implied causal assumption starting with the introduction and spread of information and communication technologies, the subsequent massification and competition for the provision of Internet access, which leads to increased productivity, and finally to economic growth. According to this view (Bakay, Okafor, and Ujah 2011:26), effective ICT deployments are measured by "the capacity and opportunity to successfully integrate ICTs into the accomplishment of self or collaboratively identified goals"; "the implementation of effectively using ICTs would create "benefit" that could be derived from the precondition of "having access" to ICTs." (see the work of Bakay, Okafor, and Ujah 2011; Bilbao-Osorio, Dutta, and Lanvin 2013; Finquelievich 2006:109)

Two basic assumptions are evident in this stance:, 1) the origin and intrinsic characteristics of ICTs are non-important and, 2) ICTs are simple tools with no other effects on users or their social, cultural, independence, and economic status now or in future other than providing the means to reach goals. While this may be the case at a very basic level -of course it is better to have a telephone line to communicate with others far away than not to have one- there are several problems with this view.

According to Tettey (2000:60) technology transfer to and their adoption in most developing countries is based on a positivist stance which sees technological implementation as socially neutral phenomena. In this view, the knowledge and expertise to develop these technologies are an afterthought. This technologically deterministic view does not acknowledge linkages between "technology, knowledge, and their social environment". This stance perceives "organizations as institutions in which everybody understands, agrees with, and pursues a unanimously defined trajectory toward the achievement of a singular goal". A similar remark is made by Brown and Grant (2008), and can be seen stated in the work of Finquelievich (2006:108), explaining that oftentimes socio-economic development is treated as the dependent variable that changes according to the adoption of ICTs. Akpan also states that development is often seen as "the number of western-type ICT gadgets that each country has" (Akpan 2003:264). However, as Akpan himself explains, "there is not yet evidence that investment in ICT directly results in growth" (2003:265). Yet this positivist approach to ICT implementation has other additional shortcomings.

Evers and Gerke (2004:06) reflect on the usual view of the digital divide as it refers to social and economic differences among and within countries in relation to "opportunities to access information and communication technologies (ICTs) and their use of the Internet (OECD 2000)". This view equals *Internet access to access to locally relevant data (information) that can lead the users to knowledge*. This conception does not consider two very important factors: the first factor is the inaccessibility of locally relevant information

due to its location behind paywalls¹, which only the wealthy or connected can climb; the second, as explained by Pimienta (2011), is that without proper [digital] and informational literacy, access to information serves little or no purpose.

Byrne and Jolliffe (2007) and Silva and Figueroa (2002), indicate that globalization leads to inequalities because the globalized world exists thanks to a network that connects dominant segments of the world population. To explain this in few words, information and knowledge are developed on the basis of exchange of the required data, information, and knowledge, which in turn is done among people who either are already part of a network that allows this exchange or have the necessary monetary capacity to enter the network (which is related to the aforementioned paywall). This logic leaves out those without the means to access the network. In this view, ICTs are not the cause of exclusion of the underprivileged sectors of societies; rather in the direction pointed out by Pimienta (2011), it is the social divide and subsequent economic divide which causes the underprivileged to lack access to an education that would enable them to make use of ICTs. Pimienta's idea is that ICTs "are the catalyzing and facilitating factor for deep changes that the society needs and that should occur independently of the existence or the presence of ICT" (2011:39). However, for Pimienta's view of ICTs as catalyzing and facilitating factors to be so, several changes must be factored in ICT deployment.

According to Akpan (2003:263), drawing from Frank and Dos Santos, unequal power relationships leading to unequal economic and technological development opportunities are the cause of continuous dependence and underdevelopment. While this view had been somewhat abandoned, Akpan provides arguments regarding the underdevelopment of South and sub-Saharan countries, pointing at five factors that contribute to continued underdevelopment: foreign debt crisis leading to restructuring processes, adjustment policies promoting export-oriented growth, over-reliance on primary commodity export and lowering selling prices, a lack of industrialization due to an over-emphasis on export-orientation, and finally a disconnection from what Castells conceptualizes as the network society. Akpan continues his argument saying that well into the 21st century, some countries are still struggling to participate in globalization without failing to meet the needs of their citizens.

While debating these arguments is outside the scope of this article, it is worth noting that only one of the aspects of development mentioned by Akpan slightly touches upon the problem of knowledge and technology: Industrialization and communication. Industrialization and communication rely on knowledge, and knowledge relies on information and the chance to discuss experiences with other knowledgeable people, so lack of one means a lack of the other. Additionally, in order to access knowledge that leads to industrialization one needs to be connected in Castells' terms. In this and other ways much too broad to include in this article (see the articles by Evers and Gerke, and Byrne and Jolliffe) "the knowledge gap [and the digital divide] is constructed in such a way, that it cannot be closed" (Evers and Gerke 2004:08).

1 Paywall here refers to the cost of accessing scholarly materials as available in scientific journals. Some recent prominent cases are the memorandum of the Library of Harvard University (Harvard Library 2012), van Noorden's article on The Future of Publishing by Nature (2013), and also the aftermath of Aaron Swartz's trial (Holpuch 2013). See also a short discussion in Marshall (2006:587).

2.2 What are the key issues being studied in relation to ICTs?

Several authors have categorized the research on ICT for development, based on the researchers' theories and foci.

Many researchers and articles apply Sen's capabilities approach, analyzing development as the enhancement of human freedoms -and how ICTs can play a role in it (Andersson et al. 2012; Thapa et al. 2012; Walsham and Sahay 2006). Thapa et al. add the term collective capabilities to Sen's individual freedoms, arguing that individuals, especially in developing countries, seldom have enough independence and means on their own to achieve their desired goals, and need to make use of social networks and collective bargaining power (Thapa et al. 2012). In this view, individuals form groups of interest that allow them to reach goals that could be unattainable individually (such as in labor unions). Resource pooling prompts individuals to be active participants in decision-making -the focus lies on how ICTs enable people to come together and make decisions as a collectivity (Thapa et al. 2012). When individuals join in decision-making, they grant the group greater organizational power, which in turn gives every individual more freedom.

Other researchers see development as the expansion of infrastructure and distribution of ICTs, coupled with intensive training in technology use (Silva and Figueredo 2002). Along these lines, other researchers focus on the use that ICTs are given within organizations such as banks or government agencies, and how these enable them to save costs and time. Another commonly studied aspect of ICT use is the increase in human capital that allows companies in developing countries to engineer systems for companies abroad, bringing in revenue that causes a trickle-down effect. For a more comprehensive review of topics and methods, see Walsham and Sahay (2006), as well as Andersson et al. (2012). Based on several reviews, Avgerou (2008:135), and Byrne and Jolliffe (2007:05-06), have categorized research on ICT and development. While their categorizations are somewhat different, both categorizations can be conjoined, as follows:

1. IS in developing countries aiming to emulate and catch-up with IS in developed countries - [focus on infrastructure and economic growth]
2. the construction of new structures in developing countries and locally adapted IS - [focus on the social embeddedness of technology, and the provision of services especially by government to citizens (G2C)]
3. implementation of IS innovations to improve living conditions in the face of a "global socio-economic order" focusing on the "processes through which IS innovations leverage[s] socio-economic change" (Avgerou 2008:135) - [focus on the transformation of society and technology]

Leaving the categorization of development as being either economic, socially embedded, or socially transformative, Brown and Grant (2008) turned their attention to a greater division of the field.

2.3 ICT for Development or in Developing Countries?

Brown and Grant (2008:07), based on the review and categorization of literature presented by Walsham and Sahay (2006), proposed a further categorization of research in the field of ICT with regards to development. In their view, research had been divided in four main areas (quoted):

1. understanding the link between ICTs and development;
2. understanding the cross-cultural and multi-cultural implications of ICTs;
3. understanding the notion of local adaptation and how developing countries appropriate ICTs;
4. understanding how ICTs lead to the development and prominence of marginalized groups.

Following a review of 185 journal articles, Brown and Grant concluded that research on ICTs in the field of development can be recategorized by rearranging the four main areas above. They divided them as follows:

1. ICT for Development: 1 and 4, understanding the link between ICTs and development, and how this development leads to the prominence of marginalized groups)
2. ICT in developing countries: 2 and 3, understanding the cross- and multi- cultural implications of ICTs and the link between adaptation and appropriation.

In their view, previous categorizations did not differentiate between ICTs used for development purposes (ICT4D), and ICTs used in developing countries (Brown and Grant 2008). To further clarify this: articles in groups 2 and 3 (*in* development) discussed either the problems found when using ICTs for the first time in private organizations such as banks, or how software development outsourcing could be problematic when the company outsourcing shared no common cultural traits with the company doing the outsourced work; articles in group 1 and 4 (*for* development) discussed how a specific technology could be used to connect poorer populations across physical distances.

Furthermore, their findings suggest that there is more research pertaining to in developing countries than there is pertaining to for development. Indeed, many of the articles reviewed by Brown and Grant focus on the use of ICTs in governments, banks, private organizations, etc. According to the authors, establishing clear lines between in and for, can help differentiate the problems that exist in one domain from the ones in the other.

2.4 Paradigms in ICT and Development

Pimienta, in calling for a focus on ICTs and how their implementations can offer long-lasting development, presents a distinct view of ICT and development. He bases his views on analyses of the approaches of projects and programs of ICT4D. Many critics of ICT4D criticize the oft used approach of disseminating computers and expecting users in developing or poor areas to just use them, access market information, and live better

lives. This approach often fails to consider that there might be a need for proper tutoring in using the technology or adapting the technology to the local settings (2011). Pimienta states that the main problem in ICT4D lies in both the focus and the perspective of the problem. Starting with the focus, Pimienta states that there are three possible foci for ICT4D, quoted with added emphasis (2011):

- An approach **based on technology** has every possibility of ending in failure for both policies and projects.
- An approach **based on contents** and applications will guarantee products but may fall short when it comes to the desired societal changes.
- An approach **based on a paradigm shift** is the key to success in obtaining a positive societal impact.

The paradigm shift to which Pimienta refers, is a change of focus in ICT4D from deploying technology to focusing on education, literacy and knowledge sharing for ICT4D. This leads to Pimienta's concept of perspective, which refers to a failure in differentiating between

- lack of access to ICTs for economic reasons, and
- lack of access to ICTs due to social factors that impede both the economic conditions to acquire ICTs and the educational factors that determine what use ICTs are given.

From here, Pimienta develops the concept of multi stakeholder partnership, referring to making decisions regarding the development, education for use, and implementation of ICT4D taking into account not only technology, but also content, and the input gained from observing the conditions and desires of the recipients of ICT4D.

According to Pimienta, ICT4D projects usually allocate funds in the following way (2011:36):

- Infrastructure of ICT: hardware and software that emit, transmit, and receive signals, both on the emitting and receiving end, and in the middle.
- Infostructure: the data and information made available over the infrastructure, as well as the communications that take place over it.
- Infoculture: "the sum of knowledge, methods, practices, and rules of good conduct that the people possess when they have appropriated the use of information and communication networks" which requires a previous process of "digital and information literacy as well as practice of uses relevant to these people".

To clarify this, Pimienta (2011:39) states that approaches to ICTs can be put in one of the following three categories:

1. ICT for the sake of ICT: there's an implicit belief that once the infrastructure is installed (computers and fast Internet access), a bottom-up process will emerge locally.
2. ICT for Development: ICTs are tools that allow specific content dissemination and application to produce real tangible "development" to occur.

3. ICT for Human Development: ICT4HD "focuses on infoculture, cooperation, and participative processes" acting as catalysts for processes "that should occur independently of the existence or the presence of ICTs"

2.4.1 ICT for ICT, and ICT for Development

Examples of the first item of the list above can be found in the approaches espoused by Bakay et al. (2011), and the World Economic Forum's Global Information Technology Report (Bilbao-Osorio et al. 2013). In this view, what makes a society more competitive is the readiness (infrastructure, skills, affordability), the use (individual, business, government), and the impacts (economic, social). The social impact is reduced to the equation $affordability + access + use = participation$; a country's readiness is measured by the digital divide, whose solution is equally formulaic as $affordable\ high\ speed\ Internet + affordable\ ICTs + push-button\ learning^2 = readiness$; benefits are $affordability + access + use = lower\ costs + more\ benefits\ accrued$. Within this framework, there is no regard for the intrinsic characteristics of technologies, nor for the potential threat represented by the model.

Examples of the second item of the list above can be found in statements by Fraser-Moleketi and Kran, who affirm that "the affordability, accessibility and networking outreach of ICTs" "allow local stakeholders to meaningfully participate, including reporting violence, human rights abuses, electoral fraud, or other violations of rights", "which can help governments become better listeners and more agile partners in sustainable development efforts" (2013:24). While that statement is succeeded by a recognition that the use of ICTs must be underpinned by a participative and human rights based approach, not endorsing the deploy ICTs and leave/ it will work approach, what is missing is a critical analysis of the underlying characteristics of the technology that is to be deployed and used in the approach.

Brunello (2010) discusses and criticizes a very common donation approach to ICT for education implemented in developing country settings. He indicates that oftentimes development consists in donations of equipment instead of training because it is easier to account for the effects of material donations, while it is harder to show evidence of training and educational efforts. His main point is the lack of training to use and maintain technologies that are implemented in developing countries, a situation entailing constant need for outside technical assistance. This has a direct effect on the choice of technology being donated, which needs to be easily deployable and employable and should require little learning. Brunello cites three effects of the donation approach to ICTs (quoted)³, to which I add the last, number four, to make the case of this paper:

2 Push-button learning refers to knowing what button to push in a machine to get the desired results, but not knowing how the machine works. While it may be argued that due to ample variety of technology available nowadays, most users operate at a push-button level. However, this should not be used as an excuse to perpetuate closed technology. This will be discussed below.

3 See also Engineers Without Borders' "Support an African Spreadsheet" (2013).

1. it reduces the project management commitment to ensure a beneficial use of technology in everyday teaching practices;
2. it tends to prefer the use of simplistic objective indicators (i.e. ratio computer to pupils, number of hours the school's computer room is open);
3. it treats technology use as a subject in itself, rather than as a teaching and learning enhancer to serve other disciplines (similar to Tettey's critique).
4. it does not question the nature of the technology being used, nor the requirements for full ownership (legal and others) (it does not question the nature of the technology being used, if it's free to study, modify, and distribute.)

In the same lines, Brunello argues that the donation approach has effects on education, where the aim is to teach students how to use the given technology, not to develop the capabilities to understand how it works inside. Even when the intention is to provide ICT access to populations with little access and knowledge, opting for an approach that is as automatic and closed as possible only means that when something stops functioning, outside expertise will be required again; however, oftentimes the available expertise will be in another country, or in the best of cases in a nearby city but still out of immediate reach (2010). In this regard, Brunello defines sustainability as "the permanence of a flow of benefits within the system, after the development project has ended and the external funding is extinguished" (2010:234). This definition clearly calls for a clearer view of what is meant by ownership, and also requires an analysis of the technology being employed to see if its intrinsic characteristics allow this. This will be discussed in the main part of the article.

2.4.2 *ICT for Human Development*

Few authors represent Pimienta's third view. These take into account the situations in their respective country of analysis, contextualizing the implementation of ICTs according to the needs of the population. Akpan sees the push to adopt ICTs in developing countries as a neoliberal approach that benefits mostly the segment of the population that has a "certain level of Western education" and serve foreign economic interests, while the other sectors that live on more traditional means see either their ecosystems destroyed or the population further divided between those who can adapt and those cannot (2003:272). In the same line, Madon proposes measuring the impact of ICT and connectivity dissemination in terms of "contribution to social progress" and not in terms of "sheer number of connected individuals" (2000:99). Avgerou, in her review of several articles on ICT in relation to developing countries, has stated that there is a need for further analysis of 1) the success of scaling up small ICT projects that are usually successful among few participants but may not work otherwise, 2) the study of specific combinations of software and hardware, and 3) the use of free software in developing countries, among others. Thapa et al. highlight that little is known about how technology affects social processes such as the formation of social capital and the development of Sens' capabilities from a collective social point of view (2012).

Something that is missing in the previously mentioned studies is the analysis of the characteristics of the technologies employed in these developing country settings. While

Rajendran and Venkataraman (2009), mention the use of Free and Open Source Software in community development in the use of telecenters in India, it is done from a cost saving perspective and emphasizing the malleability of the software from a technical perspective that reads more as a report. Bailur also conducted research on telecenter projects, with stakeholder theory, again, without analyzing the intrinsic characteristics of the technology used in the telecenters (2007). James (2003), in his analysis of ICT use in developing countries, focuses on Free Software and describes its some of its intrinsic characteristics but also from a cost-saving perspective. However, in contrast to most articles, he also focuses on the phenomenon of path dependency -how early adoption of a system means stronger preference for it later due to increased use by other technology developers, even when other systems provide improved technical characteristics- and the role of so-called piracy in leading to vendor lock-ins⁴.

Tab. 1: Paradigms in ICTs and Development. (Adapted from Pimienta, 2011 – changes in parenthesis)

Approaches	ICT4ICT	ICT4D	ICT4HD
Starting Point	access (to ICTs)	Information	Knowledge.
Extent	specific	general	Economy
Economy	consumption	use	production
Evaluation	results (number of people using ICTs, number of hours of use)	use (what use people give to the technology they access)	impacts
Project Management	results	products	process
Modalities of implementation	top down (authorities decide)	consultation (stakeholders are consulted)	participation (stakeholders and users try, decide, implement, and modify ICTs according to their needs)
General (focus)	technology	application	paradigm

To summarize his points regarding focus and perspective, Pimienta provides the explanatory chart above (2011, changes in parenthesis):

4 Vendor lock-in refers to the continued use of the products of a provider of technology due to having acquired in the past one or more of its products that are useful but incompatible with other technologies. One continues to buy from the same seller because changing systems would be expensive either in terms of time (converting file formats, learning curve) or money (purchasing conversion software, hiring experts), or because it may even be impossible to convert previous work to new formats.

2.4.3 Reaching ICT for Human Development

According to Pimienta (2011:41-44), in order to move past the paradigmatic divide between ICT4ICT and ICT4HD, it is necessary to overcome 11 hurdles:

1. the physical access hurdle requiring the installation of the necessary hard infrastructure;
2. the access and money hurdle referring not only to geographical coverage but also to the purchasing power divide between populations and their wages (local wages, global prices);
3. access sustainability, related to a sustained access to resources overcoming equipment breakdown and software updates (related to Brunello's definition of ICT sustainability);
4. access to basic literacy, meaning the basic capabilities to decipher the accessible data to use it as information and turn it into knowledge;
5. linguistic localization refers to the existence of hardware, software, and content available in one's mother tongue;
6. actual use refers to the ability to make effective and efficient use of ICT tools in relation to the environment where one lives;
7. technological ownership, proper ownership of the technology to the point where it becomes a tool and does not stand between the user and the goal;
8. meaningful use, the technology becomes truly useful to achieve development and communicational goals, users are not consumers but actual producers;
9. social ownership hurdle, understanding the societal impact of ICT use;
10. empowerment, the capability to change the social reality of a group "through social ownership of ICT";
11. social innovation, refers to not merely adapting to local or foreign changes but also to develop locally-contextualized previously unavailable methods, practices, objects, etc. (this stands somewhat in contrast to Avgerou's definition of ICT implementation)

According to Pimienta, the digital divide is simply a mirror image of the social divide. Simple access to ICTs cannot and does not ensure ICT use, especially for human development. For that purpose, digital education and information literacy are the required tools. While hardware and software are obvious prerequisites for information and communication technologies for development (ICT4D), "the true pillars of human-focused information societies (or societies of shared knowledge) are education, ethics, and participation interacting together as a systemic process" (2011:33). One important term used by Pimienta is "societies of shared knowledge".

Considering that ICTs are both seen as positivist tools and as necessary in both the developed and the developing world, it is necessary to analyze their intrinsic characteristics. Given the great changes that have taken place in ICT development and their infrastructure in the past decade, the next part will address perceived short-comings

in the literature, and in the experience of the author, in every discussion of the role these play in everyday life within and without academia.

3 A CRITICAL LOOK

3.1 The Digital, Social, and Technological Divide

There is a growing recognition that the digital divide among developed and developing countries is a greater divide than simply a gap in access to ICTs (Byrne and Jolliffe 2007; Marshall 2006). However, it is at most presented as a socio-economic/socio-techno divide, where it represents the divide between a population that has the necessary education, opportunities, and economic power to buy their access to ICTs (in most cases computers) and ICT-enabled services (read: Internet/software), and those who do not have these enabling factors. Due to a growing number of educational and economic opportunities being open to those who already have access to ICTs via their use, the section of the population without access to them only becomes poorer. This is exacerbated by the fact that technology changes, and those with barely enough access constantly need to play a costly catch-up game not to be left out of what little chance they may have to ride the ICT wave. However, even this view seems limited.

As exemplified by Kalvet (2006:182) in his study of ICT use in Estonia, not all those who may be able to afford ICTs are interested in them or buy them. In his study, he found non-ICT/Internet users to be composed of 1) "passive people" aged 50 and above for whom computers have never been part of their lives and who prefer traditional communication means or have no interest in learning to use a computer, and 2) "blue-collar" workers for whom the use of ICTs offers no advantages and in front of which they feel powerless but would learn to use them if it meant a rise in income. van Reijswoud and de Jager (2008) refer to the economic capacity to acquire ICTs but the lack of knowledge to use them as the knowledge divide. While these people may represent a problem in the long run, while their jobs exist and they continue to make a living, their disinterest in ICTs would not seem to be a major problem. The opposite of this scenario would not be hard to imagine, that is, a person who cannot or can barely afford ICTs yet may already have the tools necessary to master their use⁵. However, even this categorization of the digital divide would not be complete.

A more complete view of the social, economic, knowledge, and technological divide would have to take into account something that is usually left unscrutinized and that seems to be treated by most as irrelevant: the intrinsic characteristics of the technologies being pushed or already implemented and what effects these have on the economic, social, technological, and knowledge divide. While there are some articles that do deal with the intrinsic characteristics of technology, notably a short paper and presentation by Schiesaro (2008) and the book by van Reijswoud and de Jager (2008), most others do so from the perspective of how much money certain technologies can save in developing country settings or how malleable they are. What is not usually discussed is how the technologies themselves allow or disallow actual empowerment of users everywhere, not just in developing countries. It is the view of this author that no discussion of the divides would be complete without duly noting this seldom discussed factor.

5 This is the case of a relatively poor Paraguayan student who has only had access to a One Laptop per Child computer yet learned to program in it (ABC Color 2011). Another more recent case is that of Leo The Homeless Man (Moss and Libetti 2013).

This factor refers to the freedoms that a technology allows its users to have in relation to owning, instead of merely renting, the technology they use or are forced to use, and consequently the freedoms that the technology grants the users to understand it and modify it at will and as needed. Once these freedoms are taken into account, a completely different picture of ICT for or in development emerges and several questions arise. Do the technologies used in ICT4D deployments allow its users to own the technology and modify it at will? How does this relate to users' freedom to adapt systems to their needs? If the technologies do not allow users to modify them as needed, who interprets the needs of users, and who is allowed to make changes when the needs arise? How does this affect the dependency of the users in relation to the makers of technology? How would this affect the future of users considering current trends in ICT development?

3.2 Software Freedoms and Interdependence

Few if any articles have discussed the relevance of Free Software (FS, also commonly referred to as FOSS⁶) in development (Walsham et al. 2007; Walsham and Sahay 2006), and those who have touched upon it have not discussed its intrinsic characteristics in relation to development (James 2003; Rajendran and Venkataraman 2009). As mentioned earlier, the exception can be found in Schiesaro (2008) and van Reijswoud and de Jager (2008), yet some aspects are left uncovered. In at least one case, the definition provided for free software lent itself to confusion, as in the case of Walsham and Sahay (2006)⁷.

The adjective Free used in the context of software refers to computer programs that grant the users a set of four fundamental and indivisible freedoms, as follows (quoted from Stallman 2013):

- The freedom to run the program, for any purpose (freedom 0).
- The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

It is necessary to clarify that computer programs are not written directly in ones and zeroes, but rather in human-readable languages that are later translated to computer-

6 The movement that upholds the four freedoms is divided in two camps, the Open Source Software side and the Free Software side. This article will only refer to the four freedoms and to Free Software; the reader is advised to read about both by reading William's Free as in Freedom, Chapter 11 (Williams 2002).

7 On page 12 of that article, the authors call for more research to be done on Free Software and on Open Source Software, stating that Free Software licensing may allow the use of the software at no cost but without providing the source code, which is almost exactly the opposite of what the term Free Software actually means.

readable code. Once a program is written and turned into machine-readable code, the machine-readable version is almost impossible to decode back into human-readable language. The human-readable version of a computer program is called 'source code', while the computer-readable language is called binary package. Software that does not respect the four freedoms is called proprietary or non-free software.

Proprietary software represents a risk that would more easily be understood by using an example from another field. Paying taxes in any country is done on the basis of clearly established rules that are accessible to anyone; while they might not be easy to understand and may require some experience and studies to do the necessary maths, the rules are accessible to all who want to fill their own forms. Most people do not fill their own forms to pay taxes and decide it is easier to hire an accountant to do it for them in time and form. However, it is also good to know that if one accountant does not do their job properly or is divulging personal information to others without one's consent, one can always hire another accountant to continue the work where the previous one stopped; and the next accountant can continue the work of the previous accountant because the rules and forms are accessible and universal. What is more, if a non-accountant who had no chance to attend school has access to the laws and regulations and is good at calculating, they could either fill their own forms or help their friends do it. Most people, if not every one, would not feel very reassured if one or both of the characteristics of submitting tax forms were to disappear, that is, if the rules and equations that govern what percentage of earnings are taxed were to be handled in secret by the government or a corporation without giving anyone any access, and if one could never change one's accountant no matter how badly they did their job or every accountant told everyone about one's personal affairs⁸.

This analogy opens the floor for the discussion of the intrinsic characteristics of technology and how they affect all users, irrespective of country of residence. It is safe to assume that everybody would prefer the first situation (accessible rules and equations, interchangeable accountants), as this would represent a world where accounting is actually a service and not a hidden mystical lore; a specific accountant's advantage over others would be the quality of their work, their dependability, and their staying updated with all changes and updates regarding tax laws. What is more, an accountant could help another accountant or a non-accountant friend and everyone would be better off. Fewer people would be at ease if they had to just trust someone else to be responsible and honest to do the calculations, dictate the rules, and handle their private information at will without any explanations; this would mean that one would be helpless in accounting matters and would depend on unverifiable methods of accounting, not on a service but on secret recipes.

This last scenario is representative of the situation users face when using non-free software. It is this scenario that should be factored into the discussions about ICT deployment in or for countries, without distinguishing between developed and developing. Most computer software distributed with new computers and or sold on the shelves fall under the category of non-free software. This means that users everywhere,

⁸ This example is based on a post by an Ubuntu user (lykwydchykyn 2009), to be found under <http://goo.gl/Ky1lrr>.

both in developed and developing countries, trust their every day computing (word processing, spreadsheet calculations, statistical analysis programs, Internet access, email) to software they have no legal right to scrutinize, software that could potentially do with their data and personal information as their coders wish.

Users of non-free software are legally helpless in the face of software they are forced to use, as it normally comes bundled with the computers they purchase. As James (2003) explains it, the fact that non-free software comes bundled with computers plays a role in their increased use, as users are either unaware of the existence of other free options because they do not need to choose one when buying a computer, or they have used the bundled systems for so long that changing systems would require extra time or effort they do not have or want to invest.

Having clarified the concept of freedom in software, it should be added to the discussion of digital, social, technological, and knowledge divide.

3.3 ICTs and Relationships between Countries

Several authors and programs view ICTs as tools that can allow countries to leapfrog from their current state of development to another state of development that usually implies better access to local and foreign markets, participation in decision-making, and improvement of education levels due to access to information. While it is outside the scope of this article to debate whether or not these should be the aims of development, what is contested is the positivist push-button approach to technology deployment. As development plans push for the deployment of ICTs in developing countries, they fail to acknowledge several problems entailed in this approach.

The first problem that comes to mind is the acceptance of ICTs by people who have not had them before. It would be accepted perhaps as a sign of establishing some link to people outside the community or with other cultures or accessing basic information related to economic benefits, none of which is intrinsically bad. However, as Brunello indicates sustaining those ICT implementations can be hard due to costs and lack of locally available technical expertise to solve problems as they emerge (2010).

"Applying IS to development requires an understanding of local meanings, existing work practices, and institutional contexts, as well as a willingness to engage with the dynamics of socio-technical change over time." (Walsham et al. 2007:322) In this regard, Cecchini and Scott (2003) and Bailur (2007) also point out that applications developed bottom-up together with the users of technology are more appropriate to local conditions and are better received, while technology that is alien and needs a period of adaptation tends to fail. This is because locals know more about their "needs, circumstances, worries, and aspirations" (Cecchini and Scott 2003:81), and would demand a system that addresses those needs from their own perspectives, rather than solutions developed from the perspectives of those who do not share their living space and conditions. This is directly related to the concept of knowledge divide; once people play a part in developing the systems they need, they also build the necessary knowledge to maintain it.

Software developed outside the context of application may not reflect the logic of use of the target culture or target users (Walsham et al. 2007), rendering it less useful or in the worst of cases useless. As Brown and Grant state it: "technology, as a socially constructed artifact, is necessarily ingrained with the cultural, political and social predispositions of its creator" (Brown and Grant 2008:07). This situation necessarily leads to choosing one of two paths: a) "cultural transfer and mutual learning" (Walsham et al. 2007:319), local adaptation of the IS/ICT system if permitted by law, b) or a complete rejection of the system. The last option may not even be viable where organizations have either paid high amounts of money to acquire a system, or where the system is a donation which cannot remain unused for a variety of reasons (see Brunello 2010). While the social divide could be widened or bridged, depending on the approach, cultural adaptation of ICT systems could also indicate the existence of a cultural divide.

Beyond the lack of local technical skills and into the political predispositions mentioned by Brown and Grant, the problem of dependency to foreign-made ICTs worsens in light of international agreements that bind developing countries to pay royalties for ICT use. As James (2003) explains it, it is often the case that people in developing countries are unable to afford the cost of software and therefore turn to freely available illegally copied non-free software -which is often called by the misnomer "pirated software"⁹. Not only is this easily available to almost everyone, but it also reinforces several attitudes and future commitments (Byrne and Jolliffe 2007; James 2003):

1. Since non-free software comes bundled with new computers, others without access to newer hardware and its bundled software easily copy and use newer non-free programs to catch-up with others.
2. Since software comes bundled with computers and seems to cost the new owners nothing as it is embedded in the price tag, it lures other users to also use the system for compatibility reasons.
3. Illegally copied software, due to its widespread availability, fosters early adoption, increases habituation, and forces developers of related technologies to develop their applications for said widespread system.

The future commitments stem from the three points above. Since most people use the same system, the government uses the same system, and companies do as well. Once illegally used non-free software is widespread, countries are required to police its use and introduce measures to ensure that people pay the required royalties for their use, as is required in agreements with the World Intellectual Property Organization via Trade-Related Aspects of Intellectual Property Rights (TRIPS)¹⁰ (for a more complete picture, see Byrne and Jolliffe 2007). In this way, the power structures that exist in developed

⁹ In the view of the Free Software movement, the term piracy is a misnomer that gives the impression that what is being copied is being physically stolen as if it were a finite good. Since software can be copied without physically disappearing, the preferred term is unauthorized copying (Free Software Foundation 2012).

¹⁰ Another term that is to be avoided is Intellectual Property; as explained by Stallman, this term is a misnomer that seeks to integrate three completely different laws - copyright law, trademark law, and patent law- into one umbrella term with the intention to cover any portion of technology with strict restrictions. See (Free Software Foundation 2012).

countries are extended to developing countries. It could also be argued that there is an additional divide here, namely a legal divide between countries who have instated organizations such as the WIPO and agreements such as TRIPS, and those who could be seen as being on the receiving end of their policies.

3.4 The push-button approach

Another problem that is not identified in the ICT and development literature is the increasingly popular push-button approach to technology education. Technology that works at the push of a button would not be a problem at all if it were not for the fact that most technologies that work in this manner are also non-free. Users anywhere that become used to push-button approaches to technology under a non-free system would be in a double danger: they would not be able to solve their own problems once a piece of technology fails to do its intended job, and they would not know the real capabilities of the technologies they are paying to use.

Another less-reassuring aspect of push-button technologies is that they are increasingly dependent on so-called cloud computing. While this term does not have a very fixed meaning, it is used in at least two ways (Free Software Foundation 2012). The first is the use of the cloud to mean the storage of files in remote computing facilities owned by non-free software developers. The other use of the term is in Software as a Service (SaaS), which means that a company offers the user the possibility to run programs remotely and simply display the results of the computing in the user's screen, with the added possibility of also storing the results with the service provider.

While this may seem useful under certain conditions, the increasing push towards cloud services undermines the freedoms of the users. First of all, storing files with non-free software providers exposes the users to surveillance and may also allow the service provider own the users' data. Second, these services prevent the users from understanding how the computing is done, which means users put their data in a black box whose inner workings may do what the service says it does but may also use the data for other purposes.

This has far-reaching consequences for one of the most common buzz words in ICT and development: appropriation. Appropriation is often used to mean the comprehension of the benefits of sustained use of ICTs and its actual occurrence. However, under non-free systems and even more under non-free and remote systems, one could never speak of appropriation.

The push-button approach infringes on freedom 0 by giving users a limited set of options regarding what they can do with technology, so users are not free to use software as they wish but only as others wish. Since the code that does the computation cannot be reached by the users, users are not free to study and modify it because it is physically inaccessible; this infringes on freedom 1 and 3. Remote push-button technology may prohibit users from sharing their acquisitions, infringing on freedom 2. Under these constraints, there is no ICT appropriation but only ICT habituation. The concept of appropriation should necessarily entail the four fundamental freedoms.

3.5 Burden of Action based on Leverage

Given that makers of non-free software seek to extend their power relations as explained by Byrne and Jolliffe (2007) and James (2003), and considering their economic powers to do so, it cannot be expected that top-down approaches will encourage users to turn their attention to Free Software. The change should come from the bottom, although not as expected from the developing bottom, but from the developed bottom.

A large difference between developed and developing countries in the use of non-free software is the cost of acquiring it. As van Reijswoud and de Jager show, it costs the average person in the developed world much less in terms of hours of work to acquire non-free software than it would cost a person in the developing world (2008:25). This lower cost in access makes it impractical for the average user in developed countries to pay attention to what system they are using, be they free or non-free; and this applies to access to scientific information in the form of journals as well. Given that most users of ICTs, the Internet, and scientific journals are still in developed countries, and that the use of non-free systems does not affect them much in economic terms, they affect the path dependency of the rest of the world by maintaining a lax attitude towards the lack of freedoms.

At first thought it seems logical to say that "ICT in education is particularly important in developing countries" (Marshall 2006:xxvii); this view is also supported by the UNESCO (2013). At second thought, it is almost patronizing to think this way considering how little the average person in developed countries seems to know about free and non-free technology, as indicated by van Reijswoud and de Jager's report (2008). Perhaps it would be better to approach the subject as Education in Technology in schools and universities all over the world.

In a similar vein, Marshall (2006:xxvii) states that "Higher education in Africa is tasked with the duty of creating the capacity for sustainable development and the democratization of knowledge." While at first sight all is well with this view, it again neglects the responsibilities of those who actually currently have the power to change the status quo in democratization of knowledge. This becomes evident in the Aaron Swartz case¹¹ and in movements that recognize the increasing costs of scientific publication and the limitations of Digital Restrictions Management that are slowly but surely making their way into academic life everywhere¹². It cannot really be expected that developing countries start a Free Software and Free Knowledge change with a large impact on the rest of the world with little leverage, considering that the largest libraries of knowledge remain behind the paywalls of publishers in developed countries and under non-free conditions.

¹¹ The Aaron Swartz case refers to the incident that led to the passing of a bill in the United States in 2013 that makes the results of science funded with public money freely accessible to all. See Holpuch (2013).

¹² See footnote 1, on page 3.

3.6 Sen's Development as Freedom and Software Freedom

In the view of Sen (2011), development consists in removing the unfreedoms that prevent people "from exercising their reasoned agency" (2011:xii) and expanding those freedoms that do allow them. The freedoms and unfreedoms are limited by a country's social, political, and economic decisions. Freedoms may be exercised collectively or individually, but they require social commitment. Therefore, development in terms of ICT use should also enhance people's freedoms. The social commitment necessary must come from all sectors of society, not just the bottom that is seen as needing it the most. As stated earlier, change requires leverage, and that leverage can be found mostly in those with the most access to means and knowledge.

The enhancement of freedoms also directly depends on opening decision-making processes to the people and allowing them to scrutinize the process and the decisions. In Sen's view, development should be assessed on the basis of it 1) enhancing the freedom of people, and 2) ensuring that that freedom enables people to exercise their reasoned agency. Exercising reasoned agency in participation in decision-making requires "knowledge and basic educational skills" (2011:32) (albeit in inverted order). Denying these two requirements "is immediately contrary to the basic conditions of participatory freedom" (2011:33). In the case of ICTs in development, it would mean respecting the freedom that users should have regarding the tools they are required to use.

In many positivist views of ICTs as development tools, it is not hard to see what Sen calls "the Lee thesis" (2011:15); the thesis consists the denial of freedoms to people in exchange for rapid economic development. This is especially so in approaches that push for fast and massive adoption of ICTs without considering its consequences. A push to adopt non-free ICTs would further strengthen people's dependence on those who are currently in a position of power to dictate what freedoms they may or may not have. Development as freedom entails "implications not only for... ..[the]... ..objectives of development, but also for processes and procedures that have to be respected" (2011:33). The process of ICT deployment in development would be strengthened by the four freedoms, which require that users learn about the freedoms they have to manipulate the platforms as needed.

The reason for a strong focus on freedom is that "freedom enhances the ability of people to help themselves and also to influence the world, and these matters are central to the process of development" (2011:18). Software Freedoms 1 and 2 speak directly about this; the freedom to study how a program works allows one not only to help oneself by learning and improving as a person, it also allows one to help one's neighbor, either directly or indirectly. Indeed, I would argue all of science that is used in any way directly by people or indirectly on people should be steered by the four freedoms to ensure that the freedom of some to pursue profit does not limit the freedoms of others to help themselves and their neighbors. This seems almost impossible in a non-free system.

Some may argue that allowing people these freedoms over ICTs would be almost unnecessary because few would actually take the freedoms and make the necessary modifications to whatever ICT systems they may use. However, there are already sufficient reasons not to follow this view in the accounting example provided above; in addition, as Sen puts it, even if people decide not to make use of the freedoms available to them, it would still be a deprivation "to be left with no choice on these matters" (2011:37).

In the case of ICTs however, the lack of freedoms would not only affect the poor, but the middle and rich, as no one would have freedom to exercise reasoned agency. Freedoms in development should likewise not be limited to the freedom of making profit thanks to the use of tools; freedom should include the possibility of understanding tools and improving them. And if one has this freedom, by definition, all others have this freedom as well.

It becomes clear from this that developing countries need not be seen as "passive recipients of the benefits of cunning development programs" (2011:53). What is needed is education to introduce and enhance freedoms, as well as the establishment of organizations and institutions that support and enhance them continuously. As Sen puts it, "freedoms of particular... ..kinds promote freedoms of other kinds" (2011:xii). Given a comprehensive and sustained environment of freedoms, "individuals can effectively shape their own destiny and help each other" (2011:11).

4 CONCLUSION

It can safely be concluded from this review and reflection that not all actors understand the ramifications of their actions and groups on other fields. Most articles on ICT, whether in or for developing countries, do not cover many interdependency issues. There also seems to be a common belief that ICT4D is only relevant to developing countries; however, ICT users in developed countries are also affected by the intrinsic characteristics of ICTs, and they have a great role to play in how ICTs are deployed in other countries.

Three ideas presented here need to be put together. First, Byrne and Jolliffe (2007) and the Free Software Foundation indicate a rising trend in the restrictions put on the use of technology by Intellectual Property Rights (IPRs). Second, the findings of van Reijswoud and de Jager (2008:25) indicate that it costs the average person in the developed world much less in terms of hours of work to acquire non-free software than it would cost a person in the developing world, possibly leading to a disinterest regarding what software is acquired. Third, it has been mentioned earlier that the concept of knowledge divide entails the notion that if people play a part in developing the systems they need, they also build the necessary knowledge to maintain it. Then, if technology is increasingly protected by IPRs, this restrictive technology is bought in both developed and developing countries but more so in developed ones, and not participating in their development also entails a possible lack of knowledge to maintain the technology, it may be possible to infer from this that the dichotomy between developed and developing countries is a false one. If both populations lack the same freedoms, why divide them in developing and developed with regards to their ICT use status? If the only difference between both types of countries is the income level required to acquire the technology, how long would it take for a collective lack of freedom to become an impediment for the development of knowledge everywhere?

The review of the literature has indicated several gaps in the literature. The first gap identified is that there are several divides apart from the commonly cited digital divide. Byrne and Jolliffe discuss the existence of a socio-techno divide. There is a social divide that is related to educational opportunities and could lead to an economic divide. The economic divide could lead to an educational divide, which in turn could spark a knowledge divide, although there may also be a motivational divide that could explain the knowledge divide. In summary, the divides are social, educational, economic, knowledge, motivational, and digital (access).

Avgerou's (2008:133) definitions of research in Information System and IS innovations in relation to developing countries and the "concomitant organizational change" can be seen from two different perspectives. The ICTs introduced for development can be either free or non-free.

1. If they are free, they would require organizations to be knowledgeable in ICT acquisition, use, and modification to needs. This necessarily means either an increase in expenditure to upgrade the capabilities of the staff or to acquire support services from free-software developing companies¹³. Nevertheless, this would give them independence from vendors and improve everybody's freedom.

¹³ This is one of the many ways in which companies that develop free software make money.

2. If they are non-free, they would have access to push-button technologies that would seem easier to use at first, but would have limited functionality. No one in the organization would be allowed to make changes when they may be required, and they would likely not be able to change systems without larger expenditures in backward compatibility¹⁴.

Extrapolating this from individual organizations to individuals and then to entire countries, it is easy to see how the decisions of individuals can have an impact on Thapa's notion of resource pooling. When individuals and organizations opt for non-free ICTs and sources of information, they necessarily decrease everybody else's leverage; by preferring unfreedoms over freedoms, there can be no collective bargaining power. This is also stated by Sen, developing some freedoms leads to developing others as well. Brunello's definition of sustainability, the continued enjoyment of benefits after the end of a development program, is tied to the choice of freedoms; dependence in the form of vendor lock-ins decreases the chances for a program to build local capabilities and flourish without authoritarian outside interference.

Pimienta's hurdles 7 through 11 are especially relevant in this train of thought. His definition of an ICT tool stands in stark contrast to the positivist view of ICTs as tools. Where he states that technology should be a tool and not stand between the user and their intended goal, there is the implicit notion that the user should be thoroughly (or at least sufficiently) knowledgeable of how the tool works; users employ the tool as they want it, not as the makers of the tool want it to be used.

His notions of meaningful use also stand in contrast to the usual uses of the words content and consumer in non-free parlance. As Stallman indicates it, it is common to hear the expressions "digital content" in relation to "consumers" as if copying and distributing information were to deplete a finite source (Free Software Foundation 2012). Users in Pimienta's view use tools and information to communicate and produce further tools and information.

Once a society has passed the social ownership hurdle and come to understand the impact that a choice of ICT has on their immediate and distant future, they are also able to change their social reality. This would hardly be possible choosing non-free software and information sources. Only through understanding ICT tools, making meaningful use of them, and reaching social ownership would it be possible to reach Pimienta's societies of shared knowledge. This key concept that can be introduced in the analogy of the accountant above; in a society of shared knowledge, the emphasis lies in building capacity and providing services, instead of on developing knowledge that lies behind paywalls for few to access. Consequently, the entire data, information, and knowledge infrastructure turns into a learning and developing opportunity.

¹⁴ See the case of LiMux, the migration of the public administration of the city of Munich to free software. (Landeshauptstadt Muenchen 2012).

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