Research Article

A Framework Using Institutional Analysis and the Capability Approach in ICT4D

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Abstract

Institutional theory and the capability approach have grown influential in development research and practice. Both theories offer analytical tools for interpreting and guiding information and communication technology for development (ICT4D) interventions. In this article, we propose an analytical framework that applies institutional theory and the capability approach in the domain of ICT4D. Using empirical evidence from a case study, we argue that there are benefits for both ICT4D-research and -practice of using 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 lives. These social drivers could be overlooked when using any of the approaches in isolation. We also observe how enhanced capabilities can strengthen and develop institutions. In this article, we contribute a combined framework linking both theories and their attendant exciters and inhibitors. The framework's utility 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 inform practice by offering a novel approach to analyzing ICT-led developmental interventions.

This article introduces a novel analytical framework of information and communication technology 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 & 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 among commodities, human functioning, capability, and utility—concepts that are often conflated in traditional welfare economics (Clark, 2005).

This article 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 &

Lamont, 2009). This work builds on Evans (2009), who seeks to "advance the claim that an expanded institutional-cultural approach points us toward the possibility of integrating the institutional turn and the capability approach" (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, pivoting instead to historically evolving processes that generate enduring rules, norms, and organizational structures. To date, no attempt has been made to link the role of IT artifacts in developing-country institutional change processes toward alignment with specific capabilities. Analysis is unable to provide a holistic explanation unless it accounts for both the social context and individuals' wish fulfillment achieved through technology-driven change, as well as the technology itself. This article fills that gap and focuses on the following research question: How can the combined complementary strengths of institutional theory and the capability approach inform ICT4D?

We propose here a novel analytical framework for ICT4D that uses the complementary strengths of institutional theory and the capability approach. The analytical framework was 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 the 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 the 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 article 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 to further their lives. The utility of the combined analytical framework is then illustrated by drawing on an empirical case study involving ICT use 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 with the word "institutions." We recognize that, for political scientists, the word "institutions" risks being conflated with democratic structures, political parties, or organs of government. To complicate matters, for economists the word "institution" is easily substituted by the words "company" or "corporation." However, in our work, we see all kinds of organizations emerging from institutional trends in society.

This article 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 article. The capability approach offers a "bottom-up" analytical framework, one 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 used to regulate interactions and transactions in society, and from which organizations sometimes emerge.

Institutional Theory
Institutional analysis has been used to understand information systems–related processes (e.g., Noir &

Walsham, 2007; Orlikowski & 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 & Barley, 2001, p. 153). Institutional theory has increasingly been applied to the study of information technology (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 & Swanson, 2009), as well as in the specific domain of ICT4D (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 & Tolbert, 1997). Organizations are created to take advantage of the opportunities in society that 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 begin to be taken for granted and thus institutionalized. These rules and norms are derived from political or regulatory demands, prescriptions of professional associations and consultants, or mimetic activities (DiMaggio & Powell, 1991a).

There has been significant use of institutional theory in information systems (IS) research, with the dominant focus on empirical studies explaining the regulative aspects of institutions and their role in institutional persistence. King et al. (1994, p. 141) define *institution* as "any standing entity tht 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 literature, albeit a limited amount, on 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. Garud, Hardy, and Maguire (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 institutional theory literature to focus on institutional persistence, our main focus here is on technology-driven change and, in particular, on 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 (Alkire, 2002; Nussbaum, 1988). Current debates on the global human development agenda are increasingly influenced by the capability approach—through the creation of human development indicators, for example (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 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.

The individual conversion factors, shown in Figure 1, 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 (ibid.). The capability approach rightly emphasizes these conversion fac-
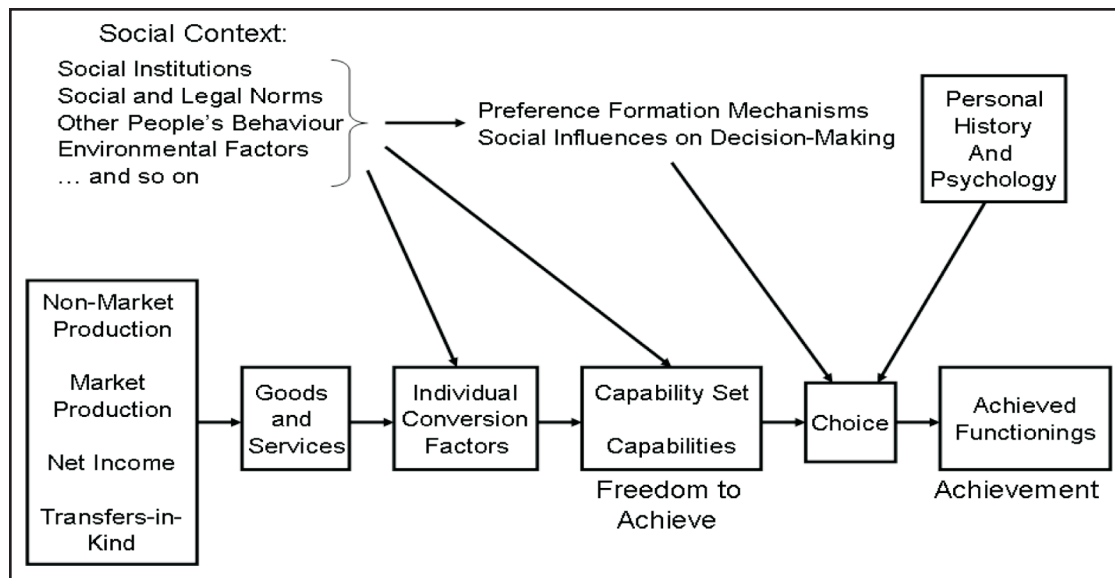
Figure 1. Stylized static representation of the capability approach (Robeyns, 2005).

tors, as well as the choices subsequently available to convert capabilities into achievements (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 ICT4D 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 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 abilities to determine and realize lives that they value.

Can institutional theory and the capability approach be combined? First, at the level of paradigm, the capability approach was derived from neoclassical economics (Sen, 1987). Institutional theory is broader and more diffuse, with two substantial themes: 1) the new institutions school that is also derived from neoclassical economics and 2) the early institutions tradition that emerged from sociology and political science (for example, see the his-

torical review in Scott, 2007, ch. 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 share neoclassical 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 of combining institutional theory with the capability approach uses institutional theory to understand the social context (see Figure 1) that may inhibit individuals from or enable individuals to take full advantage of ICT resources for the 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, generating a network of knowledge that can be shared and is open to a larger stakeholder group. The pervasiveness of these network effects has led to what Castells (2000) calls
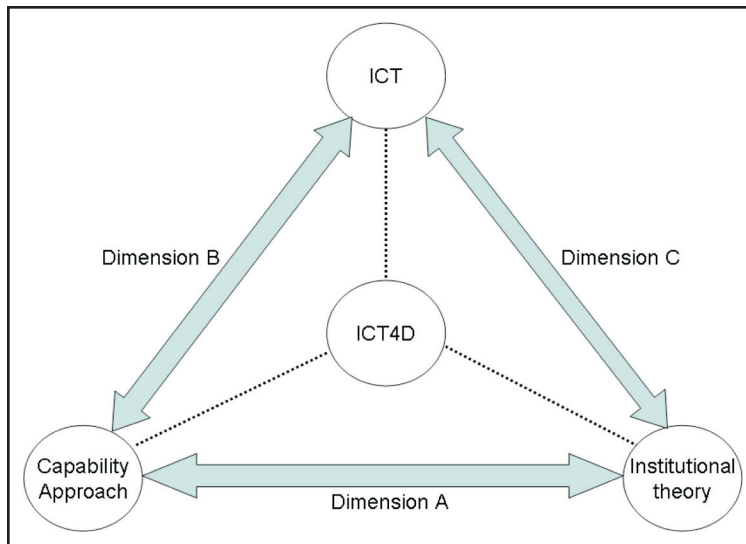
Figure 2. Institutional theory, the capability approach, and ICT.

the Network Society, allowance for collective accrual and development of knowledge enhancing social memory and enhancements in transparency and continuous feedback–based improvements that play a critical role in service delivery (Madon, 2006; Zheng, 2009).

Using the theoretical strands identified above, we have proposed an analytical framework that links institutions, capabilities, and ICTs, as outlined in Figure 2.

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

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

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; instead, they represent degrees of influence. These dyadic relationships provide an abstraction to establish causal relations, and they can also be used 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.

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 use to inculcate institutional change.

The development and implementation of specific education policies are an example of institutional mechanisms that can influence capabilities within a population. Education interventions aimed at nomadic people can, through values of inclusion, offer opportunities to formerly excluded groups (Saha, Swami, Kulkarni, & Ananthakrishnan, 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 have a collective negative impact on the fulfillment of desires (an inhibitor from institutions to capabilities on Dimension A in Figure 2). Examples of inhibitors include a male-dominated ICT sector, unequal access to training, lack of local language Internet
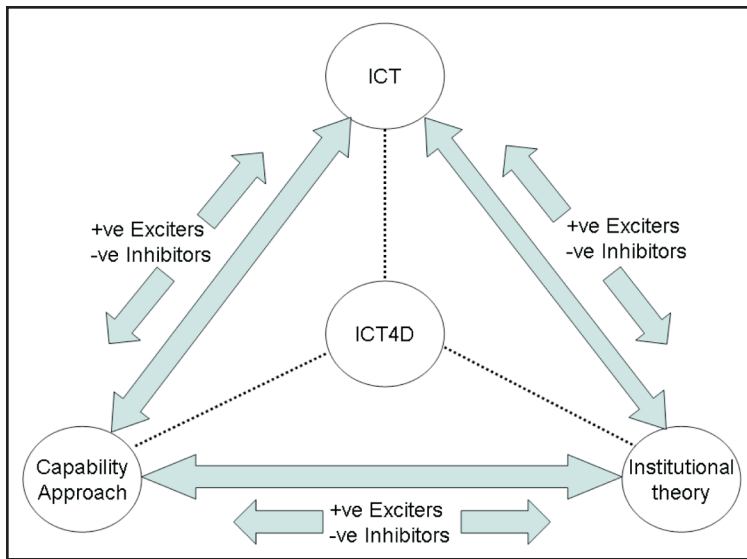
Figure 3. Exciters and inhibitors.

content and training, high Internet connectivity costs, lack of awareness, and policy advocacy.

Similarly, the lack of management skills is an inhibitor for building organizational structures to 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—for example, through distance learning or by providing access to information resources. These increased opportunities created by technologies can enable the aspiration fulfillment 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, 2010). We see this as an example of technology use to build individual capabilities in practicing medical professionals. In our analytical framework, this ICT use represents an exciter for capabilities.

Practical skills acquisition through self-study or formal learning can be used to develop enhanced ICT implementations. For instance, the establish-

ment of local area network access to server-based storage requires specialized skills.

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

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

Institutions and ICTs (Dimension C)

The relationship between institutions and ICTs is shown as Dimension C in Figure 2. ICTs can increase transparency by providing information about service provision to stakeholder groups. Improved information access helps ensure that officials are held accountable for their actions, leading to reduced corruption. We view this use as an exciter from ICT to institutions. For example, a Bangalore NGO (nongovernmental organization) has used technology-mediated means to enable slum dwellers to voice demands and exercise pressure on authorities (Madon & Sahay, 2002). Furthermore, longitudinal studies in Gujarat have shown how automated production of entitlement certificates, such as land registrations, minimizes opportunities for local officials to extort bribes (Madon, 2006).

Collaborative technologies, such as video conferencing tools, wikis, and social networking websites, enable institutionalization. Different types of virtual groups can more readily emerge with the benefit of these technologies, despite geographical boundaries (Kahn & Kellner, 2004).

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

The Luddite movement among textile workers in 19th-century Britain was an example of an organization with an explicit goal of undermining technology-driven change. While the Luddites targeted certain automated weaving machinery, modern
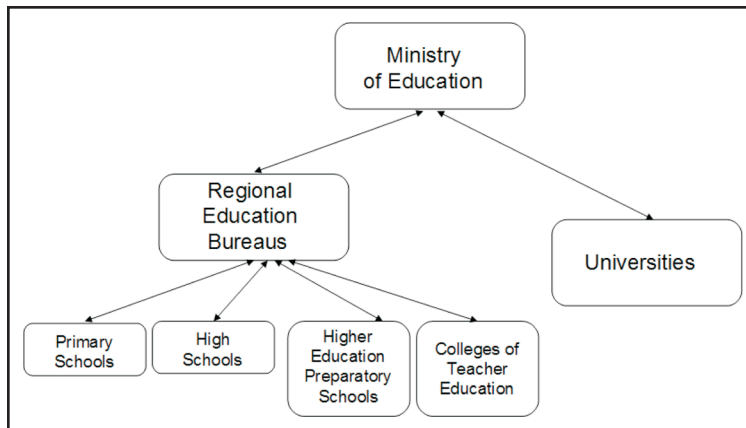
Figure 4. Management of education institutions in Ethiopia.

information technologies are undermined less systematically, often by common culturally supported beliefs that are negative toward new and changing technology, or that inhibit access by gender (Roszak, 1994).

Method

This research uses a case study approach (Yin, 2008). The case study explores ICT use in the Ethiopian higher education sector during a period of expansion. It focuses 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 and the NGO. The interviewees were granted confidentiality to encourage openness and honesty during data collection. Hence, quotations from the interviews are included (unattributed) in the case study that follows. These data were supplemented by internal and publicly available documentary sources, as well as by field notes made in personal journals by the first author, who was working in the public education sector in the 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 Educa-

tion. There are also important individuals, such as university senior officers, managers, teaching staff, and support staff. Education, in general, can be seen as a route to improved life opportunities. Higher education, in particular, presents an opportunity to inculcate pro-poor professional skills (Walker, McLean, Dison, & Peppin-Vaughan, 2009).

Ethiopia is a landlocked country in East Africa, bordering Sudan, Eritrea, Somalia, and Kenya. Ethiopia has a population of 85 million, a gross national income per capita of US$992 per annum, and a life expectancy of 56.1 years. It 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, 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 they report directly to the Ministry of Education, the government arm that also provides funding and allocates students.

Links between the capability approach and the education field have been identified by prior research (Saito, 2003; Walker, 2005). 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 helps overcome specific forms of oppression. Skills acquisition that contributes to enhanced livelihoods serves as a route to development (Lall, 2001). Pro-poor professional capabilities can be used to stimulate the capabilities among students to become change agents or 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 itself an expression of the prevailing social norms and formal rules (Stenhouse, 1975).

Table 1.* Study Sites.

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

*The degrees at Addis Ababa and Bahir Dar are Information Science.

There has been a planned expansion of the higher education sector to cope with the rising demand for skilled professionals (Commission, 2005; Ministry, 2005). Prior to 2000, Ethiopia had two public universities. In 2006–2007, 13 new public universities were opened, complementing the nine in existence by that time. In 2010–2011, a further 10 public universities were created. The number of students enrolled has risen from 54,285 in 2002–2003 to 263,001 in 2007–2008 (Ministry, 2008, 2009). This expansion has created opportunities for more than 200,000 previously disenfranchised students to gain access to higher education.

Bachelor's degree programs in Ethiopian public universities are typically three years in duration; however, the new IS and IT degree programs and existing computer science programs have been allocated four-year durations. The expanded program is designed to allow space in the syllabus for the logical progression of student attainment to more advanced topics and increased use of project and laboratory work.

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 the 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 the metric of student population also reflects the logistical burden of accommodating and feeding students. Age, measured by each school's founding, is a proxy for organizational structures, rules and norms becoming entrenched over time. It can be argued that older universities have more elaborate and complex power structures and, hence, that they are plausibly more resistant to change. The new univer-

sities, in contrast, have a preponderance of younger teaching staff. Hence, although younger, potentially more dynamic and open to change, they are hampered by having fewer well-qualified and experienced teaching staff than the older universities.

Data Collection

Documentary sources included 1) internal and published documents 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 guidelines.

The case study uses empirical data from 27 audio-recorded interviews 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 range. 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.

In addition, interviews were conducted with five education program staff and two volunteer advisors involved in educational capacity building from the international NGO Voluntary Service Overseas (VSO)

Table 2. Interviewee Job Titles.

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 Program Director	VSO Ethiopia*	1
Education Program Manager	VSO Ethiopia*	4
Education Advisor (volunteer)	VSO Ethiopia*	1
IT Advisor (volunteer)	VSO Ethiopia*	1

[†]*Interviewee names omitted to ensure confidentiality*
*VSO = Voluntary Service Overseas

to provide a form of data triangulation. The education program 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 guidelines were used and supplemented with open-ended questions. Most interviews were conducted in on-campus meeting rooms. Interviews typically lasted 30–60 minutes, with 45 minutes being typical. Respondents were encouraged to express their opinions freely. They were asked to talk about their current situation, as well as to reflect on their previous experience, work context, and significant events in their lives.

Data Analysis

Recorded interviews were reviewed, transcribed, analyzed, and coded (Patton, 2002). A particular effort was made to identify concepts and practices evident in the interview transcripts, but not existing in the interview guides. These so-called indigenous concepts are important for challenging interviewer assumptions. 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. They include the adverse impact of HIV and AIDS, sector financing, and management capacities (ibid.). 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 last century, emphasis was placed on the management and governance of both the public universities themselves and associated governmental support agencies. The job titles, roles, and specific legal duties of all the senior officers were defined in the law (Proclamation, 2003) for new universities and agencies. We see this legislation as evidence of coercive institutional mechanisms (DiMaggio & Powell, 1991b). More recent legislation is less prescriptive about the responsibilities of university and government agency officers, while simultaneously reflecting increasing interest in educational outcomes by being more prescriptive about curriculum and quality enhancement issues (Proclamation, 2009). So, coercive institutional mechanisms have shifted from officials' management responsibilities in
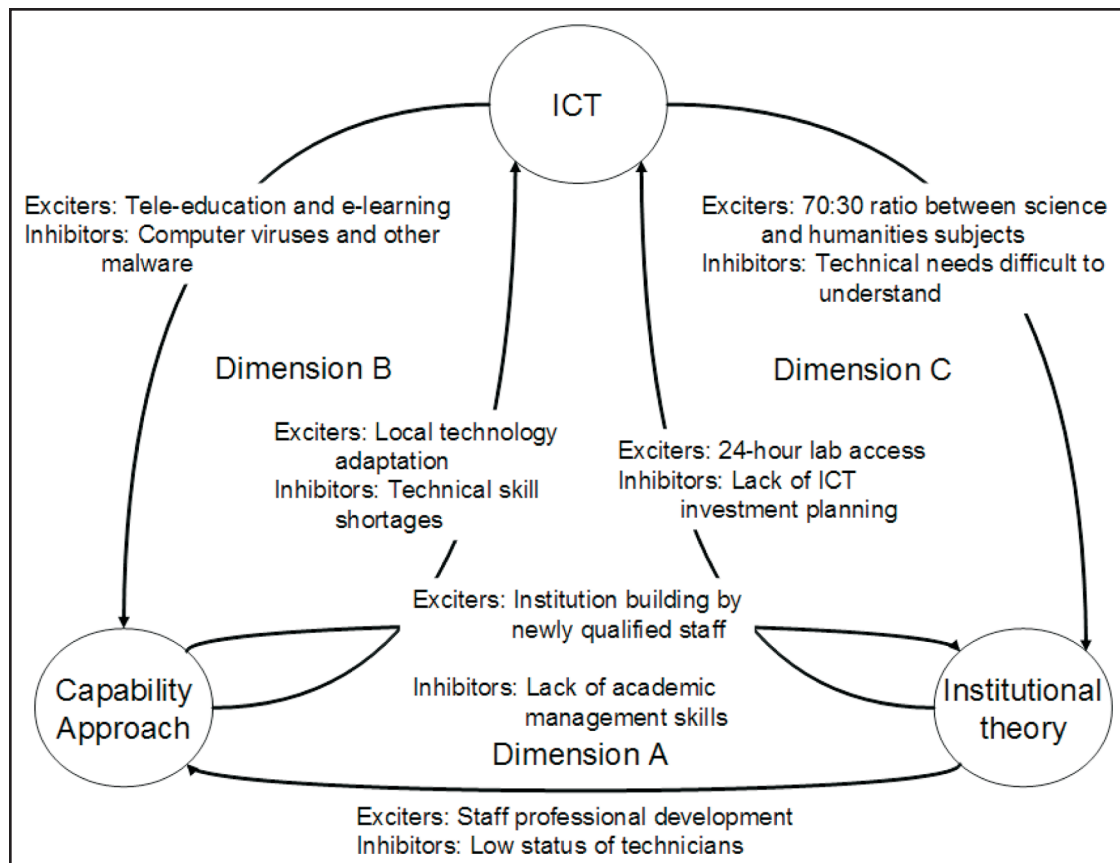
Figure 5. Case study examples mapped to analytical framework.

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 illustrate exciters and inhibitors in each direction on all three dimensions. The analysis is summarized in Figure 5.

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 (those founded in 2007) were characterized by whole universities with only a handful of PhD holders. The presidents in some of the 13 new universities were not professors, and in at least one case did not have a PhD. There are widespread shortages of higher-

degree holders among teaching staff. Most teaching staff were Bachelor's degree holders with little or no postgraduate experience. This paucity 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 restricted access to the whole of the country's public university postgraduate provision to prioritize applicants from within the public university sector. This aims to alleviate the problem of skills shortages within the higher education sector, by legislating formal rules on the allocation of all places in Master's and PhD programs to applicants from public universities. This policy represents a change to formal rules and norms in institu-

tional terms. According to an official at Addis Ababa University (recipient of many of the university instructors sent for higher degrees), "[T]he government is making its effort to promote and train many instructors, at Master's level and at PhD level so that the staffing will be as envisaged [to implement] the curricula."

For example, an instructor was selected by Debre Birhan University to undertake a Master's degree in Addis Ababa. He then successfully passed the Master's degree entrance examinations and in due course completed the requirements of the program. Successful completion of his Master's 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, October 7, 2010, reproduced with permission)

These enhanced capabilities of a staff member contribute to institutionalization of new subject areas within the higher education sector, strengthening 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 vocational training college sector. These technicians have sometimes acquired more practical skills than teaching staff who have graduated from a university. However, these technical and vocational college diploma holders tend to have low status in the higher education sector compared with university graduates. Using college technicians to teach ICT and computer skills to university teaching staff is considered undesirable by 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 when compared to OECD (Organisation for Economic Co-operation and Development) 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 the 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, & 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 1) faster, cheaper access to information; 2) the ability to participate in global forums; 3) lowered cost and increased frequency of interaction with existing partners; 4) new opportunities for critical dialogue; 5) access to collective problem-solving forums; and 6) 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 2 of the program is supporting distance learning. According to one head of department, "[T]hey 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 a recognition that Ethiopia does not have the resources to develop new technologies. However, there is value in using 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 [gradu-

ates] to be more competent in adapting the technology and using the technology [to solve] the problems in the country.

This local adaptation and use 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. This lack of skills makes it difficult to fully exploit those ICTs that are already available. The technical skills shortage is an inhibitor from capabilities to ICTs on Dimension B, as shown in Figure 5.

Prevention and removal of computer viruses and malware in general are major issues in sub-Saharan Africa (Michael, 2009). Alan Mercer, an IT trainer with 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 from 80 malware infections. Subsequent experience over the two-year period of our field research regularly identified computers with more than 100 infections. The largest number of infections found on a single PC was over 340.

Universities in Ethiopia face challenges in obtaining and installing antivirus software, and it is difficult both to ensure regular and uninterrupted computer scanning, and to download virus signature updates over intermittent and slow Internet connections. Infected computers become slow and unusable, and operators often lack 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 malware in general is a technological inhibitor from ICT to fulfillment of capabilities in Dimension B, as shown in Figure 5.

Institutions and ICTs (Dimension C)

Universities around the world have a remarkably consistent organizational structure built around disciplines and subjects. We can observe these organizational structures as expressions of academic cultures and institutions (Becher & Trowler, 2001). The universities established in 2007, such as Debre

Birhan, have started to develop websites that present a picture of how these universities wish to portray themselves to stakeholders (Catalogue, n.d.). The Debre Birhan University website, when initially created, mostly contained descriptions of the university's organizational structure, such as faculties and departments, along with their aims, objectives, and mission statements. This sought to show membership of academic territories (Becher & Trowler, 2001). Senior university officers expressed the view that the website was a prerequisite to engaging with external organizations. Web technologies have changed approaches to managing public relations by creating faster mechanisms for dissemination of information to stakeholders. The universities, as organizations, are using these new Web technologies to position themselves within academic and sociopolitical institutions. These new communication technologies allow universities to disseminate achievements in order to garner funding and political support for their objectives. Recently, the Debre Birhan University website has included evidence of formal contact between the university and external organizations. The website conveys the University's support for federal government priorities, such as community engagement in research (Welcome, 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 concern about resource shortages, despite this preferential support for science and technology subjects. One deputy dean said, "[I]n 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."

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 with regard 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, as shown 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, "[I]n Mekele University ICT . . . they have their own lab and it is open 24 hours."

We are not arguing that 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 the 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 both a paucity of information sources and a shortage 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 above case study 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 & Heskett, 1991) supporting ICT-led capacity building. Take, for example, the government's plan to enhance the capabilities of teaching staff through sponsorship of higher degrees (exciter from institutions to capabilities on

Dimension A), and then to promote staff to management positions to help build 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, the lack of strategic management skills among senior officers in universities (inhibitor from capabilities to institutions on Dimension A) means that ICT investment and planning are 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 university officers 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's degree programs in IS (or information science) and IT. 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, 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 syllabus recommendations. This awareness and knowledge primarily come from university-sponsored postgraduate 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 prioritize technology use to develop individuals' capabilities. Recognition of technologies' role in support of institutions appears to be not well developed.

Conclusions and Further Work

This article addresses this research question: Can the complementary strengths of institutional theory and the capability approach simultaneously inform

ICT4D? The paper contributes a novel analytical framework that combines the capability approach and institutional theory in conjunction with ICT for post-hoc analysis, as well as to practically emphasize the multidimensionality of ICT4D projects. The theoretical contribution of this article builds on the work of Evans (2009), which is not specific to the field of ICT4D. Thus, this article offers the first attempt to link institutional theory and the capability approach in the context of ICT4D.

The novel approach taken for combining institutional theory with the capability approach uses institutional theory to understand the social drivers that may either enable individuals or inhibit them from taking full advantage of ICT resources for the 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 strengthen and develop institutions.

The Ethiopian higher education case study (summarized in Figure 5) shows the complex, multifaceted nature of the ICT4D problem 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, institutionalization can be accelerated, in turn, fostering enhanced capabilities.

In our analysis of the data from this particular case study, we found it difficult to identify a satisfying example of an exciter from ICTs to institutions. The use of Web technologies for institution-building is a general phenomenon. Nevertheless, in an ICT4D context, our analytical framework has allowed us to explore causality between both technologies and institutions on the one hand, and among 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 among elements of the analytical framework allows us to consider its a priori use in a predictive way.

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 of literature. This could be seen as placing a considerable burden on potential users of the analytical framework.

Despite this, practitioners, policy makers, managers, and consultants would benefit from using the framework during interventions to better consider both the development of human capacities and the prevailing context in terms of institutional rules and norms when designing ICT4D projects. Inhibitors between any two of the three dimensions in our analytical framework will negatively impact the sustainability of ICT4D interventions. Failure to create a virtuous circle around all the dimensions will make achievement of any intervention objective 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 present in ICT4D interventions. Related to this, we are interested in exploring the use of the analytical framework for effective a priori design possibilities. A further stream of future work will perform a comparison with other, more established frameworks, such as the livelihood framework. ■

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References

ACM/IEEE Joint Task Force for Computing Curricula. (2005). *Computing curricula 2005: The overview report.* Retrieved from http://www.acm.org/education/education/curric_vols/CC2005-March06Final.pdf

Alkire, S. (2002). Dimensions of human development. *World Development, 30*(2), 181–205.

Avgerou, C. (2002). *Information systems and global diversity.* Oxford, UK: Oxford University Press.

Avison, D., & Wood-Harper, A. T. (1990). *Multiview: An exploration in information systems development.* London, UK: McGraw-Hill.

Barley, S. R., & Tolbert, P. S. (1997). Institutionalization and structuration: Studying the links between action and institution. *Organization Studies, 18*(1), 93–117.

Becher, T., & Trowler, P. R. (2001). *Academic tribes and territories: Intellectual enquiry and the cultures of disciplines* (2nd ed.). Buckingham, UK: Open University Press.

Castells, M. (2000). *The rise of the network society* (2nd ed.). Malden, MA: Blackwell.

Catalogue of World Universities: Universities of Ethiopia. (n.d.). Retrieved from http://www.webometrics.info/university_by_country.asp?country=et

Clark, D. A. (2005). Sen's capability approach and the many spaces of human well-being. *The Journal of Development Studies, 41*(8), 1339–1369.

Commission for Africa. (2005). *Our common interest report of the Commission for Africa.* Retrieved from http://www.commissionforafrica.info/2005-report

Currie, W. L., & Swanson, E. B. (2009). Special issue on institutional theory in information systems research: Contextualising the IT artefact. *Journal of Information Technology, 24,* 283–285.

Development Assistance Group (DAG). (2008). *Human capacity building needs analysis of Ethiopian new public universities (NPUs) final report.* Amsterdam, The Netherlands: Vreije Universiteit. Retrieved from http://www.scribd.com/doc/24868342/NewUniversityStudy-Tesfaye-S

DiMaggio, P., & Powell, W. (1991a). Introduction. In W. Powell & P. DiMaggio (Eds.), *The new institutionalism in organisational analysis* (pp. 1–38). Chicago, IL: University of Chicago Press.

DiMaggio, P., & Powell, W. (1991b). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. In W. Powell & P. DiMaggio (Eds.), *The new institutionalism in organisational analysis* (pp. 63–82). Chicago, IL: University of Chicago Press.

Evans, P. (2009). Population health and development. In P. A. Hall & M. Lamont (Eds.), *Successful societies—How institutions and culture affect health* (pp. 104–127). New York, NY: Cambridge University Press.

Fountain, J. E. (2001). *Building the virtual state: Information technology and institutional change.* Washington, DC: Brookings Institution.

Fountain, J. E. (2006). Central issues in the political development of the virtual state. In M. Castells & G. Cardoso (Eds.), *The network society: From knowledge to policy* (pp. 149–181). Washington, DC: Brookings Institution.

Garud, R., Hardy, C., & Maguire, S. (2007). Institutional entrepreneurship as embedded agency: An introduction to the special issue. *Organization Studies, 28*(7), 957–969.

Hall, P. A., & Lamont, M. (Eds.). (2009). *Successful societies—How institutions and culture affect health.* New York, NY: Cambridge University Press.

Heeks, R. (2006). Theorizing ICT4D research. *Information Technologies & International Development, 3*(3), 1–4.

Johnstone, J. (2007). Technology as empowerment: A capability approach to computer ethics. *Ethics and Information Technology, 9,* 73–87.

Kahn, R., & Kellner, D. (2004). New media and Internet activism: From the 'battle of Seattle' to blogging. *New Media & Society, 6*(1), 87–95.

King, J. L., Gurbaxani, V., Kraemer, K. L., McFarlan, F. W., Raman, K. S., & Yap, C. S. (1994). Institutional factors in information technology innovation. *Information Systems Research, 5*(2), 139–169.

Lall, S. (2001). *Competitiveness, technology and skills.* Cheltenham, UK: Edward Elgar.

Madon, S. (2004). Evaluating the developmental impact of e-governance initiatives: An exploratory framework. *Electronic Journal on Information Systems in Developing Countries. 20*(5), 1–13. Retrieved from http://www.ejisdc.org/ojs2/index.php/ejisdc/article/view/123

Madon, S. (2006). IT-based government reform initiatives in the State of Gujarat. *Journal of International Development, 18*(1), 877–888.

Madon, S., & Sahay, S. (2002). An information-

based model of NGO mediation for the empowerment of slum dwellers in Bangalore. *The Information Society, 18,* 13–19.

Michael, C. (2009, August 13). Computer viruses slow African expansion. *Technology Guardian,* p. 3.

Ministry of Education (MoE). (2005). *Education sector development program III (ESDP-III) 2005/6–2009/10. Program action plan (PAP).* Addis Ababa: Ministry of Education.

Ministry of Education (MoE). (2008). *Education statistics annual abstract, 2006–2007.* Addis Ababa: Ministry of Education.

Ministry of Education (MoE). (2009). *Education statistics annual abstract, 2007–2008.* Addis Ababa: Ministry of Education.

Morgan, G. (2006). *Images of organization* (updated ed.). Newbury Park, CA: SAGE Publications.

Noir, C., & Walsham, G. (2007). The great legitimizer: ICT as myth and ceremony in the Indian healthcare sector. *Information Technology & People, 20*(4), 313–333.

Nussbaum, M. (1988). Nature, function and capability: Aristotle on political distribution. *Oxford Studies in Ancient Philosophy, Suppl. Vol.,* 145–184.

Orlikowski, W. J., & Barley, S. (2001). Technology and institutions: What can research on information technology and research learn from each other? *MIS Quarterly, 25*(2), 145–165.

Pan African e-Network. (2010). Inauguration of Pan-African e-network project (phase 2). Retrieved from http://www.panafricanetwork.com

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

Poor Quality. (2009, January 18). Poor quality is too high 'collateral damage' for Ethiopia. *Addis Fortune, 9*(455). Retrieved from http://www.addisfortune.com

Proclamation No. 351. (2003, July 3). Higher education proclamation. *Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia, 9*(72), 2235–2263.

Proclamation No. 650. (2009, September 17). Higher education proclamation. *Federal Negarit Gazeta of the Federal Democratic Republic of Ethiopia, 15*(64), 4976–5044.

Rajão, R., & Hayes, N. (2009). Conceptions of control and IT artefacts: An institutional account of the Amazon rainforest monitoring system. *Journal of Information Technology, 24,* 320–331.

Rheingold, H. (2002). *Smart mobs.* Cambridge, MA: Basic Books.

Robeyns, I. (2005). The capability approach: A theoretical survey. *Journal of Human Development, 6*(1), 93–114.

Roszak, T. (1994). *The cult of information: A neo-luddite treatise on high-tech, artificial intelligence, and the true art of thinking (2nd ed.).* Berkeley, CA: University of California Press.

Saha, R., Swami, R., Kulkarni, R., & Ananthakrishnan, M. V. (2005). Virtual learning environments for nomadic children. *5th International Educational Technology Conference,* Sakaraya, Turkey.

Saint, W. (2004). Higher education in Ethiopia: The vision and its challenges. *Journal of Higher Education in Africa, 2*(3), 83–113.

Saito, M. (2003). Amartya Sen's capability approach to education: A critical exploration. *Journal of Philosophy of Education, 37*(1), 17–33.

Schech, S. (2002). Wired for change: The links between ICTs and development discourses. *Journal of International Development, 14,* 13–23.

Schlesinger, L., & Heskett, J. (1991). Breaking the cycle of failure in services. *Sloan Management Review, 32*(1), 17–28.

Scott, W. R. (2004). Institutional theory: Contributing to a theoretical research program. In K. Smith & M. Hitt (Eds.), *Great minds in management: The process of theory development* (pp. 460–484). Oxford, UK: Oxford University Press.

Scott, W. R. (2007). *Institutions and organizations: Ideas and interests* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

Sen, A. K. (1985). Well-being, agency and freedom:

The Dewey Lectures 1984. *The Journal of Philosophy, 82,* 169–221.

Sen, A. K. (1987). *On ethics of economics.* Oxford, UK: Basil Blackwell.

Sen, A. K. (1999). *Development as freedom.* New York, NY: Knopf Press.

Silva, L., & Figueroa, B. (2002). Institutional intervention and the expansion of ICTs in Latin America: The case of Chile. *Information Technology & People, 15*(1), 8–25.

Stenhouse, L. (1975). *An introduction to curriculum research and development.* London, UK: Heinemann Educational Books.

United Nations Development Programme (UNDP). (1990). *Human development report 1990.* New York, NY: UNDP. Retrieved from http://hdr.undp.org/en/reports/global/hdr1990

United Nations Development Programme (UNDP). (1999). *Human development report 1999.* New York, NY: UNDP. Retrieved from http://hdr.undp.org/en/reports/global/hdr1999

United Nations Development Programme (UNDP). (2009). *Human Development Report 2009: Overcoming barriers: Human mobility and development.* New York, NY: UNDP. Retrieved from http://hdr.undp.org/en/reports/global/hdr2009

United Nations Development Programme (UNDP). (2010). *Human development report 2010: The real wealth of nations: Pathways to human development.* New York, NY: UNDP. Retrieved from http://hdr.undp.org/en/reports/global/hdr2010

Walker, M. (2005). Amartya Sen's capability approach and education. *Education Action Research, 13*(1), 103–110.

Walker, M., McLean, M., Dison, A., & Peppin-Vaughan, R. (2009). South African universities and human development: Towards a theorisation and operationalisation of professional capabilities for poverty reduction. *International Journal of Educational Development, 29,* 565–572.

Welcome to Website of Debre Berhan University [sic]. (n.d.). Retrieved from http://www.dbu.edu.et

Yin, R. K. (2008). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: SAGE Publications.

Zheng, Y. (2009). Different spaces for e-development: What can we learn from the capabilities approach. *Information Technology for Development, 15*(2), 66–82.