Research Article

Policies, Partnerships, and Pragmatism: Lessons from an ICT-in-Education Project in Rural Uganda

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Abstract

For at least the past decade, political leaders and policy makers have stressed how important it is for Africa to harness technology, leapfrog development, and take part in the global knowledge economy. In numerous initiatives aimed at realizing these goals, education is a primary target, viewed as a mechanism through which information and communication technologies (ICT) can empower societies to develop technologically literate workforces. Unfortunately, there is a considerable gap between policy rhetoric and effective project implementation. Even as ICT-in-education projects increase rapidly in number and scope across the continent, many still lack necessary pre-project assessments, enumerated goals for outcomes, or understanding of what technology can and cannot do. This article's focus on policies, partnerships, and pragmatism is informed by a case study of a multi-partnered ICT-in-education project in rural Uganda that set pragmatic technology-use goals, a project for which governmental policy provided an important initial incentive, and which was subsequently revised to address actual student needs for acquiring technology skills. The case offers important lessons to inform both similar projects and government-led policy initiatives in the future.

Introduction

The level of interest and investment in projects intended to bring the benefits of new technologies to the developing world—and to Africa in particular—has skyrocketed in recent years. This trend reflects the high and ever-increasing expectations placed on the ability of information and communication technologies (ICT) to improve quality of life, empower populations, and assist in economic development.

Education is seen as a primary mechanism through which ICT can empower individuals, communities, and societies to develop technologically literate workforces that are able to participate in the information society and economy of the present and future. As such, it has been a key target of ICT-for-development initiatives. Infodev, a partnership of international development agencies, reports that most African countries had, by 2007, created national ICT policies, and that "of the 48 countries that either have a national ICT policy or are in the process of developing one, 39 of them have education sector ICT policies . . . or are in the process of developing them" (Farrell & Isaacs, 2007, p. 6).

While this is undoubtedly a positive proclamation, two additional points made in the same report are relevant to the arguments and meth-

Volume 6, Number 1, Spring 2010, 48–64

odology put forth in this article: first, that the numerous small-scale ICT-for-education projects already underway within these countries served to inform national policy formation (p. 17), and second, that there remains a disconnect between the formulation of these policies and the translation of them into reality (pp. 1, 7).

Given these two points, further analysis of case studies is warranted on the basis that, if governments took examples from pilot projects in which they had little-to-no involvement and were subsequently challenged by the translation of vision (as enumerated in policy) into realized implementation, then it will behoove them to, once again, look to case studies—to successful pilot projects—for insight. Most national policies were formulated in the early 2000s, and the fieldwork informing them was carried out even earlier. It is worthwhile, therefore, for governments to take a look at what has been successful in the ensuing years.

This article will address considerations necessary for the introduction of ICT into primary and secondary schools worldwide, although it will focus on the developing world. It will be informed by a discussion of ICT-in-education, as illustrated by the examination of a Ugandan ICT-in-education project notable for its employment of creative strategies to ensure sustainability and relevance for its students. These strategies will be examined to see which may be applicable and useful for policy formulation and implementation at the national level, as well as for other schools that are both facing similarly constrained circumstances and looking to implement ICT projects, even though we acknowledge the challenges inherent in extrapolating from a single case.

The article proceeds as follows: After a background and overview of ICT-for-education projects in the developing world, the challenges particular to such projects will be discussed. The methodology and a discussion of theory development are subsequently presented. After that comes an overview of the current education situation in Uganda, followed by the case study. The article concludes with a discussion, both of findings from the case and of the relevant policy implications those findings suggest.

Background/Overview

Education is believed to play an essential role in the development of a knowledge-based society. The rationale is that education is a powerful tool that contributes seminally to economic growth through the development of the skilled workforce necessary to increase productivity. It is equally vital to social development, as it empowers people to improve their health, environment, and governance.

Despite the soundness of theory, a sizable number of recent ICT-focused developing world education initiatives have failed to produce ecosystems of technology adoption or uptake in the classroom; in addition, follow-up and measurement of outcomes from these projects too often remains undone. Thus, questions remain regarding how to best pursue successful and sustainable ICT-for-education projects. Understanding how and when to use technology appropriately to improve the educational experience and ultimately develop a workforce literate in, and prepared to contribute to, the knowledge economy remains an unaddressed challenge.

Given the rapid rate at which ICT projects can be designed and implemented, there is a tendency to see ICT as a short-term silver bullet that will be adopted instantly on a wide scale, bringing immediate solutions to past and present hindrances to political, social, and economic growth. Few governments, or project implementers for that matter, realize the level and duration of macro-scale commitment necessary for ICT to be adopted by numbers sufficient to enable widespread change. A failure to conceive of ICT-in-education projects as long-term infrastructural and human capital investments more often than not leads to both an undercommitment of funds and overly high expectations for quick results. There is also an often-held misconception that ICT is an end in itself, or that simply distributing computers will create a need for them, a comprehension of their technology, and a technologically literate populace. Further, societies simply do not change as quickly as the technologies introduced into them do, or even at the rate that these technologies might allow or enable. All these factors can lead to unrealistic expectations, creating a gap between aspirations and outcomes.

Despite the promise that today's new technologies hold, the unplanned introduction of ICT—without a realistic understanding of what technology can and cannot do, or of which capabilities it may enhance—can intensify existing inequalities in society and lead to disappointments. Projects that do not succeed will represent unfulfilled aspirations for

the participants, as well as the squandering of scarce resources for developing country governments. The stakes are high.

One of the challenges facing many well-intentioned ICT-for-education projects is that such projects have traditionally failed to anticipate the importance of such considerations as teacher training, educational outcomes, infrastructural requirements, and the like; in other words, many fail to take a holistic approach to the adoption of the technology. And yet, it is becoming widely recognized that, in order to promote uptake, adoption, and a culture of use (i.e., to achieve sustainable outcomes), a focus that includes the entire ecosystem of a project is necessary. Further challenges include both performing a truthful assessment of the conditions into which ICT is introduced and enumerating realistic goals that the use of ICT is anticipated to achieve.

Misunderstanding ICT as a Panacea

Adelman has identified the dominant paradigm in development economics as troubling and counterproductive: "the (inherently misguided) search for a single-cause, and hence a single remedy, theory of development," a tendency stemming from the "keep it simple, stupid" paradigm found in economics (2001, p. 104). This trend has been mirrored in the policy realm: One-size-fits-all prescriptions and interventions have been carried out repeatedly by development or aid organizations targeting the developing world. The prescriptions have changed over the decades, but the accompanying mindset has not (Adelman, 2001; Akpan, 2000; Evans, 2005; Rodrik, 2006).

One of the dangers of the top-down, one-size-fits-all prescriptive policy approach is that it fails to allow or account for societal, historical, political, or other existing differences, or for change. Such an approach looks to theory for an answer as to what will cause growth—the simpler, the better—and then attempts to apply that theory to a complicated reality, with life-altering consequences for countless human beings. When the proposed solution fails to deliver, the developing country's shortcomings are blamed, and the theorists regroup to come up with the next solution. Over time, the single-solution "answers" proposed to bring about growth have included all of the following: increased capital, entrepreneurship, foreign investment, international trade, human capital, and more (or less) government (Adelman, 2001; Evans, 2005). Technology is currently being touted as the new "answer."

Not surprisingly, as with most panacean initiatives, once there is an answer, little is done in the way of examining what the question was. ICT cannot be a solution if the source of the problem has not been thoughtfully and honestly articulated. For example, if there is no universal education in a country, there is a reason, and it has nothing to do with whether there are computers in the classroom. There may be no classrooms. There may be no teachers. The prevailing social, economic, political, or even infrastructural conditions may not allow parents to send their children to school. None of these issues will be addressed or solved by handing out computers. Technology that will lead to meaningful development cannot be an answer in search of a question. It must be the other way around. This is by no means exclusive to Africa—it is relevant all over the globe.

One of the shortcomings of the leapfrogging argument so often alluded to when describing the potential for ICT vis-à-vis development is that it tends to focus solely on the technology, missing the human element of meaningful ICT use. Merely providing technology does not automatically create a need for it, nor does it foster a culture of use or attempt to comprehend the underlying issues and challenges most efficiently addressed with the aid of technology. It has become an axiom among those who study and deploy ICT that technology is "neutral." This view ignores the fact that technology is always and everywhere introduced into a society that is far from neutral; the individual characteristics of each society greatly affect fundamental issues, such as whether and how technology will be adopted and used, and who will benefit from it.

The very notion of "bridging the digital divide" is simplistic and misleading. It offers up an attractive visual image of being able to provide a bridge to a technologically disempowered "have-not," so that he or she may cross over (and progress) to join the enabled, empowered "haves" on the other side. However, it has been argued that there are multiple "divides" (Keniston, 2004), as well as gradations of technological access and use (Warschauer, 2002). Seeing the issue as black and white, as an either/or dichotomy, oversimplifies both the concept and the

proposed solutions, often making them unrealistic. It also tends to privilege the technology itself as the bridge, rather than recognizing that complicated human beings face multifaceted realities that will, to a great extent, determine which technologies are perceived as useful.

It is tempting to confound the goals of assisting development with the goals of providing technology; this is further complicated by the fact that most of those who either study or are involved in these areas have good intentions and want to see technology assist development. Still, technology must be seen as an enabling tool, and for it to be effective in its purpose of enhancing people's capabilities to meet their needs and desires, it must also be appropriate to their circumstances. It may not always be that complicated technology is the most appropriate solution for addressing a given issue. This notion is far more complex, in addition to offering less instant gratification, than jumping on a bandwagon with a sound-bite solution like "laptops for children" and seeing that as the way to solve all developing countries' education and technology issues. Yet when simple solutions do not remedy complex problems, disappointment is the result.

Developing a populace and workforce able to access, incorporate, and create information is a worthwhile goal, but it is also one that will take an honest, circumspect evaluation of whether and how technology can enable, empower, and enhance existing methods of teaching and learning, as well as a rejection of the too-simplistic notion that technology alone is the answer that will change everything. If technology is adopted, this will require a long-term investment on the parts of government, participants, and stakeholders in ICT-for-development projects, as well as an understanding of what such an investment will require. Simple provision of, and access to, technology may be necessary, but it is far from sufficient.

ICT for Education: What Do We Think We Know (That We Didn't Know Before)?

Schools are being called on to build the human capital essential for participation in a technologically advanced society that is able to participate in the global economy. Information technology is being introduced into schools around the globe, yet the goals for doing so are often not clearly articulated. As a result, project success is not easy to determine, and outcomes are difficult to measure.

One oft-cited goal for the introduction of ICT into schools is that of making the learning process more efficient (Cuban, 2001, p. 13). It is arguable whether or not this is actually possible. Technology may make many peripheral processes and capabilities associated with learning more efficient, but the learning process itself is not sped up through technology. To wit: even with all existing technology at its disposal, the world has not yet discovered shortcuts for teaching children how to read, write, or figure mathematics problems. Technology does not make learning more efficient, but it can enhance the experience.

This possibility for enhancement points to an alternate goal for ICT in education, one that may possibly be more feasible: Technology can transform teaching and learning into an engaging and active process connected to real life, and it can prepare students with the skills necessary to enter the workplace of the 21st century (Cuban, 2001, pp. 14–15).

However, even this goal has a number of hidden assumptions that bear discussion. First, we should not take for granted that there is a relevant workplace for ICT-literate workers to enter and contribute to upon graduation—particularly in the developing world (Mercer, 2005). Second, "transform" is a strong word. Cuban finds in a study of ICT-equipped schools in the Silicon Valley region of California that the overwhelming majority of teachers implemented technology only partially and incrementally into their lesson plans, largely maintaining the status quo in terms of their teaching styles (2001). If this was the case where state-of-the-art technology and comprehensive training and support were provided, and where teachers may have been considered reasonably comfortable with (and adept at) using technology because it was integrated into many aspects of their everyday life, what can we expect of teachers who have never seen or used a computer before, or who have received neither sufficient training nor support?

Once again, it is important to examine underlying assumptions and expectations about technology use. There seems to be a belief, common among development and aid organizations, as well as among many scholars and practitioners, that Africans, if provided with computers and the Internet,

will use them only for obtaining information that will spur them to economic growth and socio-political development (Mercer, 2005). But it is unrealistic to expect user patterns of new adopters of technology to differ significantly from user patterns already witnessed around the world (ibid.). How can we expect that Africans will only use the Internet for information seeking in order to improve their livelihoods, skills, and incomes, when the majority of people around the world use the Internet largely for entertainment and communication?

Providing schools with computers—or giving laptops to students—without addressing underlying educational issues or attempting to anticipate how their presence would change the learning environment is a fruitless endeavor; it has been tried in the developed world with disappointing results (Hu, 2007). Computers and technology alone do not further the education process. It may be true that even young children can teach themselves how to use a computer, but it would be a rare child indeed who taught himself or herself how to read, write, and do mathematics problems with that computer if there were games to be played on it instead. Indeed, most programs that attempt to teach children how to read or to learn a language are packaged in the forms of games. Children like to have fun—schools do not exist to teach them how to do so. It is generally agreed that schools exist to teach children such things as skills, social norms, and ways of learning that would most likely not come to them if they were left entirely to their own devices.

Technology does not teach children other intangibles also learned in school, such as how to interact and get along with other children their age, respect the authority of the teacher, and respect various other rules and concepts—attendance, timeliness, waiting in line, sharing, working in teams, etc. Education has come to be recognized as a universal human right, and schools at least at the primary level) are universally the place where children go to be taught and learn from teachers who make use of lesson plans and curricula. Though there are certainly exceptions to the rule, as well as numerous cases where universal primary education is not yet a reality, agreement is general worldwide that schooling is a common good (or even a human right) that should exist.

Perhaps a realistic expectation for computers-in-schools programs in the developing world is that they may come to resemble similar programs in the developed world in terms of teacher adoption and use of technology. Cuban reports that, a decade after the introduction of computers and the Internet into California schools, no advances had been made in terms of efficiency of learning or teaching that were attributable to their presence (2001, p. 178). However, the argument that computers have become ubiquitous tools in an information society is still valid, and schools can provide this training, so equipping children with the skills to use relevant technological tools is an appropriate goal. What is important is to not set expectations that are based on unrealistic visions of what technology can accomplish.

One further consideration worth mentioning is that ICT is a long-term investment. In addition to teacher training and support (from the government, administrators, and parents), there are other important considerations that must be part of the investment equation for the developing world, and for Africa in particular. ICT is not a one-time investment. It is an infrastructural and human capital investment that requires upkeep and reinvestment at a much faster pace than traditional infrastructural capital investments. Countries across the African continent have an unfortunate legacy of not reinvesting in infrastructure (Tomlinson, 2007). This mindset will need to change on a number of fronts regarding both ICT investments in general, and ICT-for-education projects in particular. First, the human capital needs to be considered: training and support must be offered on an initial and ongoing basis. Second, the equipment will need to be maintained, and the hardware and software will need to be updated when they become outdated or obsolete.

Another often-overlooked factor is the long-term power costs involved with setting up ICTs. In Africa, electricity, where it is available, is often expensive. This means that the least costly methods for operating computers should be taken into consideration; computers should use as little power as possible to operate (bringing into question the wisdom of using old donated, power-hungry refurbished PCs), and alternate sources of electricity than that available from a grid should be investigated. Solar power or other renewable sources of energy should be considered, although these may require considerable up-front expenditures, and their maintenance must be considered in a long-term fiscal plan. All these

budgeting issues must be kept in mind by implementers of both local, small-scale projects and larger, government initiatives.

Methodology and Theory-Building

This article employs a qualitative, case study methodology, which is particularly relevant for researchers examining strategies in emerging economies. In addition, the case study is the most appropriate method for studying the "many variables-small N" [number of cases in a data set]–type of subject presented herein (Lijphart, 1971). The case study is best employed when there are a limited number of cases for analysis, as it allows the researcher to examine the study intensively. An additional strength of the case study methodology is the contribution it can make to both theory-building and best practices identification. We adopt Gerring's definition of a case study as "an intensive study of a single unit for the purpose of understanding a larger class of similar units" (2004, p. 342).

One distinct, yet nascent, theory-building area to which we hope this article will contribute is the enumeration of a process theory of the "top-down-meeting-bottom-up" approach to ICT and development-related efforts. Because there have been few articles written specifically on this topic, there is not yet a body of literature from which to draw. As a result, in attempting to formulate a coherent framework for this article and for future work in this area of study, this literature review draws from scholarly work in the fields of economics and international business, where we can witness a changing paradigm regarding interaction between developed and developing world actors. (The disciplinary origin of this literature is not, however, meant to reflect a business-oriented perspective in the case at hand or for such projects in general.)

In 2004, London and Hart identified a problem: corporations from the developed world tend to conduct business in the developing world according to the Western norms to which they are accustomed. However, given the high failure rate of numerous endeavors that they investigated, combined with the absence of efficient, formal markets and the rule of law to uphold property rights often seen in the developing world, they concluded that a new strategy for Western firms doing business with the world's poor was needed. In the same year, C.K. Prahalad published his widely cited book, *The Fortune at the Bottom of the Pyramid,* which encouraged Western corporations to consider the profit potential of doing business with the poorest of the poor around the globe, citing numerous examples of original, successful approaches to doing so.

However, Iqbal Quadir, founder of GrameenPhone in Bangladesh, challenges the top-down strategy that has been generally been employed with bottom-of-the-pyramid initiatives: simply treating the poor as consumers does nothing to increase their incomes or, therefore, their purchasing capacity, nor does it stimulate much-needed entrepreneurship (Quadir & Morse, 2003). Thus, there is also a growing comprehension that reaching this group and realizing successful ventures will require new strategies. Hosman and Fife (2008) have identified two paradigm-shifting strategies to promote sustainable outcomes in projects that involve developed- and developing-world participants: the first is to focus on the wants, needs, and characteristics of the local communities and involve them as stakeholders from the outset of such projects, and the second is to form partnerships to carry out the projects (p. 52).

Discovering the true needs and demands of the poor will require their input and involvement. Determining whether or not these needs can best be met through technology, and then establishing how to do so, may best be done by those with pre-existing technological expertise. The challenge is to establish a feedback loop between the top and bottom in order to understand local communities' needs and develop appropriate technology-based projects. Scholarly study on the topic of bottom-up meeting top-down initiatives is nearly non-existent.

There is not yet a theoretical framework that focuses specifically on public–private or international partnerships (Stewart & Gray, 2006). Even so, some types of partnerships have been identified as promising: Public-private partnerships are currently held in extremely high esteem by governments, NGOs, development organizations, and firms alike. Another form of partnership—involving universities and university-based researchers—not only holds promise for establishing back-and-forth communication between locals and "experts," it also bodes well for academic analysis, since by definition, those involved are university based.

The unique partnership highlighted in the case study below involves three parties: the St. Julie School in Buseesa, Uganda; a San Francisco–based nonprofit technology solutions provider (Inveneo); and a local technology expert based in the Kibaale region of Uganda. In fact, before the case below took place, a partnership already existed between the local technology expert and Inveneo because, in order to promote local capacity building and sustainability, Inveneo recruits, trains, and certifies local ICT professionals. In turn, after hands-on guidance with their first project, these trained entrepreneurs subsequently perform the installation, maintenance, and support for ongoing and future endeavors themselves. At the stage of the case detailed below, the St. Julie School entered into a partnership with Inveneo and the local technologist. This partnership, as well as the computer lab project, is described in detail in the case study and discussion sections. As stated earlier, it is the intention of this article to contribute to the theory-building process on partnerships for development, and in particular, on how effective feedback loops, as well as local capacities, can be developed to promote successful, sustainable-partnered projects.

The research findings presented herein are based on a combination of secondary literature review and document content analysis, as well as on interviews with key project participants. The interviewees included Sister Anita, the project leader at the St. Julie Model Primary School, which is the school under focus in this case study, and Mark Summer, co-founder and CEO of Inveneo, the NGO partner in the project and a provider of local technology training in the region. He was involved directly with the project from the time that Sister Anita first contacted him in the spring of 2007. The interviews informing the article took place between October 2007 and November 2009. The reporting on the case thus represents over two years of the project's development and implementation.

The case was chosen because of the identified best practices evident at this stage of project deployment (including the enumeration of goals for technology use, the training of teachers, and technology use being evident in the classroom) and the challenges faced (such as the lack of electricity and the harsh environmental conditions) that will likely be common to similar projects undertaken in the future. The article makes use of micro-level findings in order to inform at the macro level using the insight gained through in-depth case study analysis of the challenges and successes experienced at one school to inform and make policy recommendations aimed at the state level. It also reports on both challenges and success factors that may be faced by like-minded initiatives taking place in schools throughout the developing world, particularly in the sub-Saharan African context.

Still, this article acknowledges that there are difficulties inherent in extrapolating from a single case study. What has been successful in one geographical location may be completely inappropriate for another. Any attempt at policy prescription must be preceded and informed by a sincere effort to gain an understanding of the particular situation at that point in time, and of how it got there, on both a recent and historical time scale. We are mindful of this limitation. However, as Ottevanger, van den Akker, and de Feiter (2007) identify, there are many commonalities in the challenges facing ICT-in-education initiatives across the African countries that are attempting to implement them. Because such commonalities exist at the macro level, it is reasonable to assert that they also exist at the micro level, as schools across these countries, and indeed, across the developing world, face similar challenges in introducing ICTs into schools that have never had them before, to teachers and students that have never used them before, all under challenging conditions in terms of climate and environment; constrained budgets; ambiguous government policies; inadequate infrastructure, including expensive and/or non-existent electricity; and a lack of prior experience in this realm. To the extent, therefore, that the case under examination has faced challenges and adopted identified best practices in terms of technology project implementation, we believe that reporting on these factors can be of significant value for similar future ICT-in-education endeavors that will take place on a micro, or grassroots, level.

In addition, as outlined earlier, because most of the national ICT-in-education policies currently in place in Africa were informed by non-government-affiliated pilot projects that took place in the late 1990s to early 2000s, the use of a case study to inform at the policy level both builds on previously used methodology and updates the body of knowledge from which the government may choose to draw in terms of policymaking.

Primary and Secondary Education in Uganda

Uganda's National Information and Communication Technology Policy was established in July, 2002.[1] Within this document, ICT is explicitly identified as having "the potential to leap-frog Uganda to benefit from the globalized economy" (Government of Uganda, 2002).

Although there is no specific Ugandan ICT-for-education policy as of yet, the national ICT policy does mention education. It is mainly addressed in section 3.4, "Human Resource Issues." The fieldwork and surveys performed to inform this policy document were carried out in 1998. It is time to take another look at cases that have proven successful during the intervening decade to inform the creation of the nascent ICT-for-education policy currently "in progress" (Farrell & Isaacs, 2007).

The government of Uganda mandated universal primary education (UPE) in 1996. In a single year, primary school enrollment surged from approximately 3.1 million pupils to 5.2 million, an increase of approximately 68% (Uganda Bureau of Statistics, 2007). The state did not legislate an increase in the number of teachers and schools to accommodate this massive swell in student enrollment. In fact, it was only after the UPE was promulgated that thought was given to creating a regulatory framework for carrying out the mission (McGee, 2000, p. 88).

Some of the regulations put into place subsequent to the UPE's introduction include the following: restricting beneficiaries to four children per family, at least two of whom must be girls; making Parent Teacher Associations (PTAs) and the fees associated with them illegal; and instituting automatic promotion from year to year of all pupils, regardless of achievement (Dauda, 2004; McGee, 2000). Goals for the project were announced mainly in terms of easily quantifiable targets: 55 pupils per teacher, 55 pupils per classroom, one book per pupil—none of which have come close to being met, and all fail to take into consideration any meaningful measure of the quality of education.

Unfortunately, this focus on easily measured but non-quality-related metrics is all too commonly mirrored within development organizations, typifying the focus on easy answers originating from the "keep it simple, stupid" argument noted above. In fact, Deininger (2001), from the World Bank bases his analysis of the program on school attendance, disregarding any notion of quality as demonstrated by retention rates, relevance of curriculum, completion rates, literacy levels, achievement, the experience of teachers, and the like. He pronounces the program "a success" (p. 292) and "remarkably effective" (p. 303). In fact, he ultimately dismisses the topic of the importance of the quality of educational inputs, asserting that early discussions of the topic were not generally satisfactory (pp. 293–294).

Meanwhile, micro-level studies undertaken on the ground in Uganda reveal a different picture. Dauda (2004) reports that the outlawing of PTAs halted the development of an institutional organization that had sprung up in the absence of governmental funding during the 1980s and 1990s to make primary education possible by promoting accountability and communication between teachers and parents. In fact, in a reversal of policy, the Ugandan government eventually partially restored the legality of PTAs under the UPE (p. 32).

The government is still making incremental attempts to remedy the situation created over a decade ago by its lack of foresight and planning regarding UPE's overnight implementation, though these efforts often consist of little more than stopgap measures. To address severe school overcrowding in the capital city, for example, some secondary schools have mandated a double shift program, in which Level One students will study in the morning, while those in Level Two will study in the afternoon (New Vision, 2008a). Tellingly, once again, the human resource issue has not been addressed. Teachers, whose workload has effectively been doubled as a result of this measure, are offered no increase in remuneration as a result of the new policy (ibid.).

Ugandan primary and secondary schools face a number of infrastructural and basic supplies deficiencies. These include shortages of trained teachers, classrooms, water, latrines, and textbooks. Teachers are paid next to nothing, and sporadically at that (Dauda, 2004, p. 30). Other schools have

1. The Web site on which this document may be located belongs to an international agency—the International Labour Organisation; oddly enough, it cannot be found on any local or official Ugandan government Web site.

resorted to using shade trees as classrooms and/or staff rooms (New Vision, 2008b).

Some parents have become so disillusioned with the public schools (or lack thereof) in their areas that they have instituted private, community-run schools in a grassroots attempt to address public school shortcomings (Arbeiter & Hartley, 2002; Dauda, 2004). These community schools are not without their own challenges. Reports on one such school, wherein all the textbooks are borrowed from other schools, and they have, at most, one for each subject in each year (Boseley, 2007).

Though the Uganda Bureau of Statistics (UBOS) reports that the student-to-teacher ratio continues to improve, it also reports that primary school enrollment has continued to fall during the present decade (UBOS, 2007), and the recent announcement to allow an increase in the maximum class size (Boseley, 2007) belies official reports of progress in this area. A few secondary schools in Uganda have initiated ICT projects, but the government points out that "only a very small percentage of Secondary Schools are offering ICT Training, and in almost all cases the facilities are awfully inadequate for reasonable hands-on experience" (Government of Uganda, 2002).

Another on-the-ground research endeavor—one in which local educators were trained to carry out structured, analytic research on the quality of primary education within their own region in Western Uganda—revealed surprising results (Heneveld, 2007). The educators had assumed that they needed more classrooms, books, and housing for the teachers. After systematic assessment, they discovered, to their surprise, that their particular region was not so overcrowded, and that there were sufficient textbooks (but that they were sitting in storage).

This project was carried out across four regions in Africa; studies found that the teaching style remained uniform across regions: the teachers talk, while students are passive but pay attention. Further, the most effective educational outcomes were realized when teachers prepared lesson plans, emphasized reading and writing, and evaluated students regularly (Heneveld, 2007, p. 654). Even so, each region produced its own unique findings; this cautions against universal truths being proclaimed and strengthens the argument for the importance of involving local researchers' insights in the implementation of national reforms.

This overview is not presented in order to detract from the positive aspects of increasing children's enrollment in school and providing them with educational opportunities. Rather, it is to highlight the government's failure to consider the necessity of planning for project implementation, or to provide the basic requisites—such as teachers, teacher training, and infrastructure—necessary to ensure that students receive a quality education. At this time, ICT's "potential to leap-frog Uganda to benefit from the globalized economy" seems disconnected from the government's lack of assessment of what constitutes a quality educational experience and requirements that such be realized.

Case Study

In 1995, the Sisters of Notre Dame—an international congregation of Catholic women—established the St. Julie Model Primary School in rural Buseesa, Uganda to board and educate children in grades three through seven. A secondary school was started in 2003, and the primary school has since added grades one and two. The primary school is co-educational, while the secondary school is only for girls. The sisters who run the school hail from the United States, Germany, and Uganda. In total, there are approximately 150–180 students attending the school; they live in dormitories, while the sisters—the school's teachers—live in an adjacent convent. The school has six classrooms, one of which now functions as a computer lab. The school and convent make use of solar power to meet their energy needs.

The children attending these schools are mainly from the Kibaale district, which is often called "the forgotten district" or the "lost district" because of its severe lack of roads, infrastructure, and electricity, as well as its endemic poverty. Even so, fees to attend this school are much lower than for many private schools in Uganda, thanks to cost-defraying donations from the United States. The school is working on becoming self-sustaining, so that, when the sisters from the United States and Germany return home or move on to other missions, Ugandan sisters will be able to continue their work.

The idea to put a computer lab in the school was the result of an October 2005 visit to Buseesa by

two California-based provincial superiors. The superiors discussed the idea with the sisters in Uganda, and in June 2006, secured a grant from a foundation, also based in California, to fund the project. They have since secured a second grant for the maintenance of the lab. Sister Anita, who is from the United States, took the lead in pursuing this project, and may be considered the project coordinator.

As the school's convent was already solar-powered, and the sisters were using solar-chargeable laptops, the decision to continue using solar power as an energy source seems a straightforward one. In a similar vein, in terms of the technology, Sister Anita initially investigated the possibility of obtaining laptop computers to supply the lab. However, there are drawbacks to the use of laptops. First, they are far more costly than traditional PCs, both for the initial outlay and for repairs (generally, the whole computer needs to be repaired if one part breaks, which is a likely occurrence with numerous young children using them on a regular basis). Next, they would each require an expensive inverter to convert DC to AC power, and finally, they are not energy-efficient, and would, in fact, require quite a bit of power to run.

In the spring of 2007, through word-of-mouth (from the Internet service provider that previously provided Internet service to the mission, but had since gone out of business, leaving the sisters with no connectivity for over two years, up to the present), Sister Anita learned of Inveneo, a nonprofit company based in San Francisco that provides innovative ICT solutions to those in rural and remote locations in the developing world. She e-mailed them, and a dialogue began.

To most appropriately meet the ICT needs of their clients, the people who work at Inveneo first determine existing infrastructural conditions and eventual goals. Inveneo then assesses whether its products are a good match for these circumstances and expectations. When creating ICT devices, Inveneo considers external environmental conditions, energy supply (or lack thereof), and long-term energy costs. In this particular case, the technology users would be multiple classes of children rotating in and out of the computer lab throughout the school day; the environment is one of considerable dust, heat, and humidity; and the energy supply is limited.

The solution proposed was to outfit the computer lab with 20 computers that operate on a 12-volt battery system recharged by the school's existing solar power setup. The computers in the lab are efficient, requiring approximately 18 watts each to power, as compared with the approximate 200 watts required to power a normal desktop computer. Additionally, this technology set-up runs directly from 12-volt DC power, which requires no conversion from AC to DC power, so it can be powered directly from the solar panels. The software and operating systems are open source—free—for both the servers and desktops. The computer lab has been operational since approximately October 2007.

One unique aspect of Inveneo's focus on project sustainability is the recruitment, training, and certification of local ICT professionals to perform the installation and maintenance of, as well as support for, the projects. This keeps costs down, promotes sustainability, and benefits the local economy by building local expertise and abilities. This focus on the "local" is most important with regard to maintenance and support. It is easy to forget that technology deployments rarely run perfectly upon installation; the St. Julie school computer lab was no exception. The software has required reinstallation three times, for various reasons. The solar panels have been dislodged and blown off the roof twice during storms. There are ongoing network problems and individual computer issues. These realities underscore the importance of having local, trained technical support for ICT projects. In fact, this point can be taken further: There is also a benefit to having competition among local ICT technicians. Inveneo has trained multiple local technology experts in the Kibaale region, and the St. Julie school found that the second local partner to which they were introduced was more interested in and amenable to working with a school and meeting its particular needs and concerns.

In terms of the real-world costs for this project, the school spent approximately US$20,000 on the technological hardware for the project, which included 27 computer stations, two printers, and two switch boxes. This equipment is divided between the computer lab and an office area. Approximately $14,000 was spent on the solar technology to power the equipment, which included nine solar panels and six 200-amp-hour batteries. In both cases, the installation and maintenance of the

equipment was part of the contractual agreement with the local technology partner. The second grant the school obtained is being used for ongoing maintenance and to do an assessment of the lab to determine future needs. All the funding for this project has come through grants from Catholic Church–affiliated organizations.

The goals for having a computer lab and making use of ICTs at the St. Julie mission were enumerated at the outset of the project. They are pragmatic, and they have been revised since the project's deployment. The school originally had two specific goals: the first was to have its students be able to sit for a national-level Computer Studies exam by the year 2010, and the second was to develop the students' technology skills to help them get a job. The job may be an end in itself, or it may provide funds to enable the students to eventually further their education. After performing a needs assessment, the school has revised these goals: the former has been foregone in favor of the latter.

Uganda instituted a national testing program in Computer Studies in 2004. It consists of both theory and practical use of computers (including use of word processing, databases, spreadsheets, and the Internet). Students must sit for a certain number of exams at the end of their studies, both after the primary level and four years later, when it is necessary to obtain the Uganda Certificate of Education. Computer Studies are now included in the list of elective exams from which students can meet the required total number of exam subjects. As stated earlier, the school's original goal was that its students would be able to sit for the Computer Studies exam by 2010. In the event, there were a number of factors that contributed to the school's decision to abandon this goal in favor of promoting basic computer skills among its students.

The first reason was that the national exam required an extensive knowledge of theory that, in the school's estimation, and based on feedback from graduating students, would be less useful to them than the acquisition of basic computer skills. The second reason was that, to sit for the computer studies exam, the students would have to decide in their third year of studies not to study accounting or commerce; yet the St. Julie School has a very strong instructor for both of these subject areas, as evidenced by the fact that the students consistently receive high scores on the national A-level exams in these two fields of study. In addition, the computer studies exam is listed in the "vocational" group of exam subjects. For A-level students looking to continue their education, "traditional" exam subjects can be more appealing, as they are often considered more attractive by higher education institutions. Third, the school has not yet been able to obtain Internet access. There is no reliable phone network in their region of upcountry Uganda, and a satellite Internet connection would be too expensive for the school (at a subscription rate of about $200 per month, not including the cost of the dish itself, which would add another US$5,000–$7,000) so the students would not be able to be trained for the Internet-related portion of the national exam.

Finally, even though taking traditional A-level exam subjects is regarded as helpful for a student to gain admission to the university, the students discovered once they arrived at the university that, whether or not they had taken computer studies as a subject, there existed an expectation that students would already know how to use computers. Students entering the workforce instead of the university were finding a similar expectation, or were more successful in finding a job because of their basic computer-use skills. For these reasons, the school has taken a pragmatic approach, opting to emphasize hands-on computer skills training for all their students, rather than pushing for the goal of sitting for the national Computer Studies exam.

In terms of teacher training in computer skills at the St. Julie School, the school initially hired a young man from the local village, Andrew, who had computer skills and training. He assisted two of the sisters in teaching students during the week, and he trained the other interested teachers on the weekends. Andrew was not trained in computer pedagogy, and his training focused on more basic computer skills development, rather than on any pedagogical incorporation of technology into the curriculum. Even so, this type of training seems to be appropriate for the St. Julie School's present needs: approximately 70% of the teachers/staff are Ugandan and did not have prior experience with computers, so basic computer training was essential. In addition, the computer lab was only being used to teach a limited number of subjects, and the majority of teachers were not yet using the computers in the context of their own teaching. Given this fact, the teacher training has been entirely voluntary

for the teachers, and to date, approximately half of them have attended the weekend training. Recently, because of his computer skills, Andrew was able to obtain a full-time job elsewhere, and has not been able to continue the teacher training, so it has reverted back to Sister Anita. She continues to offer the weekend training for teachers, and she has also trained an older student, Olive, who now assists her in the classroom. However, Olive will be joining the Sisters of Notre Dame mission in the next year, and she will need to be replaced. The training of student helpers can certainly be a beneficial endeavor, both for the student and the teachers who receive the student's support, but it must be recognized as an ongoing undertaking, as students graduate and leave the school. In all cases, the training and instruction provided to the teachers at St. Julie School has been on a one-on-one basis, which has allowed the teachers to both express their particular interests and receive individualized training.

Since there is one computer lab that serves the entire school, the students' time in the computer lab is necessarily limited. At present, the students in primary levels five, six, and seven use the computer lab for about 40 to 45 minutes, once per week. The secondary level students use the computer lab for two blocks of 80 minutes per week, when they share the computers in a 2:1 ratio. Then, during an afternoon study session, they come in for an additional 40 minutes to practice by themselves without their partners. In total, the secondary students have access to the computers for about 200 minutes per week. The programs being used in the computer lab include open-source versions of MS Paint, word processing, spreadsheets, databases, Publisher, PowerPoint, a dictionary program, and a typing instruction program. The students are using the dictionary program to learn new words (in English) and to improve their grammar. In the future, the school hopes to acquire read-aloud storybooks, mathematics-practice software, and an Internet connection.

As emphasized earlier, the lab is being used to teach students basic computer-use skills, as these were determined to be more relevant to their lives and future livelihoods than computer theory was proving to be. Regarding student interest in the computers, Sister Anita reports:

> The students are so excited. They love any moment they spend in the lab and any free second I have, they want me to take them in there. They would love to listen to more music and, of course, they miss not having the Internet. Since we do not have a telephone network and a satellite connection is very expensive, we live without that. In fact, it would be a mammoth job of controlling that, for sure. So we have what we need and what we can manage.

Discussion

It may be too soon to comment on the outcome of the technology initiative at the St. Julie Mission School. Even so, there are identifiable characteristics of the school that bode well for the success of the project.

The goals for adding a computer lab to the school and for the outcomes from its use are pragmatic. They were enumerated from the start of the project, and they have already been revised to better align with feedback that the school received from its own students regarding their technology needs. At first, the goal for having a computer lab aligned with the introduction of Uganda's Computer Studies exam, but this proved to be less useful to the students than emphasizing basic computer skills abilities for all the school's pupils. Additionally, the use of computers is in line with the capabilities and interests of a sufficient number of the teachers. Teacher training is provided, but not required. Those teachers who are interested in receiving computer training are doing so on weekends, and the training they receive is one-on-one, designed to meet their particular interests and needs. Only a few the teachers are, in fact, giving instruction on the computers. However, it is straightforward to make the case that this is in line with the facts that the school has only one computer lab and that the students rotate in and out, depending on which class is meeting in the lab. In terms of the lab itself, the technology that was installed complements the school's existing infrastructure, in terms of both the number of classrooms the school had available for use and the existence of solar panels for providing power to the school. In this way, the technology may be considered an enhancement of the teaching and learning process already underway at the St. Julie School.

The presence of a project champion has been identified in the literature as a best practice that bodes well for technology adoption (Hosman, Fife, & Armey, 2008). The St. Julie School's technology

project has benefited from a project champion, Sister Anita, who was willing to investigate alternate possibilities for the technology, deployment, and maintenance, as well as to look after training and to lead many of the computer courses.

The technology may be deemed appropriate for local circumstances, as it took into consideration environmental conditions, energy capabilities, characteristics of the potential users, and long-term costs. The project may be considered sustainable, as funds are expected to continue to accrue through donations. Some may take issue with whether this type of funding is sustainable; the school also has plans in place to become sustainable from school fees. However, at this time, fees are being kept low to ensure that local enrollment is possible.

Appropriate local partners were identified for project deployment, and service and maintenance were both built in to the agreement signed between the school and the local technology partner. The local economy is supported through the employment of both the technicians and the computer instructor.

Re-shifting the focus to the bigger picture, we can identify several characteristics of this project that may inform the Ugandan government's efforts at ICT deployment on a national level. Still, there are difficulties inherent in extrapolating from a single case study.

The first best-practice characteristic we can identify is an understanding of technology as an enabling tool and a complement to existing teaching and infrastructure, not as a silver bullet or as an end in itself. The second characteristic is a realistic assessment of the existing situation. If there are insufficient schools, classrooms, and teachers, the provision of these must precede technology initiatives (or at best, be combined with them). It is beyond the scope of this article to make recommendations as to how the recruitment of teachers and building of schools will best be achieved, but this reality does need to be addressed.

The next characteristic concerns the size of the endeavor: modest efforts in line with local realities and appropriate to local conditions are more likely to be adopted and may prove more successful and sustainable. Technology in the schools may be an area where the government should continue to focus on promoting cases and pilot projects, allowing other partnerships to be formed, rather than legislating an overnight change to be implemented in all schools across the country, regardless of readiness or appropriateness—as was the case with the "overnight" promulgation of universal primary education legislation. Smaller projects are more easily adapted to changing conditions. Even successful, scalable projects often begin as pilots, the successes of which may inspire the confidence to "think bigger."

A further characteristic is the identification of the technology appropriate to the project. Oftentimes, simpler is better. In this case, some of the newest available technologies were used, but this had much to do with the local environment and the power situation. In the end, the choice of technology must be determined by the project's characteristics.

Training is important. The St. Julie School is actively offering technology training to teachers, and yet not pushing the training too hard. There are a sufficient number of teachers who are interested in using the technology, and those teachers are taking the training. The school is in the financial position to be able to offer training. These are all key human resource issues that the state must factor in to any technology initiative. Just as there is no shortcut for teaching children how to read and write, there is no dependable, accelerated technique for making adults who have never used technology comfortable with it—each person will adjust differently.

Another characteristic is the setting of realistic, pragmatic goals. The goals set forth for the technology at St. Julie's school were initially in line with Uganda's recent offering of an exam in computer studies, but they were revised to take student needs and feedback into consideration. Further, these goals are concrete, enumerated, and feasible for the school to reach. A goal of "harnessing technology to leapfrog into the information society" is vague and unrealistic; it is therefore non-measurable and, likely, unattainable. It is better to clearly specify achievable goals and avoid the aspirations gap.

A project champion is important as well; this has been well documented in studies of ICT-for-development project implementation at every level and size, from pilot programs to nationwide initiatives. The St. Julie School benefited from the presence of Sister Anita; similar project champions need to be identified, empowered, and supported in any government-led ICT-in-education projects, and they

should range from head teachers in individual schools to the national minister of education.

Project sustainability is of great consequence. The St. Julie School uses solar power, so the ongoing expense of grid electricity was not a factor in its case, but it may be one for numerous schools across the country. Energy costs and the upkeep and maintenance of technology need to be taken into consideration. Additionally, support for and maintenance of the technology were part of the contract/agreement with the local technicians and the St. Julie School. Such an agreement should be the case for schools targeted for ICT deployments; the ongoing maintenance of technology is an essential, yet often overlooked, component of project sustainability. If it is not built into a project's budget from the beginning, it can prove difficult to raise funds for it later on. The financial outlay for the upkeep of both hardware and software, the rapid rate of technological capital's depreciation, and the eventual need for technology repair and replacement must be factored into a project's overall implementation budget, just as it was at the St. Julie School. In addition, employing local technicians helps the community's economy and makes support and maintenance efforts more efficient, and such a practice should be encouraged in similar projects, whenever possible.

Ongoing funding for project continuation is another important consideration for sustainability. The St. Julie School is run by the Sisters of Notre Dame, an international community of Catholic women who operate more than 20 missions and schools in locations that span the globe. The sisters working at these missions have dedicated their lives to their work and ministry, and they do not receive remunerative pay for this work. These missions are ultimately supported by, and receive ongoing financial support from, the international Roman Catholic Church, and they can expect both to continue receiving this funding and to have a reliable supply of teachers. The school is continually pursuing strategies to make its continued operation sustainable on a local basis, but to date, this has not become a reality. The fact that the school can continue to rely on the financial support of the international Roman Catholic Church makes for a unique situation in terms of financial sustainability, but in this case, the support may be considered ongoing, and therefore sustainable. By contrast, public schools that are implementing technology will need continued public funding to meet this need, and this case remains limited in terms of wider applicability of source funding vis-à-vis sustainability.

A similar case for project sustainability is often made in terms of including the larger social community in the project in order to promote active community participation and, often, to promote financial sustainability through local revenue-generating streams by offering services that community members value enough to pay for them. Though this aim is certainly an identified best practice in many circumstances, it is not yet the case for the St. Julie School. Although the school has interest in providing computer exposure to the greater community, that is beyond their capability at present, as there are two main obstacles: the availability of both the computer lab and a teacher, and language issues. The St. Julie computer lab is currently being used on the weekends for teacher training, and the local trainer initially engaged by the school has sought employment elsewhere. Also, due to the limited exposure time that students have to the computers at present, if the computer lab were available on weekends, it seems likely that the school would prioritize its use to further the students' learning and training. In addition, language is a barrier to the potential for community use of the computers. As stated above, English is being taught in the school, as well as in the computer lab. The primary language of the local community, and of the parents of these students, is not English. Even so, the school remains optimistic about future community involvement, albeit an optimism that is realistic about the school's present capacities.

The establishment of feedback loops to promote a top-down-meets-bottom-up method for project implementation is imperative, as well. In this case, the NGO Inveneo establishes such a dialogue, first by working with clients (bottom-up) who approach them, and second by asking the clients what their needs, goals, and present circumstances are. It then offers its expertise (top-down) to provide solutions, while at the same time, it trains local staff in the skills necessary to provide support/maintenance on the current project and carry out future deployments on their own. If recent history may be considered indicative, the Ugandan government will likely make use of public-private partnerships to carry out ICT-for-education initiatives. Establishing similar feedback loops will be essential to avoiding an overly

top-down mentality, and to determining local needs, desires, interests, and capabilities.

The technology in the case presented here is promising in terms of adoption and meeting goals because all the other pieces were in place, and because the technology is a complement to them. The school has the proper hard and soft infrastructure, a classroom that can be used for computers, a project champion sufficiently comfortable with using and teaching computers, and sufficient and ongoing financial support. The school did not set unrealistically high expectations for technological solutions, and it revised its goals and classroom implementation to meet the real-world needs of its students based on a needs analysis and the students' own feedback.

Specific policy implications may be taken from the case level in order to inform at the national level. First, the implementation of Uganda's computer studies exit exam is, in fact, a top-down policy, issued centrally (with no corresponding human capacity or infrastructural provisions for being able to effectuate its realization—a pattern identified earlier). Even so, the St. Julie School's original goal of preparing its students to sit for this exam represents, in fact, a bottom-up effort to creatively make use of a top-down act of policy to realize educational goals. Creative efforts—particularly those with bottom-up approaches—to bring about improvements in the educational system may be seen both as a valuable method for addressing shortcomings on the part of the national government, and as a stepping-stone for building local capacities. The fact that the school revised its goal vis-à-vis the Computer Studies exam does not take away from the best practice of allowing creative endeavors to flourish at the grassroots level, and in fact, this case may further inform those authorities at the national level as to the real needs being experienced at the individual school level: The ability to make use of computers is perceived as a real need, yet the computer studies exam may not provide the right incentives for all schools across the country.

Another policy that the government should be encouraged to continue, based on the secondary research informing this article, is that of allowing Parent-Teacher Associations (PTAs) to develop. These organizations build increased accountability between civic groups and local institutions. This vital stepping-stone in the building of civil society groups that hold local and national levels of government accountable is crucial to socio-political development in any nation, and it is an important step in need of encouragement across many sub-Saharan African countries. Further, the local level of government may, in fact, be a more appropriate level for carrying out educational policy. It may be that national governments are not the most appropriate actors to implement educational initiatives; their involvement may be most effective when it is indirect, where power and control are delegated to the local levels to determine the most appropriate solutions. Accordingly, if local competencies are encouraged to develop—as in the local research-capacity building initiative described above—solutions proposed may be more fitting and relevant, and those responsible may be more likely to see themselves as stakeholders contributing to the process of educational reform.

Conclusion

Africa has witnessed its share of revolutions, transformations, and grand plans over the years; all intended to be the answer to its problems of slow growth and underdevelopment. Unfortunately, the hyperbole currently surrounding information and communication technologies trumpets them as the new solution to these problems without an examination of their underlying causes; by doing so, it sets this latest-and-greatest panacea up for failure, as well. But that is not the only possible outcome, and the case presented in this article offers up the possibility of success. ICTs do, indeed, hold promise and potential, but it must be remembered that, though they do enable human beings to meet their needs and desires more efficiently, they are not silver bullets or ends in themselves. They will not transform society and the economy overnight, simply by their presence. A realistic assessment of existing circumstances, an understanding of how technology can empower and enable human capabilities, and an enumeration of goals for technology-oriented projects are critical steps that must be taken for success in ICT-in-education initiatives.

This article presented a case study of an ICT-in-education project in rural Uganda and enumerated policy-relevant lessons that may be taken from it. Though the project described is a promising one, the overall picture—once that instance is extrapo-

lated and translated into policy implications—becomes complex and full of challenges.

African governments have a historical pattern of neglecting ongoing investment in infrastructure that must be overcome; long-term human capacity-building must be recognized as paramount for the adoption of ICT because supplying technology alone will not create a need for its use, nor will it solve underlying problems. A realistic assessment of the ways in which technology can complement and amplify current capabilities must be made before further scarce resources are invested in the ever-increasing number of ICT-related projects implemented in the name of development. The case detailed above describes a local-level initiative to both bring the benefits of ICT to students and, at the same time, remain mindful of the real technological needs facing its students. Local, creative initiatives should be allowed—and encouraged—to continue to inform future national policy and to promote the cultivation of local-level competencies, as such allowance and encouragement will assist those entities and institutions that advance socioeconomic development to do so. If such entities are enabled to handle educational issues in the future, perhaps national governments can delegate power and responsibility to the levels and bodies most appropriate to the task—but currently lacking the capabilities—in Uganda and elsewhere. ■

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