A Framework using Institutional Analysis and the Capability Approach in ICT4D

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Abstract

Institutional theory and the Capability Approach have become influential in development research and practice. Both theories offer analytical tools for interpreting and guiding Information and Communication Technology (ICT) for development interventions. In this paper we propose an analytical framework which applies Institutional theory and the Capability Approach in the domain of ICT for development (ICT4D). We argue, using empirical evidence from a case study, that there are benefits for ICT4D research and practice of utilizing the contrasting strengths of these analytical tools. A combined theoretical framework offers analytical and practical insights in terms of potential for stimulation ("excitation") and degradation ("inhibition") of development goals. The novel approach taken for combining Institutional Theory with the Capability Approach uses Institutional Theory to understand the social drivers that may inhibit or enable individuals from taking full advantage of ICT resources for furtherance of their own lives. These social drivers could be overlooked when using any of the approaches in isolation. We also observe how enhanced capabilities can help strengthen and develop institutions. In this paper we contribute a combined framework linking both theories and the attendant exciters and inhibitors. The utility of the framework is illustrated with a case study based on empirical work in the Ethiopian higher education sector. The combined framework and case study contribute to theory development and informs practice by offering a novel approach to analyze ICT led developmental interventions.

A Framework using Institutional Analysis and the Capability Approach in ICT4D

This paper introduces a novel analytical framework of Information and Communication Technology (ICT) for Development (ICT4D) informed by Institutional theory (Scott, 2004) and the Capability Approach (Sen,1999). Institutional theory has been influential in improving our understanding of contextual features that may support or impede development (Currie and Swanson, 2009). The Capability Approach has been used to establish basic capabilities in health, nutrition and education (Alkire, 2002, Saito, 2003). It is practically helpful because it distinguishes between commodities, human functioning, capability and utility; concepts that are often conflated in traditional welfare economics (Clark, 2005).

This paper is motivated by recognition of the potential benefits of improved connections between Institutional Theory and the Capability Approach contributing to the work on "Successful Societies" (Hall and Lamont, 2009). This work builds on Evans (2009) who:

> "advance[s] the claim that an expanded institutional–cultural approach
> points us toward the possibility of integrating the institutional turn and
> the capability approach." (Evans, 2009, p. 105)

The capability approach enables analysis to expand the definition of development goals. Earlier economic models conflated opulence with self-fulfillment. The capability approach identifies the conversion factors and choices applied to the commodities and resources available that enable achievement of desires. In addition, Institutional theory has shifted attention away from levels of investment and price setting to historically evolving processes that generate enduring rules, norms and organizational structures. To date there has been no attempt to link the role of IT artifacts in developing country institutional change processes towards alignment with specific capabilities. Analysis is unable to provide holistic explanation unless it accounts for both the social context and the wish fulfillment of individuals achieved through technology-driven change, as well as the technology itself. This paper fills this gap and focuses on the following research question: How can the combined complementary strengths of the Institutional theory and Capability Approach inform ICT for development?

We propose here a novel analytical framework for ICT for development that uses the complementary strengths of Institutional theory and the Capability Approach. The analytical framework has been developed from previous work identifying strengths and weaknesses in the two approaches and relevant prior empirical work (Scott, 2007, Sen, 1999). The novel approach taken for combining Institutional Theory with the Capability Approach uses Institutional Theory to understand the social drivers that may inhibit or enable individuals from taking full advantage of ICT resources for furtherance of their own lives. These social drivers could be overlooked when using any of the approaches in isolation. Our analytical framework contributes to ongoing discussions about the discourses within, or theory underlying, ICT4D. In general terms, the framework draws on theory from organizational studies and development studies both identified as disciplinary foundations for ICT4D by Heeks (2006, p. 3).

A novel contribution of this paper identifies how enhanced capabilities may lead to institutional change. There is a gap in the literature in relation to the social context that enables people to take full advantage of ICT resources in order to further their lives. The utility of the

combined analytical framework is then illustrated drawing on an empirical case study involving the use of ICT in the Ethiopian higher education sector.

Institutions are the broad range of social, cultural and legal rules and norms prevalent in society. Institutional theorists, see organizations as being suspended in a web of institutions, in effect, they inhabit institutions. Thus, organizations of any kind can sometimes coalesce out of the social, cultural and legal currents that we describe using the word institutions. We recognize that for political scientists, the word institutions risks being conflated with democratic structures, political parties and organs of government. To complicate matters, for economists, the word institution is easily substituted by the word company or corporation. However, in our work, we see all kinds of organizations emerging from institutional trends in society.

The paper is organized as follows: first we provide an introduction to Institutional theory and the Capability Approach. We then introduce our novel analytical framework for understanding ICT4D projects followed by a description of the research method used to gather empirical data. The case study illustrating the analytical framework is presented next,   followed by a discussion of the analytical framework and its limitations. Finally conclusions and future work are presented.

Related Work

An overview of Institutional Theory and the Capability Approach is presented below. There are substantial bodies of work associated with both so this section focuses on the facets of most relevance to the scope of this paper. The Capability approach offers a "bottom-up" analytical framework where the starting point is consideration of individuals' opportunities to achieve their wants and needs. In contrast, Institutional Theory enables a "top-down" analysis of the rules and norms that are used to regulate interactions and transactions in society and from which organizations can sometimes emerge.

Institutional Theory

Institutional analysis has has been used for understanding information systems related processes (e.g. Noir and Walsham 2007, Orlikowski and Barley 2001). In essence, institutional analysis examines how broad social and historical forces, ranging from explicit laws to implicit cultural understandings, affect and are affected by the actions of individuals and organizations (Orlikowski and Barley 2001, p153). Institutional theory has increasingly been applied to the study of IT implementation and use. One of the earliest contributions (King et al., 1994) pointed out the strength of institutional analysis in making sense of the context into which IT implementations are embedded. Institutional analysis has subsequently been advocated as a valuable theoretical lens in mainstream information systems development (Currie and Swanson 2009) and in the specific domain of ICT for development (e.g. Avgerou, 2002). Silva and Figueroa (2002) for instance draw on an institutional analysis for ICT policy in Chile to examine why some policies achieve their objectives while others may not.

Institutional theorists perceive organizations as being suspended in a web of institutions, in effect, organizations inhabit institutions (Barley and Tolbert, 1997). Organizations are created to take advantage of the opportunities in society which are determined by institutions. An institutional lens on the environment of organizations emphasizes societal rules and beliefs to

which the organization must adhere and these socially prescribed practices become taken for granted and thus institutionalized. These rules and norms are derived from political or regulatory demands, prescriptions of professional associations or consultants or mimetic activities (DiMaggio and Powell, 1991a).

There has been significant usage of institutional theory in IS research, with the dominant focus in empirical studies explaining the regulative aspects of institutions and their role in institutional persistence. King et al. (1994) view institutions as 'any standing entity that exerts influence and regulation over other social entities'. This emphasizes the regulative aspect of institutions (government authorities, international agencies, trade associations) as opposed to contested change.

There is some, albeit a limited amount of, literature in the use of institutional theory in IS that addresses the issue of change and the role of IT in that process. Rajão and Hayes (2009) point out that IT artifacts are understood as both enablers and constrainers of institutional change drawing on the example of Fountain's (2001, 2006) study of e-Government. Hardy et al. (2007) examine the dilemma of how actors embedded in existing institutional routines can serve as entrepreneurs of change.

Although there has been a tendency for the literature in institutional theory to focus on institutional persistence, our main focus here is on technologically-driven change and in particular institutional change. We are also concerned with the relationship between enhanced capabilities and institutional change.

The Capability Approach

The Capability Approach emerged in mainstream development research and practice in the 1980s with the work of Amartya Sen (1985, 1999). It has stimulated debate, critique and expansion (Nussbaum, 1988, Alkire, 2002). Current debates on the global human development agenda are increasingly influenced by the Capability Approach, for example through the creation of human development indicators (UNDP, 1990).

Sen's work has improved our understanding beyond previous work that tended to conflate the abundance of commodities and achievement. The conversion between commodities and capabilities are of particular interest to this discussion, as shown in Figure 1. The social context (which we will argue may be analyzed using Institutional theory) influences an individual's ability to create capabilities (freedom to achieve) from commodities (production, transactions, goods and services). Further, social influences affect choices about how to deploy capabilities to create functionings (actual achievement).

The Capability Approach recognizes that neither opulence (income or commodity ownership) nor utility (happiness or desire fulfillment) are sufficient to conceptualize human well-being or deprivation (Clark, 2005, Robeyns, 2005). Within the Capability Approach development itself should be a process that enables the expansion of the real freedoms – the opportunities of people.
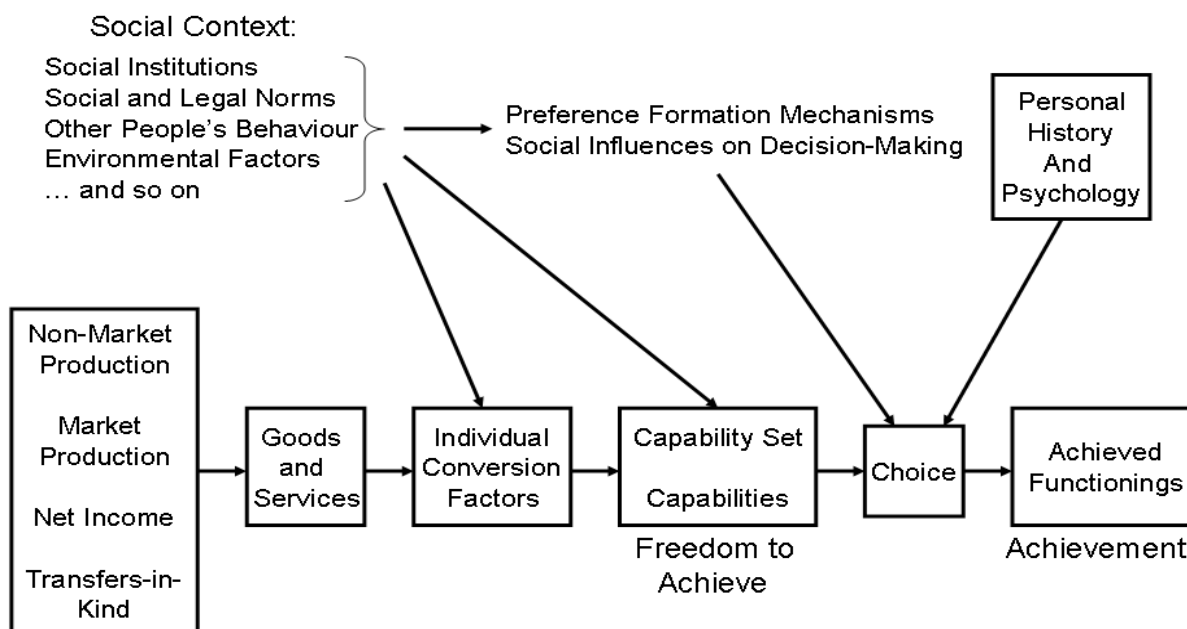
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Figure 1. Stylized Static Representation of the Capability Approach (Robeyns, 2005).

The Individual Conversion Factors, shown in Figure 1 above, represent the impact of social context on an individual's ability to convert the means to achieve (such as goods and services) into the freedom to achieve their capabilities (Robeyns, 2005). The Capability Approach rightly places emphasis on these conversion factors, and the choices subsequently available to convert capabilities into achievement (functionings). We argue that the limits and opportunities presented by the social context may be analyzed using Institutional theory, while retaining the analytical benefits of the Capability Approach for understanding conversion factors and capabilities.

The term "capability" in ICT for development research tends to refer to an individual's ability to use technology (Zheng, 2009). In comparison, in the Capability Approach, "capability" refers to the *freedom* to achieve and accomplish their goals. The Capability Approach views ICT as a type of commodity, that is meaningful only in the ways that it enhances human capabilities. This avoids the risk of seeing ICT as intrinsically good, as if the use of technology in itself was a valuable achievement. This view of the Capability Approach focuses on the extent to which technology expands people's ability to determine and realize lives that they value.

Can Institutional theory and Capability Approach be combined? Firstly, at the level of paradigm, the Capability Approach was derived from neo-classical economics (Sen, 1987). Institutional Theory is broader and more diffuse with two substantial themes, (1) the New Institutions school that is also derived from neo-classical economics and (2) the early institutions tradition that emerged from sociology and political science, (for example see the historical

review in Scott, 2007, Chapter 1). The new institutions school shares a focus on markets, competition and transactional efficiency. Hence, the new institutional branch of institutional theory and the Capability Approach shares a neo-classical economics roots and thus are commensurable. Yet both have acquired a considerable and complementary body of research in development and technology-driven change processes.

As mentioned earlier, the novel approach taken here for combining Institutional Theory with the Capability Approach uses Institutional Theory to understand the social context (see Figure 1) that may inhibit or enable individuals from taking full advantage of ICT resources for furtherance of their own lives.

A Conceptual Framework

The novel analytical framework presented here identifies the links between the Capability Approach and Institutional theory in relation to development. In this context, ICT is an enabling technology to deliver human centered development (Schech, 2002). ICT's role in development includes:

- its ability to create network effects; creating a network of knowledge which can be shared and is open to a larger stakeholder group, the pervasiveness of these network effects has led to what Castells (2000) calls the Network Society,
- allowance for collective accrual and development of knowledge enhancing social memory and
- enhancements in transparency and continuous feedback based improvements which play a critical role in service delivery (Zheng, 2009, Madon, 2006).

Using the theoretical strands identified above, we have proposed an analytical framework which links institutions, capabilities and ICTs, as outlined in Figure 2.
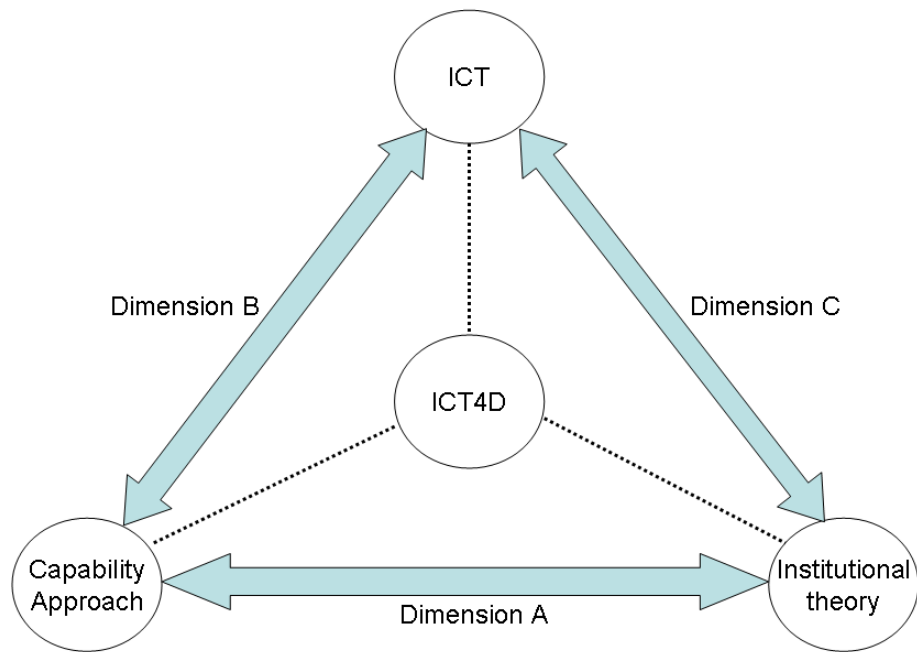
Figure 2. Institutional Theory, the Capability Approach and ICT

The diagrammatic form of the analytical framework uses bidirectional arrows to represent influences between ICTs, the Capability Approach and Institutional theory. These influences should not be seen in terms of simple cause and effect relationships but as a metaphor to explore the complex inter-relationships and influences (Morgan 2006). In an ICT implementation, prior research has demonstrated that a wide range of social forces, pressures and influences over time can be envisaged including dialectical conflicts between social groups (Avison and Wood-Harper, 1990).

The dashed lines in Figure 2 show the relationship between the elements of the framework and the overall goal of ICT4D. In this framework, any project directed towards development has the design task of balancing institutional design, individual capabilities, needs and design within the scope and limitations of technology available.

The bidirectional arrows in Figure 2 represent influences, both positive and negative, in each direction, as shown in Figure 3. Positive influences can be seen as "exciters", while negative influences are "inhibitors".

We use the terms exciters and inhibitors to describe the relationships between elements of our analytical framework. We note that the term influences is widely used in capabilities and institutions literature. These exciters and inhibitors are not binary or Boolean values but represent degrees of influence. These dyadic relationships provide an abstraction to establish causal relations and for explanation and prediction. Our first task in establishing the framework is to demonstrate examples of both exciters and inhibitors in each direction on each dimension.
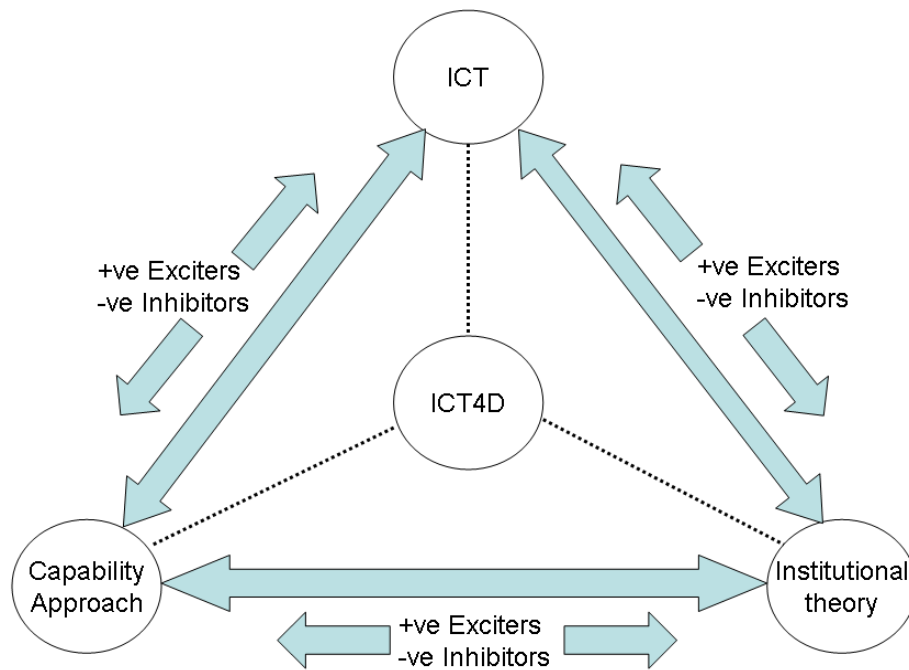
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Figure 3. Exciters and Inhibitors

Institutions and Capabilities (Dimension A)

Group or individual capabilities may have a positive influence on the formal rules and informal norms identified using institutional analysis (an exciter from capabilities to institutions on Dimension A in Figure 2). For instance, Rheingold (2002) describes how virtual communities have deployed their capabilities in Internet social media usage to inculcate institutional change.

The development and implementation of specific education policies are an example of institutional mechanisms that can influence capabilities within the population. Education interventions aimed at nomadic people can, through values of inclusion, offer opportunities to formerly excluded groups (Saha et al., 2005).

In contrast, informal institutional norms such as discrimination or sexist practices resulting in low status for women, poor people or ethnic minorities create social exclusion and limits on ICT access that has a negative impact on the fulfillment of desires (an inhibitor from institutions to capabilities on Dimension A in Figure 2). Examples of inhibitors may be a male-dominated ICT sector, unequal access to training, the lack of local language Internet content and training, high Internet connectivity costs, lack of awareness and policy advocacy.

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Similarly the lack of management skills is an inhibitor for building organizational structures that can fulfill institutional goals. Empowering and motivating teams to implement strategies is difficult using a management repertoire restricted to command and control tactics.

Capabilities and ICTs (Dimension B)

ICTs can increase access to opportunities through, for example, distance learning or by providing access to information resources. These increased opportunities created by technologies can enable the fulfillment of aspiration leading to individuals with enhanced capabilities. The first phase of the Pan African e-Network Project, a collaboration of the Government of India and the African Union, provided professional development "webinars" with live question and answer sessions using video conference facilities installed in major teaching hospitals in sub-Saharan Africa (Pan African e-Network, 2010). We see this as an example of the use of technologies to build individual capabilities in practicing medical professionals. In our analytical framework this use of ICT represents an exciter for Capabilities.

The acquisition of practical skills through self-study or formal learning can be used to develop enhanced ICT implementations. For instance the establishment of local area network access to server based storage requires somewhat specialist skills.

ICTs that are overly complex, that lack user friendly features and rely on technical jargon undermine the capabilities of user groups. Such aspects of technologies inhibit exercise of conversion factors that lead to functionings.

Conversely, lack of awareness of the benefits of ICTs or lack of access can exclude individuals or communities from the opportunities to enhance capabilities (Johnstone, 2007, Madon, 2004).

Institutions and ICTs (Dimension C)

The relationship between Institutions and ICTs is shown as the Dimension C in Figure 2. ICTs can increase transparency by providing information about service provision to stakeholder groups. Improved access to information can help to ensure officials are held to account for their actions leading to reduced corruption. We view these uses as exciters from ICT to institutions. For example, an NGO in Bangalore has used technology-mediated means to enable slum dwellers to voice demands and exercise pressure on authorities (Madon and Sahay, 2002).

Furthermore, longitudinal studies in Gujarat have shown how automated production of entitlement certificates, such as land registration, minimises opportunities for local officials to extort bribes (Madon, 2006).

Collaborative technologies such as video conferencing tools, wikis and social networking web sites enable institutionalization. Virtual groups of different kinds can more readily emerge with the benefit of these technologies despite geographical boundaries (Kahn and Kellner 2004).

In contrast, lack of access to technologies can inhibit the transparent application of policies and institutionalized corruption can persist.

The Luddite movement among textile workers in nineteenth century Britain was an example of an organization with an explicit goal to undermine technology-driven change. While the Luddites targeted certain automated weaving machinery, modern information technologies are undermined less systematically by common culturally supported beliefs that are negative towards new changing technology and/or inhibit access by gender (Roszak,1994)

Method

This research uses a case study approach (Yin, 2008). The case study explores the use of ICT in the Ethiopian higher education sector, during a period of expansion, and is focused in particular on a curriculum change process across three ICT disciplines (computer science, information systems and information technology). The case study includes replicated investigations at four public universities and an international NGO engaged in skills capacity building by responding to requests from across the public education sector to place education and IT advisers from abroad. Interviews were conducted with 27 respondents from the four universities as well as from the NGO. These data were supplemented by internal and publicly available documentary sources and field notes made in personal journals by the first author who was working in the public education sector in country throughout the study period.

Research Sites

The Ethiopian higher education sector provides a rich study context comprising universities, government support agencies and the Ministry of Education as well as individuals such as university senior officers, managers, teaching staff and support staff. Education in general can be seen as a route to improved life chances. Higher education in particular presents

an opportunity to inculcate pro-poor professional skills (Walker, McLean, Dison and Peppin-Vaughan, 2009).

Ethiopia is a land-locked country in East Africa bordering Sudan, Eritrea, Somalia and Kenya. Ethiopia has a population of 85 million, Gross National Income per capita of US $992, a life expectancy of 56.1 years and is ranked 157 out of 169 in the human development index (UNDP, 2010). Combined gross enrollment in education has risen from 24% in 1997 to 49% in 2007 (UNDP, 1999, UNDP, 2009). Decision-making in some parts of the education sector is decentralized, as shown in Figure 4. Public universities have some autonomous decision-making powers, but report directly to the Ministry of Education who also provide funding and allocate students.
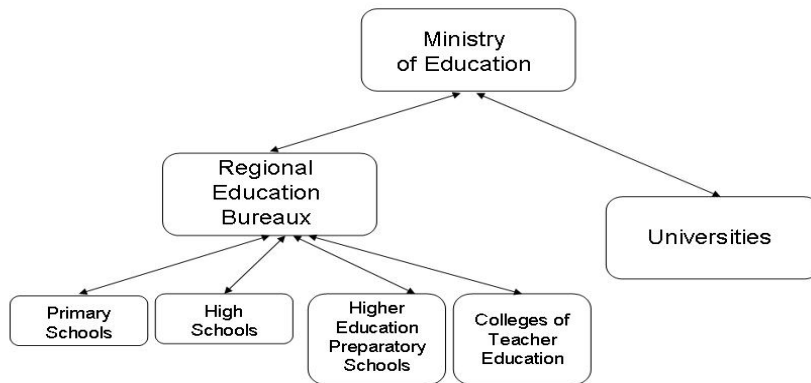

Figure 4. Management of Education Institutions in Ethiopia

Links between the Capability Approach and the field of education have been identified by prior research (Walker, 2005, Saito, 2003). Education has the potential to develop or expand capabilities both of students and teachers. This potential may not be fulfilled, of course, if some learners are not valued because of their gender, ethnicity, etc. From this perspective, individual empowerment can help to overcome specific forms of oppression. The acquisition of skills that contribute to enhanced livelihoods are a route to development (Lall, 2001). Pro-poor professional capabilities can be used to stimulate the capabilities among students to become change agents or the capability to work with high standards of professional ethics. Favorable rules and norms in education, such as inclusivity and valuing scholarship, considered from an institutional perspective, can amplify opportunities for learning. The educational syllabus is derived from social groups reconciling competing stakeholder interests bounded by the broader educational curriculum which is an expression of the prevailing social norms and formal rules (Stenhouse, 1975).

There has been a planned expansion of the higher education sector to cope with the demand for skilled professionals (MoE, 2005, Commission for Africa, 2005). Prior to 2000 Ethiopia had two public universities. In 2006-07 13 new public universities were opened, complimenting the 9 existing at that time. In 2010-11, a further 10 public universities were created. The total number

of students enrolled has risen from 54,285 in 2002-03 to 263,001 in 2007-08 (MoE, 2008, MoE, 2009). This expansion has created opportunities for over 200,000 previously disenfranchised students to gain access to higher education.

Bachelors degree programs in Ethiopian public universities are typically three years in duration, however, the new Information Systems and Information Technology degree programs and existing Computer Science programs have been allocated four year durations. The expanded program duration is designed to allow space in the syllabus for logical progression of student attainment to more advanced topics and increased use of project and laboratory work.

Table 1. Study Sites

University	Year Established	Full Time Students Population (approx)	Computing Subjects
Addis Ababa	1950	33,000	Computer Science Information Science Information Technology
Bahir Dar	2000	16,500	Computer Science Information Science Information Technology
Debre Birhan	2007	10,000	Computer Science Information Systems Information Technology
Hawassa	2000	16,000	Computer Science Information Systems Information Technology

The university study sites were purposefully selected to represent extremes of size and age as well as the median population of mid-sized universities, see Table 1. Size, measured by number of full time students, is a proxy for organizational complexity in terms of number of campuses, faculties, schools, institutes, departments and so on. The overwhelming majority of students in Ethiopia live on campus, in catered university residences, so student population also reflects a logistical burden of accommodating and feeding students. Age, measured since year of establishment, is a proxy for sedimentation of these organizational structures. It can be argued that older universities have more elaborate and complex power structures, and hence plausibly more resistant to change. The new universities, in contrast, have a preponderance of younger teaching staff. Hence although younger, potentially more dynamic and open to change they are hampered by having less well qualified and experienced teaching staff than in the older universities.

Data Collection

Documentary sources included (1) internal and published documents both from the universities such as curriculum documents, (2) policies and strategies from the federal ministry of education as well as, (3) external sources for example federal legislation and newspaper

reports. These documentary sources were collected and carefully examined. These data were used during the formulation and planning of interview guides.

The Case Study uses empirical data from 27 recorded audio recorded interviews which were conducted between February 2009 and April 2010. The interviewees were mostly teaching staff from four public universities (Addis Ababa, Bahir Dar, Debre Birhan and Hawassa) with positions ranging from newly appointed graduate teaching assistants to department heads and faculty Deans, as shown in Table 2. The teaching staff members interviewed from Debre Birhan are all in the 20-29 age range, while teaching staff members in the other more established universities are more experienced and in the 30-49 age ranges. Thus, the respondents were chosen because of their first-hand experience of the computing curriculum change processes in the context of an increasing student population. Some participants saw themselves as managers and change agents; other participants portrayed themselves as reluctant actors in these transformation processes.

Table 2. Interviewee Job Title

Job Title	Affiliation	Number of Respondents
Dean (Including Assistant Dean)	Addis Ababa University	1
	Debre Birhan University	2
Department Head	Debre Birhan University	2
Instructor	Bahir Dar University	1
	Debre Birhan University	1
	Hawassa University	1
Graduate Assistant	Debre Birhan University	12
Education Programme Director	VSO Ethiopia	1
Education Programme Manager	VSO Ethiopia	4
Education Advisor (Volunteer)	VSO Ethiopia	1
IT Advisor (Volunteer)	VSO Ethiopia	1

In addition, interviews were conducted with 5 education programme staff and 2 volunteer advisors involved in educational capacity building from the international NGO Voluntary Service Overseas to provide a form of data triangulation. The education programme managers were familiar with the university sites investigated. While volunteer advisers provided dispassionate perspectives on the implementation of education policies and strategies in the higher education sector.

Structured interview guides were used and supplemented with open-ended questioning. Most interviews were conducted in on-campus meeting rooms . Interviews typically lasted between 30 minutes and one hour with 45 minutes being typical. Respondents were encouraged to express their opinions freely. They were asked to talk about their current situation and also to reflect upon their previous experience, context and events.

Data Analysis

Recorded interviews were reviewed, transcribed, analyzed and coded (Patton, 2002). Particular effort was made to identify indigenous concepts and practices evident from the information sources. Interview transcript re-coding emphasized issues raised across the study sites. This was an iterative process of analysis, coding, clustering of codes and re-analysis. Thus, issues arising in all the study sites were clustered into categories representing common themes. The analysis and coding drew on the conceptual framework introduced in the previous section.

Findings

We now explore the potential for ICT to assist the development of capabilities and for ICT in education to beneficially affect institutions by considering the public higher education sector in Ethiopia. The level of ambitions and challenges to higher education expansion has been described by Saint (2004). These challenges can be seen as barriers to achieving functionings for students. These challenges include the adverse impact of HIV and AIDS, sector financing, and management capacities (Saint, 2004). However, expansion has attracted criticism for compromising standards (Poor Quality, 2009). The legal context for the process of higher education expansion has evolved reflecting a shift in government concerns. Around the turn of the century emphasis was placed on the management and governance of the public universities themselves and associated governmental support agencies. The job titles, roles and responsibilities of all the senior officers were assigned in law (Proclamation No. 351, 2003). We see this legislation as evidence of coercive institutional mechanisms (DiMaggio and Powell, 1991b) which placed specific legal duties on senior officers of new universities and agencies. More recent legislation is less prescriptive about responsibilities of university and Government agency officers' while reflecting increasing interest in educational outcomes by being much more specific about curriculum and quality enhancement issues (Proclamation No. 650, 2009). So, coercive institutional mechanisms have shifted from the management responsibilities of officers in the higher education sector to outcome-related quality assurance processes.

Case analysis

In the following sections we consider the case study data through the lens of the analytical framework. We now illustrate example exciters and inhibitors in each direction on all the dimensions. The analysis is summarized in Figure 5.
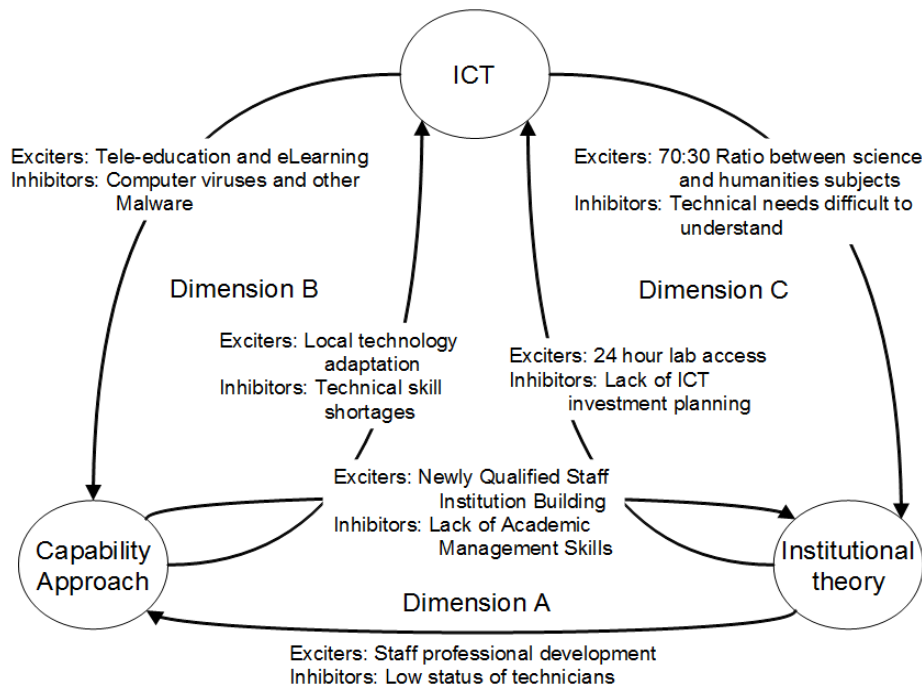

Figure 5. Case study examples mapped to analytical framework

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Institutions and Capabilities (Dimension A)

A major obstacle to higher education sector expansion and computing curricula change, viewed from an institutional perspective, is the shortage of academic skills among university teaching staff (DAG, 2008). The early years of the new universities (founded in 2007) were characterized by whole universities with only a handful of PhD holders. The Presidents in some of the 13 new universities are not Professors, in at least one case they do not have a PhD, and there are widespread shortages of higher degree holders among teaching staff members. Most teaching staff members were first degree holders with little or no post graduate experience. This scarcity of qualified and experienced teaching staff is a reminder of the resource challenges faced by educational expansion and quality enhancement in developing country settings. Using our analytical framework we see this lack of academic management and research skills as an inhibitor from capabilities to building and sustaining institutions, shown on Dimension A in Figure 5.

The Government has assigned the whole of the country's postgraduate provision to alleviating this problem, by legislation for formal rules on the allocation of all places on Masters and PhD programs to applicants from public universities. This policy change represents a change to formal rules and norms in institutional terms. According to an official at Addis Ababa University (recipient of many of the university instructors sent for higher degrees)

> the Government is making its effort to promote and train many
> instructors, at Masters level and at PhD level so that the staffing will be
> as envisaged [to implement] the curricula

For example, an instructor from Debre Birhan University, was selected to undertake Masters degrees in Addis Ababa and successfully passed the entrance examinations. Having successfully completed his Masters degree had a positive impact on his capabilities and functionings as a member of teaching staff. This prioritization of professional development is an exciter from institutions to capabilities on Dimension A of our analytical framework, as shown in Figure 5.

Further, the Debre Birhan University is now able to benefit from these enhanced capabilities.

> [Debre Birhan] university [has] now opened a new department called
> Information System department and they have assigned me as a course
> coordinator for the department (that means head of the department.)
> They have also gave me full responsibility to bring an IS (Information
> System) curriculum (S. Demissie, personal communication, 7th October
> 2010, reproduced with permission)

The newly enhanced capabilities gained through completion of a Masters Degree can be seen as an exciter for institutional development in Dimension A, in Figure 5, in our analytical framework. These enhanced capabilities contribute to institutionalization within the higher

education sector resulting in strengthening of the university through formation of a new academic department.

Technicians with ICT skills have started to qualify in recent years with diplomas from the Technical and Vocation Training college sector. These technicians have sometimes acquired more practical skills than teaching staff who have graduated from the university sector. However, college diploma holders tend to have low status in the higher education sector compared with university graduates. The use of college technicians to teach ICT and computer use skills to teaching staff is not considered desirable by university managers. The low status of technicians reflects an inhibitor from institutions to capabilities in the analytical framework.

Capabilities and ICTs (Dimension B)

In developing countries Internet access costs are high even compared to OECD countries, worse still these high costs are exaggerated by lower income levels. Further, bandwidth availability tends to be lower. Provision of Internet access to teaching staff and/or students is clearly intended to support educational outcomes. However, we observed complaints from instructors about lack of Internet access. According to one instructor

> Even the Internet […] there is no Internet connection, there is no reading
> material. So it affects [implementation of] the curriculum

We see personal educational outcomes as enhanced capabilities (Johnstone, 2007, Walker, McLean, Dison and Peppin-Vaughan, 2009) which may, through appropriate choices, lead to enhanced educational functionings. Johnstone (2007) identifies several potential positive influences from ICTs in terms of educational capabilities such as, (a) faster, cheaper access to information, (b) the ability to participate in global forums, (c) lowered cost and increased frequency of interaction with existing partners, (d) new opportunities for critical dialogue, (e) access to collective problem solving forums, and (f) access to a greater range of expertise leading to new models and understandings.

The Pan African e-Network (2010) has been specifically developing networking connectivity with sufficient bandwidth to support video-conferencing between centers in India and Africa. The Faculty of Medicine at Addis Ababa University has been receiving online professional development lectures from India. Phase two of the program is supporting distance learning. According to one head of department

> they are going to send three individuals [to Addis Ababa to] learn in
> Ethiopia by tele-education… from Madras University

Tele-education is an exciter from ICTs to capabilities on Dimension B of our analytical framework, as shown in Figure 5.

There is recognition that Ethiopia does not have the resources to develop new technologies. However, there is value in utilizing and adapting technology to meet local needs and solve problems. According to one deputy Dean

> Ethiopia is a developing country; we are taking and using technology.
> We are not inventing technology. But here, the education system [must

create graduates who are] in a position to have a skill for adaptation of the technology, utilization of technology, for facilitating the development process of the country…That enables [graduates] to be more competent in adapting the technology and using the technology [to solve] the problems in the country.

This local adaptation and utilization of technology is seen as an exciter from capabilities to ICTs on Dimension B in our analytical framework as shown in Figure 5.

The lack of technical skills identified by DAG (2008) is widespread and severe. Lack of skills makes it difficult to fully exploit ICT already available. This technical skills shortage is an inhibitor from capabilities to ICTs on Dimension B, in Figure 5.

Prevention and removal of computer viruses and malware in general are a major issue in sub-Saharan Africa (Michael, 2009). Alan Mercer, an IT trainer with Voluntary Service Overseas (VSO), says "Show me an Ethiopian computer without a virus and I'd ask which foreigner it belongs to" (quoted in Michael, 2009). Personal computers with tens or hundreds of malware infections are not uncommon. The first author, having worked in the IT industry for more than 10 years and having previously experienced only two damaging virus infections, arrived in Debre Birhan to be asked for advice about a Dean's computer that proved to be suffering with 80 different malware infections. Subsequent experience over the a two year period regularly identified computers with in excess of 100 infections. The largest number of infections found on a single PC proved to be over 340.

Universities in Ethiopia face challenges to obtain and install anti-virus software, ensure regular and uninterrupted scanning of computers and download virus signature updates over intermittent and slow Internet connections. Infected computers become slow and unusable, often without operators having the skills or knowledge to take remedial action. These viruses prevent users from achieving functionings by disrupting the effective use of computer technology. The problem of viruses, and computer malware in general, is a technological inhibitor from ICT to fulfillment of capabilities in Dimension B.

Institutions and ICTs (Dimension C)

Universities around the world have a remarkably consistent organizational structures built around disciplines and subjects. We can observe these organizational structures as expressions of academic cultures and institutions (Becher and Trowler, 2001). The universities established in 2007, such as Debre Birhan, have started to develop web sites that present a picture of how these universities wish to portray themselves to stakeholders (Catalogue of World Universities: Universities of Ethiopia, n.d.). The Debre Birhan University web site, when initially created, predominantly contained descriptions of the organizational structures of the university such as faculties and departments along with their various aims, objectives and mission statements. They seek to show membership of academic territories (Becher and Trowler, 2001). Senior officers in the university expressed the view that the web site was a prerequisite to engaging with external organizations. Web technologies have changed approaches towards managing public relations

creating faster mechanisms for dissemination of information to stakeholders. The universities, as organizations, are using these new web technologies to rapidly position themselves within academic and socio-political institutions. These new communication technologies allow universities to disseminate achievements in order to garner funding and political support for their objectives. More recently, the Debre Birhan University web site has started include evidence of formal contact between the university and external organizations and convey their support for Federal Government priorities, such as community engagement in research (Welcome to Website of Debre berhan Univeristy [sic], n.d.). Here the web technologies are being used to foster support for the goals of these broader academic cultures and institutions.

However, recalling the developing country context there is a general concern about resource shortages, despite this preferential support for science and technology subjects. According to one deputy Dean

> in software technology, hardware technology, even though, to some
> extent, we have some resources for introductory and intermediate
> courses. But for advanced courses we have serious shortage and
> problem for acquiring this software and network technologies

So, Government institutionalization efforts around ICTs are hampered by lack of technology resources on the ground. For some stakeholders, this is not only about a shortage of technology resources, but also about institutional weaknesses in regarded to fulfilling ICT needs. The deputy Dean elaborates

> Up to now nothing has been planned, nothing has been captured…
> Processing these activities, purchasing process activities and planning,
> setting budgets for this purpose still have some limitations

So, Government institutionalization efforts around ICTs are also hampered by limitations in university management. This lack of planning, the weaknesses in purchasing processes and the difficulties of setting budgets tied to ICT curriculum needs are all seen as inhibitors from institutions to ICTs. Thus, management norms in relation to planning ICT interventions act as inhibitors from institutions to ICTs in Dimension C in Figure 5.

Two of the studied universities have appointed temporary security staff members, or even student representatives, to enable and monitor student access to laboratories outside normal working hours. As one instructor at Addis Ababa University enviously observed

> in Mekele university ICT […] they have their own lab and it is open 24
> hours.

We are not arguing 24 hour access to laboratories is unique to Mekele, of course. Rather, we see this as evidence that universities face a choice between traditional values (that emphasize security and protection of valuable university assets) or more creative approaches (that enlist students and others to provide security). More creative solutions that allow 24 hour access to laboratories encourage technology use. Thus, institutional rules and resulting norms can be shaped to support access to technology representing an exciter from institutions to technologies.

University teaching staff members cite the rapidly changing nature of technology as a major obstacle to planning and implementing ICT infrastructure as well as to the implementation of computing curriculum change. Changing specifications, standards and terminology are difficult to follow. Teaching staff report a paucity of information sources and lack of time to keep abreast of technological developments. These perceptions of ICT complexity and rapid change inhibit development of institutions.

Discussion

We have used the Case Study above to achieve our first task of demonstrating exciters and inhibitors in each direction on each dimension of our analytical framework. We can observe some examples of virtuous circles, Schlesinger and Heskett (1991), supporting ICT-led capacity building. For example, enhancing the capabilities of teaching staff, through sponsorship of higher degrees (exciter from institutions to capabilities on Dimension A) and then promoting staff to management positions to help building institutional capacity (exciter from capabilities to institutions on Dimension A). Needless to say, vicious circles that undermine development objectives can also be observed. For example, lack of strategic management skills among senior officers in universities (Inhibitor from capabilities to institutions on Dimension A) mean that ICT investment and planning is weakened (Inhibitor from institutions to ICTs on Dimension C) making implementation of tele-education projects problematic. The tele-education projects, if implemented, could be used to enable senior officers in universities to learn more about strategic planning (Exciter from ICTs to Capabilities on Dimension B).

The computing curriculum change process has resulted in the establishment of new bachelor degree programs in Information Systems (or Information Science) and Information Technology. We see the introduction of these new subject areas and clarification of the differences in focus and emphasis of these degrees resulting from new institutional forces. These new institutions are already developing tangible organizational forms as new university departments are established to support the new degree programs. Establishment of these new institutions in Ethiopia is itself influenced by views of curriculum propagated by international professional bodies (ACM/IEEE Joint Task Force, 2005). The development of these new institutions relies on a critical mass of teaching staff with enhanced capabilities. Conversion factors for individual teaching staff members include awareness of foreign curriculum guidelines and knowledge of the specific recommendations. This knowledge and awareness primarily comes from university-sponsored post graduate education.

We had some difficulty identifying a satisfying illustration of an exciter from ICTs to Institutions due to a paucity of such influences in our case study data. This partly reflects the tendency to prioritise the use of technologies to develop the capabilities of individuals. Recognition of the role of technologies in support of institutions appears to be not so well developed

Conclusions and Further Work

This paper addresses the research question: can the complementary strengths of Institutional Theory and Capability Approach simultaneously inform ICT for development? The paper contributes a novel analytical framework that combines the Capability Approach and

Institutional theory in conjunction with ICT for post-hoc analysis and to practically emphasize the multidimensionality of ICT for development projects. The theoretical contribution of this paper builds on the work of Evans (2009) which is not specific to the field of ICT for development. Thus, this paper offers the first attempt to link Institutional Theory, Capability Approach in the context of ICT for development.

The novel approach taken for combining Institutional Theory with the Capability Approach uses Institutional Theory to understand the social drivers that may inhibit or enable individuals from taking full advantage of ICT resources for furtherance of their own lives. These social drivers could be overlooked when using any of the approaches in isolation. We also observe how enhanced capabilities can help strengthen and develop institutions.

The Ethiopian higher education Case Study (summarized in Figure 5) shows the complex multifaceted nature of the problem of ICT4D and how institutions, ICTs and capabilities are linked, excited and inhibited. Sustainable developmental change requires a virtuous circle involving institutions, capabilities and technology. Failure to create and foster the exciters along any of the dimensions in our analysis framework may become an impediment to change. However, where individual capabilities are enhanced, then institutionalization can be accelerated which in turn fosters enhanced capabilities.

In our analysis of this particular case study data, we found it difficult to find a satisfying example of an exciter from ICTs to Institutions. The use of web technologies for institution building is a rather general phenomenon. Nevertheless, in an ICT for development context our analytical framework has allowed us to explore causality between both technologies and institutions on the one hand and conversion factors, functionings and capabilities on the other. Causality demonstrates that a framework of analysis missing one of these elements (i.e. missing either institutions or capabilities) would miss important causal influences. Further, identification of causality between elements of the analytical framework allows us to consider its a priori use in predictive manner.

A practical limitation of the analytical framework is the requirement to understand both the capabilities approach and institutional theory. Each of which has its own substantial body literature. This could be seen as placing a considerable burden on potential users of the analytical framework.

Despite this, practitioners, policymakers, managers and consultants would benefit from using the framework during interventions to help consideration of both the development of human capacities and the prevailing context in terms of institutional rules and norms when designing ICT4D projects. Inhibitors between any of the three dimensions in our analytical framework will negatively impact sustainability of ICT4D interventions. Failure to create a virtuous circle around all the dimensions will make achievement of any intervention objectives problematic.

There are opportunities to expand on this work through further empirical research to enable a more detailed taxonomy of the dimensions, exciters and inhibitors during ICT for development interventions. Related to this, we are interested to explore the use of the analytical framework towards effective a priori design possibilities. A further stream of future work will be to perform a comparison with other more established frameworks, such as the livelihood framework,

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