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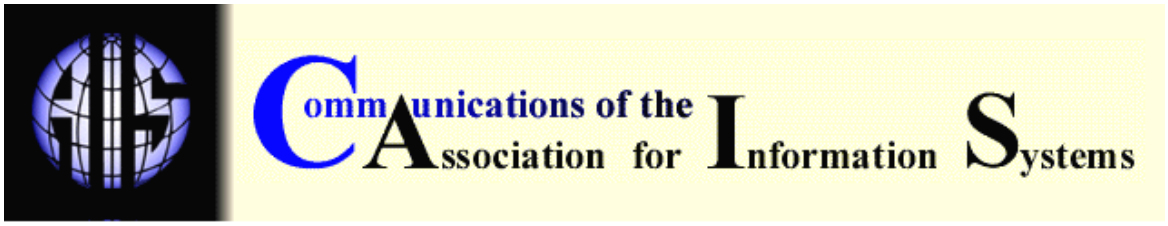

LEVERAGING INFORMATION TECHNOLOGY TO SUPPORT AGENTS OF WORLD BENEFIT

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ABSTRACT

There is much debate about social responsibility in the context of business and industry but not much in the context of information technology. We address this void by examining developments and innovations at the interface between information technologies and positive social change. In particular, the paper explores the role of information technology in three critical domains: connectivity, education, and economic development. The underlying premise of the authors is that information and communication technologies can serve agents of social innovation in underserved communities and that their consideration is vital to the success of many efforts that pursue global and sustainable change. We also submit that such issues ought to be integrated more centrally into the practice and scholarly mission of the IS discipline.

Keywords: Social Innovation, Social Responsibility, Bottom of the Pyramid, Underserved Communities, Digital Divide, Universal Access, Connectivity, Education, Economic Development, Change Agents, Call to Action

Information and communication technology give us reason to hope that we are approaching a world free from power brokers and knowledge brokers. Individuals will be in command. There will be no screening authority on center stage. This is particularly exciting for all disadvantaged groups, voiceless groups, and minority groups. Any power built on exclusive access to information will disintegrate. Every common citizen will have almost as much access to information as the head of a government. Leadership will have to be based on vision and integrity, rather than on the manipulation of information.... At each step future information and communication technology should be creating a global environment to unleash the creativity, ingenuity, and productivity in every human being

> Muhammad Yunus, Nobel laureate and Founder of Grameen Bank[1].

I. A CALL TO ACTION

Social issues are important to organizations and their stakeholders (Blowfield and Googins, 2006; Bonini et al, 2007; GEMI-BSR, 2006; Kolk, 2004). While there is much talk about social responsibility in the context of business and industry, there is not much in the context of information technology, or IT. Information technologies encompass technologies for capturing, transforming, storing, and communicating information.[2] They can support agents of social innovation for underserved communities, and they are vital for progress toward a world that is more equitable, healthy and peaceful. The purpose of this paper is to motivate people in the IT world to think seriously about the good things that can happen if our professional expertise is utilized accordingly. It is a call to action, not a homily to the greatness of information technologies. It focuses more on opportunities, than on problems to be solved, and on ways to take advantage of exciting IT capabilities that are emerging.

The arguments here build on the work of Prahalad (2004) and Hart (2005) and their vision for sustainable improvement in the welfare of the vast majority of the world's people at the "bottom of the pyramid." This vision embodies a combination of enlightened assistance from those at the top of the pyramid, and self-interested, entrepreneurial effort by those at the bottom. In this vision, IT can aid in *connectivity*, *education*, and *economic development* by improving communication, enabling formal and informal learning, and shaking the status quo to replace prejudice with respect and compassion. The arguments in this paper are framed as a call to action for IS scholars, but they relate equally well to people at any point on the continuum of concern, from national and international institutions and organizations, to grassroots efforts in disadvantaged communities themselves. The remainder of the paper examines how IT can be leveraged to produce positive social change and concludes with suggestions for future scholarly and professional effort toward that end.

II. CONNECTIVITY

Mobile and ubiquitous computing that provides anytime-anywhere computer-based services enables new products, services, and work practices. These have revolutionized the lifestyles of those at the top of the pyramid; might they do the same for those at the bottom? Eliminating barriers to information might narrow the digital divide between the "haves" and the "have-nots." Roads and railways created an infrastructure for global distribution of goods and promoted

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1 From *Banker to the Poor: Micro-Lending and the Battle against World Poverty*, 1999, pp. 238-239.

2 Different literatures use different signifiers to denote the full range of technologies included here. The use of Information Technology in this paper is meant to include what is often referred to as Information and Communication Technology or ICT.

international brands. So too, the Internet has become an infrastructure for global distribution of information. In principle, these kinds of infrastructure can diminish the differences among the members of the global society through global access to goods and information. In fact, universal connectivity and global access remain out of reach for too many. Despite many IT innovations, at least three billion people worldwide lack basic connectivity. Some of the world may be flattened by connectivity, but the world as a whole remains bumpy.

A MORAL PRINCIPLE

Given the importance of connectivity to human social and economic development, connectivity should be a basic human right, universal and available for all (Best, 2004; UNPFII, 2005; Yunus, 1999). Universal connectivity is an attainable objective that could yield enormous social and economic returns on investment. First-hand access to diverse information sources provides an opportunity to consider multiple points of view, an opportunity for every voice to be heard, a mechanism to share and exchange knowledge, and a fertile ground for organized action at the grassroots. We therefore propose that:

> **Every member of the global community – rich or poor – has an inalienable right to participate in the global community's digitally converged network.**

All members of the global society should be able to participate directly in mutual exchange through electronic networks. This is a moral obligation, in the same class as citizenship, food, shelter, healthcare, education, employment and recreation. How might this be achieved?

REQUIREMENTS FOR SUCCESSFUL DEPLOYMENT

To achieve universal connectivity, every member of the globally linked community should have access to the following:

- **Technology –** a "basic kit" of IT that is capable of communicating interactively with global networks (e.g., the Internet), processing digital signals and bit streams, storing relevant data and applications, and interacting effectively with human users.
- **Information –** a portfolio of information resources necessary to function and flourish as citizens, whether in text, images, sounds or other forms.
- **Training** – guidance on utilizing the technology kit to find and use available information sources, to ask questions and interpret answers about matters of concern, and to be able to share information and contribute knowledge.

These three enablers—the provision of basic IT, access to information resources and ability to get proper training— form the infrastructure that is required for developing and attaining universal connectivity. Furthermore, in spite of the standardized nature of universal connectivity, we cannot assume that "one size fits all" and ought to address the inherent heterogeneity of the global village. Thus, to achieve universal connectivity in a pluralistic world we must also ensure:

- **Cultural compatibility** – Each of the three enablers, technology, information and training, must be usable by every community, no matter how socially or environmentally diverse.

So far, much progress has been made on developing the infrastructure of universal connectivity, but its cultural compatibility requires more careful attention, as it is lagging far behind. This can be probably attributed to the origins of IT that emerged as part of the modern world, where prosperity is propelled by economies of scale and equilibrium of global markets at the expense of local values and situated cultures.

The values of modernity arose from the scientific and technological revolutions of the 17th century and have transformed the societies of most developed countries. Modernity has been accompanied by an increasing material standard of living, and for many, an improved quality of

life. IT is used to inform people of events in their communities and the larger world, which is important for creating and sustaining civil society and democratic government. IT is used to entertain people and provide restorative leisure activities. IT is instrumental in providing learning opportunities, making government and legal services available, providing healthcare support, encouraging safety, providing transportation schedules and travel assistance, informing people about job opportunities, and providing library services.

Many people in the world live in modern societies, but many more do not. People in less modern societies may depend more on the spoken word than on text and reproduced images, with oral traditions and rumor more trusted than data from a book or off a screen. They may be "place-based" rather than mobile, living in relatively geographically fixed locations. They may live close to nature, attaching great importance to their land for their livelihood and identity. Environmental sustainability may be paramount in their worldview, preferring respect for other living things in the natural world to the dominance of humans. Cultural identity may be defined by indigenous practices, reinforced through ceremonies, dances, dress codes and deeply instituted daily routines. They may live in societies that place greater emphasis on community needs than on individual prerogatives. They may approach life spiritually, with less obvious regard for material conditions than is common in industrial societies. It is not clear that people in such societies do or should want to be modern, and it is important to avoid hegemonic and imperialistic efforts to force technological change on those who do not desire it. Nevertheless, many people in less modern societies desire the option to participate in the modern world, and this option depends on universal connectivity. Cultural compatibility becomes crucial if universal connectivity is to provide a workable option for participation.

Experience shows that technology that fails to "fit" into societies and their cultures will be ignored or rejected. Still, many examples of successful adoption and adaptation prove that new technologies and traditional cultures can find common ground: pickup trucks instead of horses at a Navaho roundup and snowmobiles to corral reindeer among the Sámi are just two examples. The goal is to find the essential attributes of connectivity that uncover common ground across diverse cultures.

EXAMPLES: TOWARD UNIVERSAL CONNECTIVITY

IT is not merely modern - and often alienating - to many people; from the view of those at the bottom of the pyramid, it is usually expensive beyond reach. Until the problem of basic accessibility is addressed, it will be difficult to determine the other attributes of IT needed for cultural compatibility. Two interesting examples suggest that the accessibility problem can be surmounted.

The Hole in the Wall project. In 1999 Dr. Sugata Mitra, a computer scientist leading an R&D group for a major software company in New Delhi, tried an experiment. He placed a microcomputer connected to the Internet facing outward in a wall that separated his modern office from a slum. He provided no instruction, yet almost immediately, the uneducated children of the slum were attracted to the computer and began to play with it. Most of the children figured out how to point and click within minutes. By the end of the day they were using the Internet browser. In a short time they developed their own language for communicating with each other about the computer, and they established social rules for using it. The children taught themselves to use word processing and paint programs, make photos, participate in "shared blackboard" activities, and surf their favorite Internet sites. To extend the experiment, the researchers made the equipment more rugged, tamper-proof, and fault-tolerant so it could be used unsupervised, outdoors, in harsh conditions, with low energy consumption. In time, more than 55 similar sites were established in slums across India, all with the same results.

One Laptop per Child (OLPC). Nicholas Negroponte and his associates at the MIT Media Laboratory conceived the OLPC project to bring computing and networking capability – a key element of the "basic kit" above – to the world's children via a laptop computer costing only US$100. The small machine is designed to operate reliably in harsh environments with limited

electricity – common conditions at the bottom of the pyramid. The computer is built to be rugged. Its inexpensive display uses only 20 percent of the power required by most computers, and it includes a built-in video camera. It can be recharged using simple human-powered devices driven by a foot petal, a hand crank, or a hand-pulled device similar to a lawn mower starter. It incorporates a "mesh" wireless network to enhance mobility and encourage peer-to-peer communication. It has an open source Linux operating system with Small Talk and specially tailored software including a browser, a word processor, and e-mail, and learning programs based in part on Seymour Papert's "learn how to learn" philosophy. In order to achieve a critical mass, Negroponte does not intend to begin installations until commitments are received for between 3 and 5 million machines.

These experiments by themselves do not come close to meeting all of the four criteria listed above, but they represent significant progress toward providing large numbers of children from diverse backgrounds with access to a basic kit of technology, information and training. The real payoff from the experiments is what researchers can learn about how to provide these resources so that children, and by extension everyone, can use IT effectively under diverse cultural conditions.

III. EDUCATION

Education is fundamentally an information-based enterprise. It is also essential to social welfare in the modern world. Investments in primary and secondary education yield high returns, and strong higher (tertiary) education is required for sustainable economic development (Psacharopoulos, 1994; OECD, 1998). A great deal of work remains to be done to improve global primary and secondary education, and this paper's focus on higher education does not detract from that need. Higher education is a focus here because that is the context and frame of reference of many researchers in the fields of information and communications technology. That is also the milieu in which they have an opportunity to innovate and make a difference. Innovations pioneered in higher education will eventually extend to primary and secondary education.

ACCESSIBILITY TO HIGHER EDUCATION

The state of higher education differs greatly between developed and developing nations. Data from the United Nations World Educational Indicators (WEI) program provide some context.[3] Using the OECD countries as proxies for developed nations and the 19 WEI countries as proxies for developing countries, the differences are stark. Per capita GDP in OECD countries is USD 20,681; in the WEI 19 it is USD 5,360. Average per-student expenditure for higher education in the OECD countries is USD 10,655; in the WEI it is USD 4,541. Expenditures for higher education in OECD countries constitute 3% of all public expenditures and 1.3% of GDP; for the WEI 19, the figures are 2.6% of public expenditures and 0.8% of GDP. Of course, much higher

[3] WEI is a joint program of the Organization for Economic Cooperation and Development (OECD) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). OECD countries include: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Data for the study include the OECD countries plus a selected set of 19 developing and middle-income countries that together comprise over 70% of the world's population: Argentina, Brazil, Chile, China, Egypt, India, Indonesia, Jamaica, Jordan, Malaysia, Paraguay, Peru, the Philippines, the Russian Federation, Sri Lanka, Thailand, Tunisia, Uruguay and Zimbabwe. Data reported here at http://www.uis.unesco.org/ev.php?ID=6234_201&ID2=DO_TOPIC

public expenditures and GDP in the OECD countries exacerbates the difference in actual funding levels as compared to the WEI 19.

Despite all their advantages, the OECD countries are facing a crisis in higher education spurred by a variety of factors. These include changing demographics, the rising cost of higher education, a shift from a *public good* model toward a *private good* model for higher education (with corresponding shifts in the cost burden from the state to households), and increasing demands for "accountability" in higher education, to name just a few. Ironically, these factors are accompanied by growing recognition by government leaders that a larger percentage of the population should participate in higher education. This sentiment is fueled by globalization as exemplified in popular books such as *The World is Flat* (Friedman, 2005). Developing nations leverage low wage structures and growing competence to "take" jobs away from their traditional locations in developed countries. The only salvation for developed countries is increasing innovativeness, made possible by better and more highly educated populations. Thus, higher education in the OECD countries is being faced with increasing demands for performance, including expansion of participation among the population, while simultaneously experiencing economic and political changes that weaken their traditional revenue structures. If higher education is to respond successfully to the first demand, it cannot expect to do so through linear speedup: traditional sources will not provide sufficient resources to educate more people at the same marginal costs of production. The only workable solution is a major increase in the productivity of higher education.

This is where newer forms of IT become important. There is now no doubt that IT has had a dramatic impact on productivity (Jorgenson, et al., 2004; Brynjolfsson and Hitt, 2004). That impact has been strongest in the manufacturing sector, or at least most clearly explicated. The next frontier is the service sector, of which higher education is part. Unfortunately, certain sub-sectors of the service sector have long suffered from a phenomenon known as Baumol's Cost Disease (Baumol, 1996; Baumol and Bowen, 1966; Heilbrun, 2003). This was first noticed in the performing arts: after centuries of technological progress, it still takes four highly skilled musicians to play a string quartet. Broadcast technologies such as audio, cinema, and video recording extend access to individual performances, but they do not provide the same experience as live performance. Moreover, broadcast technologies do not improve the actual productivity of performance; they merely extend subsequent access. The problem with fields afflicted with Baumol's Cost Disease is that the wages across the economy are bid upward by rising productivity in other fields that benefit from technological progress. As most of the economy experiences productivity growth, wage pressure is high even in fields that have not seen such productivity gains. The costs of those fields rise without relief from productivity improvements.

Higher education has long suffered from Baumol's Cost Disease. The results are clear in rising costs even as demand grows. Unless that cycle can be broken by improved productivity, higher education cannot hope to improve accessibility. However, with improved productivity, higher education can become more accessible in developing as well as developed countries. Technology has traditionally been of some help on the margin in extending access to educational materials. As with entertainment such as opera and chamber music, broadcast technologies such as educational television have extended access to educational programming. However, the net results of such efforts on the quality and reach of education have been even more disappointing than they have been with broadcast entertainment (Wetzel, et al., 1994). The main problem is the inability of such broadcast technologies to provide the intense interactivity required for effective and sustained learning. Although participation can be extended through use of such technologies, the overall quality of education declines, thereby making true productivity improvement evasive.

There are three areas where newer forms of IT have the potential to enable greater productivity in higher education. The first is in facilitating production of core educational infrastructure and content by leveraging economies of scale and scope as well as positive network externalities. Examples of such endeavors include the various "open" movements that allow distributed communities to contribute to the creation of educational content and the means to distribute and use it in educational activities. The open courseware movement spearheaded by the

Massachusetts Institute of Technology provides freely accessible content used in nearly all MIT courses[4]. Dozens of other universities have joined the open courseware movement, sharing their course content in ways that make it readily useful to other educators. The University of Michigan's Sakai project has grown into an international consortium of over 100 universities building and sharing course management software in an open source model[5]. The concept of open educational resources embodies these and other initiatives aimed at improving use of educational content and delivery mechanisms at a low marginal cost of production.

The second area of potential is direct support of the learning process. Larger class sizes and higher teaching loads for instructors do not increase productivity so much as they decrease quality. Contemporary distance education also falls short of improving productivity, although it is arguably moving in the right direction. Distance education allows remotely located students to take advantage of educational opportunities without having to travel or relocate, but most distance education programs are extensions of the standard classroom-based learning model extended over wires. They are reminiscent of the early days of educational television, for which there was great hope of productivity improvement that never materialized. Educational television and contemporary distance education are still primarily extensions of a broadcast model: a provider (teacher) sends product (educational content) to a consumer (student). The intense interactivity present in traditional, high-quality higher education environments is missing. New collaboration support technologies, including integrated systems that enable real-time, high-resolution audio/video conferencing and synchronous or asynchronous sharing of content, promise to take the concept of distance education to the next level. In this model, distributed communities of learners can be in more-or-less constant touch with one another as part of a protracted learning process. This is not a new concept: it is an extension of the "invisible college" of scholarship first recognized in the middle of the 17th century by the formation of the world's first scholarly organization, The Royal Society, and the establishment of the first scholarly journal, Philosophical Transactions (Hedstrom and King, 2006). What is new is that IT substantially expands the scope and scale of the number and complexity of "invisible colleges."

The third area of potential is facilitation of genuinely distributed learning that takes place either in autodidactic form or among distributed teams of learners. The on-line encyclopedia Wikipedia[6] provides just one powerful example of this. Wikipedia articles are written by anyone who cares to participate. Many Wikipedia entries are created initially by inexpert authors interested in the topic. Over time, experts correct the entries, improving quality.[7] Edits to the entry are maintained for all to see, and controversies regarding facts and interpretations get sorted out in a process similar to academic peer review. There has been considerable controversy about whether Wikipedia's entries are of the same quality as traditional encyclopedias,[8] but the fact remains that Wikipedia has enabled community-based creation of a shared knowledge resource with approximately one million entries without the direct participation of any traditional institutions of learning. This can be seen as a threat to such institutions, including higher education, but it makes more sense to see it

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4 See http://ocw.mit.edu

5 See http://sakaiproject.org

6 See http://www.wikipedia.com

7 It is worth noting that this scheme – having amateurs write papers that are then corrected by experts – is a time-honored tradition of higher education. A classic example of marshalling "amateurs" to produce knowledge is The Oxford English Dictionary (See Simon Winchester, 2003)

8 Some claim Wikipedia holds up well compared to traditional encyclopedias such as Britannica (Giles, 2006); Predictably the traditional encyclopedia industry disagrees: http://corporate.britannica.com/britannica_nature_response.pdf

as proof that distributed, collaborative learning is possible at remarkably low cost. The challenge for higher education is to learn from the lesson of Wikipedia and leverage this new capability in the service of higher education's aspirations and values.

EXAMPLE: OPEN EDUCATIONAL RESOURCES

Open courseware initiatives such as the Sakai Project mentioned above facilitate organization and delivery of education, but do not provide the payload: the educational content students will learn. A complementary movement in Open Educational Resources, or OER, exploits new delivery mechanisms such as the Global Text Project,[9] a grassroots initiative that is changing the rules of the education game and developing a critical mass with minuscule upfront investment.

The Global Text Project aspires to create a free library of 1000 electronic texts, in multiple languages, covering topics typically encountered in a university's undergraduate programs. The project involves the global academic community and global corporations to create and sponsor the library. The project was initiated following the founders' insight that the prevailing business model of textbook publishing does not meet the needs of developing nations. For one thing, they are far too expensive, beyond the reach of ordinary students in many developing economies. For example, a Biology textbook that sells for US$110 might sell for US$50 in Africa, but this discount is not enough to trigger price elasticity of demand, given that the USA's PPP GNI[10] per capita is US$41,950 while Uganda's is US$1500 and Tanzania's is US$730[11]. In other words, a US$50 textbook costs a typical Ugandan or Tanzanian citizen the USA's equivalent of US$1398 or US$2873 respectively.

Textbooks in the Global Text Project are produced on a Wiki platform, which is a scalable Internet-based infrastructure to support the creation of free, open content, electronic texts. In contrast to Wikipedia, this model applies editorial control to ensure that the content is authoritative. As with open source software, anyone can contribute "code," but only expert gatekeepers can put that code in the code base. Open content electronic books are made freely available via a Web site[12]. The model reduces the physical distribution constraints of normal textbooks and permits easier tailoring to suit local needs. Content can be distributed globally over the Internet to universities, which then handle local distribution. The project's initial focus is on content development and Web distribution, working with relevant authorities to facilitate dissemination in light of bandwidth availability and adequacy.

To succeed, the Global Text Project must create effective branding, production, marketing and distribution based on sound business principles. The brand must stand for credible, authoritative books created with strong editorial control by topic experts who can ensure completeness and accuracy before acceptance. The production system needs to support all authors, including those

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9 See http://globaltext.org

10 Purchasing Power Parity Gross National Income (PPP GNI)—this measure is gross national income converted to international dollars using purchasing power parity. An international dollar has the same purchasing power over GNI as a US dollar has in the United States. The World Bank favors this measure for accurate measurement of poverty and well-being; in effect, it substitutes global prices for local measured prices, thereby more accurately reflecting the real value of the good or service in question.

11 Source: 2005 World Bank data, available at http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf

12 In an *open content model*, all content donated to or generated by a publisher – in this case the Global Text Project – is made freely available to all, for all time. Books are published under the Creative Commons Attribution License.

who lack extensive technical knowledge of Wikis, XML, PDF, relational databases, the Internet and so on. Marketing and distribution require networks to get the word out about the availability of books and details on how they can be accessed and used. A key to the success of the Global Text Project is voluntary effort among authors who create content as well as experts who build and manage the brand, production system, and the marketing and distribution functions. These volunteers must tap into the expertise and talent of established leaders in industry and commerce who have demonstrated that it is possible to use IT to meet fundamental needs of education in the world's developing economies.

Fortunately, major corporations have already stepped up to such challenges at all levels of education. Microsoft has developed a new type of digital school at the request of the Philadelphia School District[13]. Cisco has used its global Networking Academy to help disadvantaged citizens gain technical skills that employers demand[14]. The list of such projects is long. One of the most interesting is a public-private partnership between IBM and dozens of public schools around the USA[15]. IBM has worked with schools facing major financial, socio-economic and administrative challenges, starting by having the schools identify their toughest issues, ranging from in-class instruction and teacher support to tracking student performance and ensuring compliance with standards. IBM then assigned many of its most talented research staff to work full time with people in the schools. IBM made its investment on the condition that the schools would continue to fund all efforts themselves after IBM ended its support. Student achievement has risen and the schools have shared best practices, stimulating reforms across districts and states. IBM's US$100 million dollar investment has created a new market for tools such as Learning Village (online juried lesson planning); Instructional Planner (student performance documentation); and Watch me! Read (online reading tutors). Creating these capabilities has resulted in competencies applicable to other industries, including speech recognition, data warehousing, and Java programming development.

IV. ECONOMIC DEVELOPMENT

The need for continued economic development is illustrated in sobering global statistics: The world population is growing at a rate of 1.3% per year, while world poverty is growing even faster at 4.5% per year (Figures 1 and 2). Sub-Saharan Africa is seeing a poverty growth rate of 8.7% annually, despite a 7.3% growth in donor giving (Figures 3 and 4). There is a strong and compelling need for greater effectiveness, efficiency, and capacity building: a quantum leap in impact that requires doing things in radically different ways.

IT can play a major role in economic development by providing societal opportunities and amplifying the effectiveness of several core tools for alleviating poverty, as shown by the following examples from welfare, agriculture, health, and financial services. Each example covers the business situation, the technology deployed to improve it, and the resulting opportunity.

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[13] See http://www.pbs.org/newshour/bb/education/july-dec06/hightech_11-14.html & http://dir.salon.com/story/news/feature/2005/03/13/public_school_privatization/print.html & general information at http://www.microsoft.com/education/schooloffuture.mspx

[14] See http://www.cisco.com/web/learning/netacad/index.html

[15] See "The Reinventing Education Initiative from an Evaluation Perspective: The Role of Innovative Technology Partnerships in Addressing Significant Challenges to Education Improvement" a report by Center for Children and Technology, available at: http://cct.edc.org/admin/publications/report/IBMRE_evalsum_04.pdf

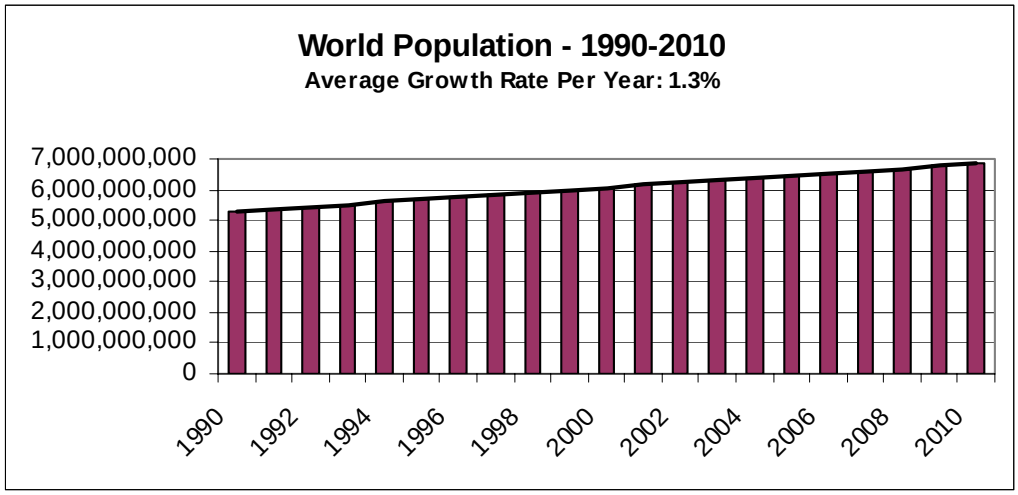

Figure 1: World Population Growth
Source: U.S. Census Bureau, International Data Base

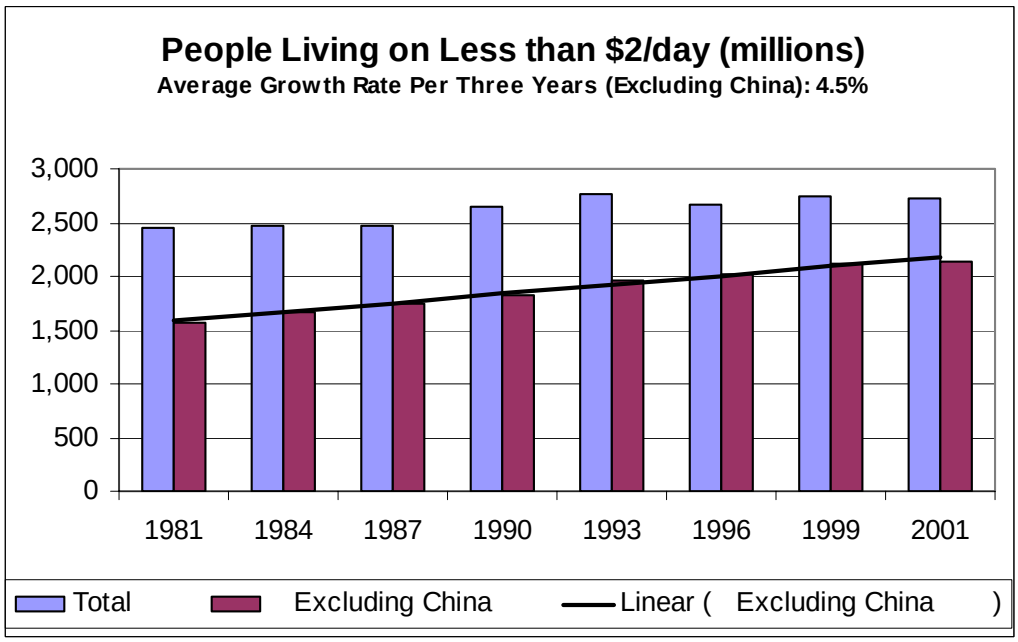

Figure 2: World Poverty Growth
Source: The World Bank Group: World Development Indicators

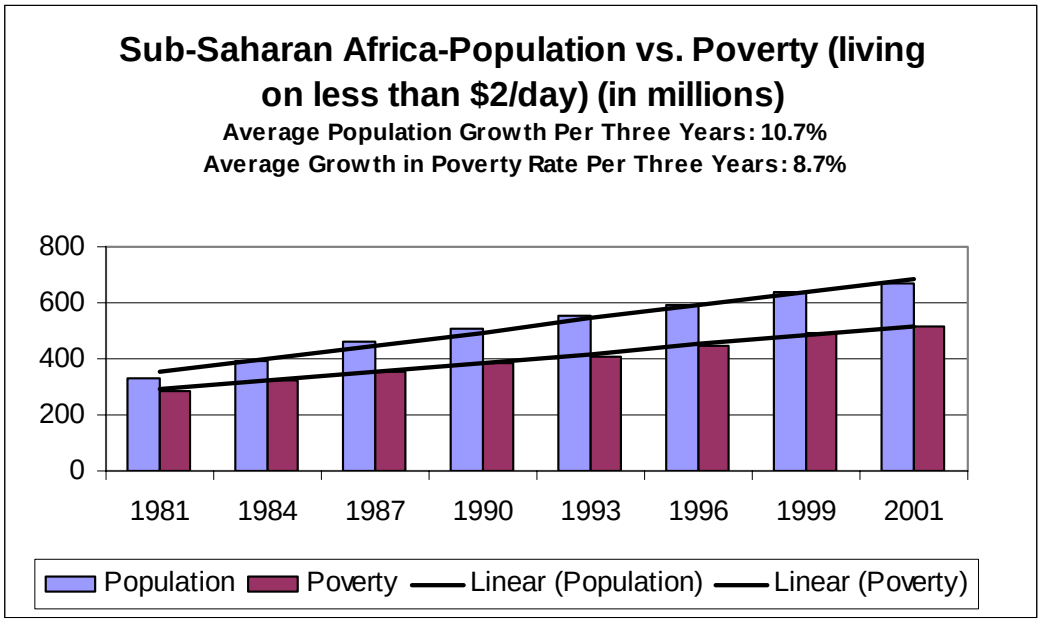

Figure 3: Population and Poverty Growth in Africa
Source: U.S. Census Bureau and World Bank

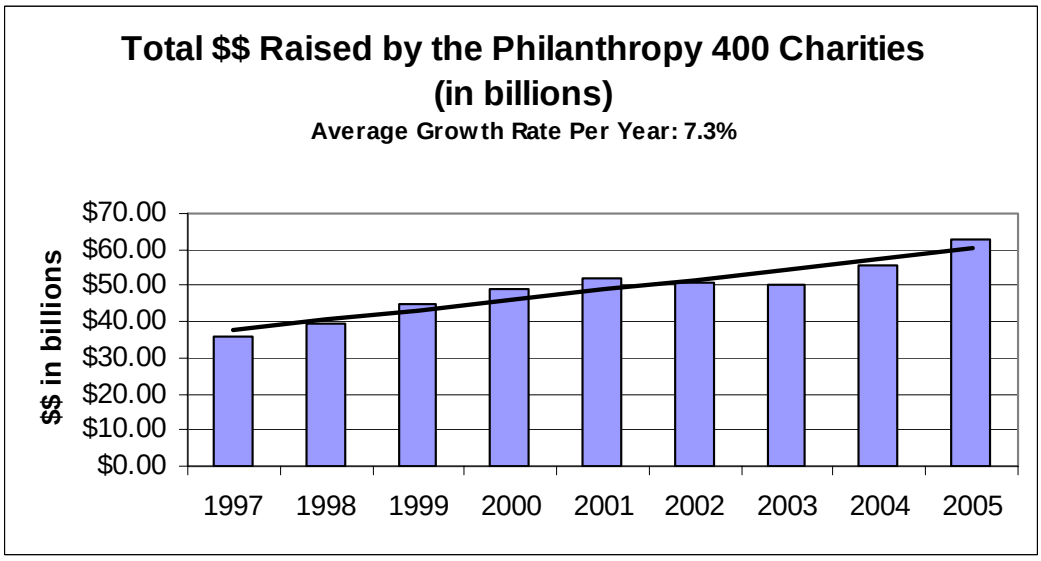

Figure 4: Donation Growth in the top U.S. Charities
Source: *The Chronicle of Philanthropy,* Oct 26, 2006

CAPACITY BUILDING: SAVE THE CHILDREN

Children are an important focus of many international non-government organizations (INGOs) seeking to improve the condition of underserved people. Capacity building is illustrated well by Save the Children, an INGO that operates in 40 countries to aid children through a variety of programs.[16] Capacity building can mean a number of things, including training, adding headcount,

16 See http://www.savethechildren.org

increasing productivity, and improving the ability to scale up programs. Technology impacts the latter two primarily by helping the same number of people to get more done at a given time. The basic productivity gains that can be provided by effective application of technology are important everywhere, and especially in resource-lean far-flung outfits.

Traditionally, capacity building has usually been internally-focused, for example in bringing knowledge and information-based work up to standards, and on building basic services and infrastructure. However, stopping with internally-focused applications alone would mean missing many strategic opportunities that are possible. It is important to distinguish between organization-facing technology applications and beneficiary-facing applications. Save the Children can be used to illustrate four orders of technology (seen in Figure 5) and how they can be used to realize the full potential of IT. *First order* applications are used directly by beneficiaries, such as the children themselves and often their mothers. These are the most strategic uses of technology for an INGO. In literacy-training programs in rural America, children use the Accelerated Reader application on PCs to take practice reading exercises and tests. Subsequently, scores are rolled up to the school and district levels for review, and nationally for program managers and donors who can log-on and track improvements in reading as a function of donor dollar support for the program. This end-to-end, technology-driven program is expanding at 95% per year (number of children reached), with 5% more children reading at grade level each year (Figure 6).

Second-order applications improve program delivery to beneficiaries. They are comprised of workflow applications that improve the productivity of program delivery, including applications for Supply Chain Management, Program-Project Management, and Measurement and Evaluation. For example, in Bangladesh, where Save the Children distributes food to 192,000 people monthly, the cumbersome paper forms for tracking and reporting on food distribution was initially replaced by laptop computers. Unfortunately, laptop batteries last only two hours, after which fieldworkers had to revert to paper. By porting the tracking application to PDAs, battery life can be extended to ten hours, saving 39% in data entry time (Figure 7). Handling more transactions per day can mean the difference between life and death for women and children who have walked several kilometers and must wait in line in scorching heat and high humidity for rations that are their only source of food.

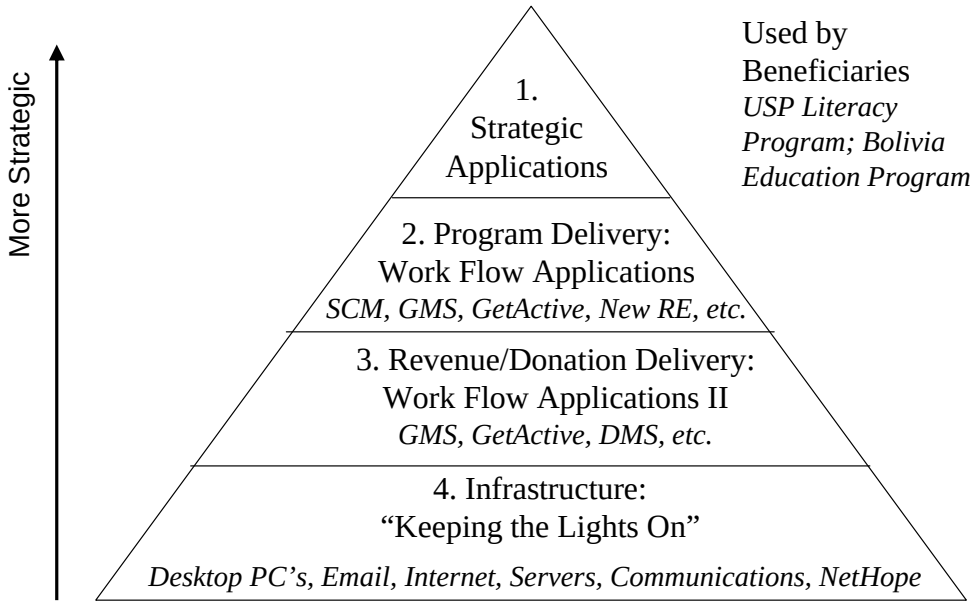

Figure 5: Orders of Technology Impact
Source: Save the Children IS Strategic Model

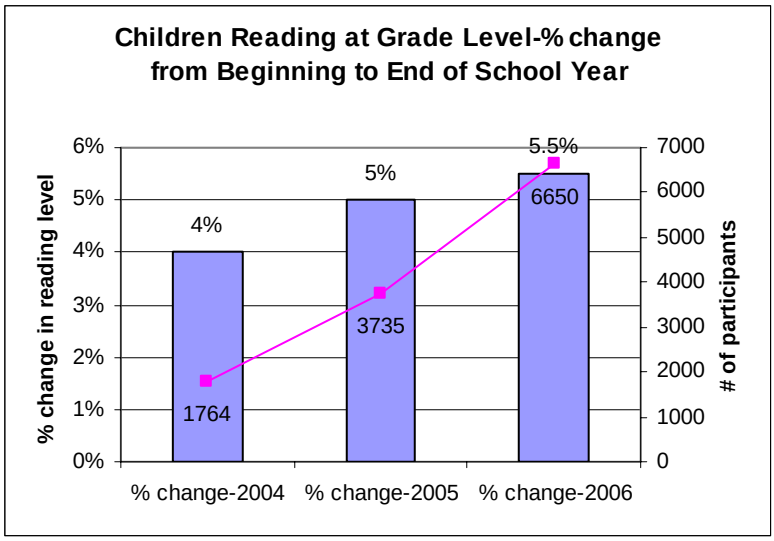

Figure 6: U.S. Literacy Program Impact
Source: Save the Children Data

Third-order applications deliver the revenue that make the INGO's work possible. Save the Children uses donor management systems, grant management systems and web-based donation systems such as GetActive.[17] Being able to raise more donations, and to do so for lower cost per dollar, means more money for the core purpose of the organization.

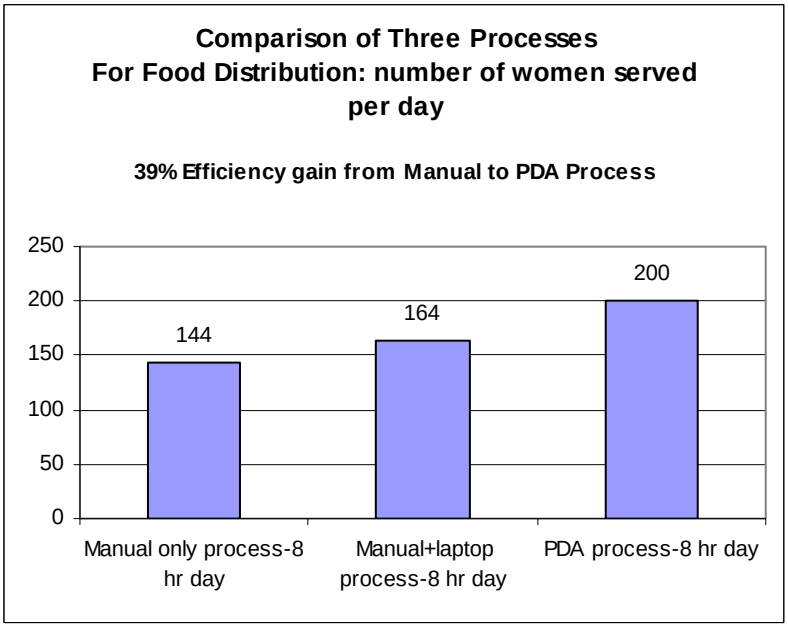

Figure 7: Bangladesh Food Distribution: Transaction Input Rates
Source: Save the Children Data

17 See http://www.getactive.com

Fourth-order systems are the infrastructure that underlies the others. Save the Children's infrastructure includes desktop PC's, office application suites, email, Internet, servers and communications systems. Basic connectivity is the foundation for everything else Save the Children does with technology. Collaboration groups such as NetHope[18], which Save the Children helped found, deliver connectivity to the challenged areas of the world in which INGOs work, often as the only provider of the "last 100 kilometers" to reach those in need. The correlation of regional bandwidth and poverty levels shown in Figure 8 suggests the importance of such connectivity.

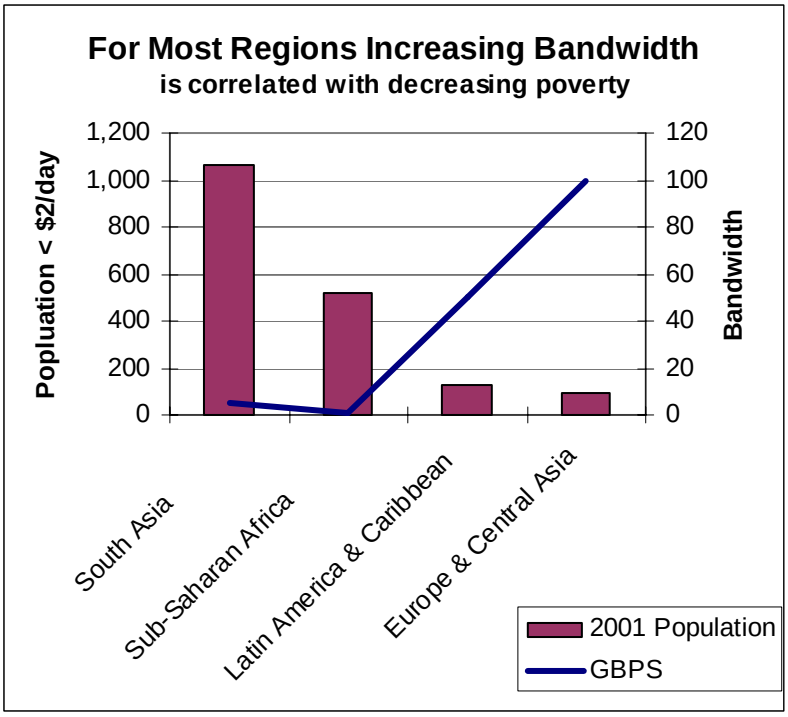

Figure 8: Bandwidth versus Poverty Levels
Source: U.S. Census Bureau and Telegeography Global Bandwidth report

There is a pressing need to leverage current information technology to benefit the globe's many less privileged, but this requires the right balance among the different kinds of systems discussed above. It is crucial to know how much effort must be invested in the supporting applications of the second to fourth orders to deliver the most strategic applications at the first order. Making the right investments at each level of the pyramid will determine how strategic the technology will be in supporting the organizational mission. Ultimately, the goal of INGOs is to connect the disadvantaged with information and means that are relevant to their livelihoods. The success of this strategy has been amply demonstrated by the pay cellular phone cottage industry that Muhammad Yunus' Grameen Bank19 has incubated among poor women in Bangladesh, and by the use of IT in connecting farmers to the on-line port of export prices in the Dominican Republic to the elimination of fraud (Best et al, 2002; Shakeel and Best, 2002). Corporations and the academic community can partner with INGOs in helping them achieve the optimum investment strategies across the pyramid. The remaining examples provide further related illustrations.

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[18] See http://www.nethope.org

[19] See http://www.grameen-info.org

AGRICULTURE: ITC E-CHOUPAL

Many of the world's developing countries still depend on agrarian economies in which farmers remain poor and easily exploited. That problem has been addressed by India's ITC (formerly the Indian Tobacco Company), a huge, highly profitable family of diversified companies, whose International Business Division has long supplied agricultural products to world markets. ITC traditionally bought the products of farmers through intermediaries, who in turn bought the products on-site from farmers at public marketplaces called mandis. Farmers seldom had advance knowledge of prevailing prices and therefore would often accept any price offered rather than transport their produce back home. In response, ITC developed and deployed for the farmers a large number of solar powered PCs equipped with VSAT (satellite)-enabled Internet connectivity. With the technology, farmers gained access to weather information and agriculture planting advice. They also were able to interact with ITC's new electronic market place called e-Choupal. Farmers for the first time could see current market prices and decide whether to transport their goods to market or wait for higher prices. The intermediaries have been disintermediated, and ITC now compensates the farmers directly for their products. Farmers make more for their products than they did in the past, while ITC receives better produce on a more reliable basis and at better prices. ITC has also established relationships with farmers that have enabled the creation of a "reverse" supply chain in the form of retail systems catering to rural citizens.

HEALTH CARE: ARAVIND EYE HOSPITAL

Eye disorders are a serious challenge for people in developing countries, many of whom cannot reach or afford effective treatment. The Aravind Eye Care System is addressing that challenge. Started 30 years ago by Dr. Govindappa Venkatswamy with just 11 beds, Aravind today is the world's largest eye clinic, performing a quarter million surgeries a year. Two-thirds of its patients pay nothing, yet Aravind remains profitable through fees collected from the other third plus revenues from products such as intra-ocular lenses and other services Aravind sells. Huge patient volume is the key to Aravind's success in fulfilling its primary mission of eliminating needless blindness and spreading the costs of its state of the art eye technology among as many patients as possible, while ensuring that Aravind's practitioners obtain the specialization and experience to produce very high success rates for their treatments. Aravind attains its volume by holding weekly eye camps throughout rural India in which practitioners in vans equipped with mobile ophthalmic equipment hooked to PCs beam satellite images of patient eyes back to specialists in the city hospital. Subsequently, Aravind's specialist determines which patients can be treated locally and which need surgery. Those needing surgery are taken by bus to the hospital along with their family members. Real-time information is used to balance deployment of surgeons and support personnel among Aravind's four main operating outfits.

FINANCIAL SERVICES: KIVA

Intense poverty makes it almost impossible for a person to get ahead as there are no bootstraps to grab. This problem has been addressed by the phenomenon of specialized financial services for the poor, as illustrated by the recent Nobel Peace Prize laureate Muhammad Yunus and his Grameen Bank. The bank was a pioneer in providing micro-credit, tiny loans of perhaps US$20-50 with which destitute people can begin enterprises that enable them to earn a living, pay for the education of their children, or meet other needs. An estimated half-billion households could benefit from microloans. Microloans and similar financial products bypass traditional means of securing the loan and collecting payments, but their success has prompted major financial institutions such as Citigroup and Deutsche Bank to join the microfinance movement. Kiva.org is a non-profit organization that extends microcredit to the desktop by allowing individuals willing to make microloans to do so using e-commerce payment services such as PayPal to lend money to micro-entrepreneurs in the developing world. Kiva works with vetted microfinance institutions that receive, disburse, and manage repayment of the funds. Upon repayment of the loan, a lender may cash out or begin the cycle anew to support another small business that might lift its owner

out of poverty. Kiva relies on grants and donations to support some of its internal costs, but it plans to generate enough income to be financially self-sufficient in the next two years.

ENERGY: EUROPEAN CLIMATE EXCHANGE

Fundamental changes in energy production and consumption are needed to mitigate the threats to life on the planet due to climate change that resulting from excessive discharge of carbon into the atmosphere. Information technology plays a role in supporting shifts to cleaner technologies through "carbon trading." European companies that emit carbon are given a "carbon allowance," with which they can respond in three ways: they can exceed their limit and pay fines; they can develop or deploy technology to stay under their limit; or they can buy "carbon credits" from another company that emits less than its allowance. The latter is enabled by the European Climate Exchange (ECX) that provides a stock market-like environment for carbon allowance trading. Information technology supports all aspects of the exchange, from posting prices, allowing trading, and clearing transactions. The market in carbon credits creates market-based monetary incentives for investment in innovative technologies that reduce atmospheric carbon buildup.

V. THE ROAD AHEAD

The relationship between technological change and social change has long been a theme of research in computer science, information systems and other academic disciplines concerned with IT (e.g., Weizenbaum, 1976; Kling, 1980; Markus and Robey, 1988). Technologies do not necessarily lead to significant changes in social conditions, nor do they always yield improved social welfare (c.f., Brown and Duguid, 2000). For example, radio and television have had major social impact, but they have not led to overall better and more educated populations, nor did they realize a hypothetical potential to overcome ignorance or cultural submission (Kraut, 1994; Postman, 1986). Why should the technologies of the networked 21st century be different? Putting IT into the hands of people in underserved communities will not necessarily lead to social progress, but IT does have the following features that might provide greater opportunities for social improvement than older generations of technologies:

- **Scalable and affordable.** Following Moore's law, IT has seen improvements in processing, memory and other capabilities, unlike those seen in earlier technologies (Messerschmidt and Sczyperski, 2003; Kurzweil, 2001). These are likely to continue until 2015 and beyond with new materials, 3-dimensional fabrication techniques, heterogeneous integration and a constant shift towards deploying nano capabilities (Medea 2006). In 2006 alone, over 1 billion mobile phones were sold, extending communication to increasingly larger numbers of people. As the price/performance of IT devices continues to improve, respective infrastructure and services will increasingly come within reach of people at the bottom of the pyramid.
- **Decentralizable and distributable.** Previous advances in IT (e.g., telegraphy, telephony, radio, TV, mainframe computing) evolved hierarchical technical designs and regulatory structures that relied on centralized control and distribution. Newer IT based on microprocessors and open networks can grow dynamically and scale up or down as needed, often under significant control of end-users. Similarly, distribution of information and content can be organized centrally through global services (e.g., Google), distributed in hybrid configurations (e.g., Skype), or controlled by local communities (e.g., independent community networks). This configurability makes new IT very flexible and malleable.
- **Adaptable and situatable.** Newer IT evolves continually in terms of features and capabilities and in response to markets and environments (Messerschmidt and Sczyperski, 2003). Devices and services can be customized and tailored to a degree never before seen (e.g., compare today's huge variety of cellular telephone models and features with telephony of 20 years ago). Technologies that can be adapted and situated

support new forms of social organizing that promote spontaneous exchange, coordination, and grassroots initiatives.

Learning and diffusion patterns associated with IT-based initiatives can be open-ended and dynamically adjustable, allowing greater local responsiveness and adaptation to personal, cultural, economic, and geographic differences. IT alone cannot induce social change, but it can be used to promote and support change in ways more ubiquitous and dramatic than seen by many earlier technologies. One technology of similar scale is probably the 16th century invention of the printing press, which catalyzed the reformation and enlightenment, which were the harbingers of modernity. In a sense, new IT has brought into focus Schumacher's (1999) vision for using the highest levels of science and technology in the service of common or rural people, acting in their own culture.

WHAT CAN SCHOLARS DO?

Most scholars engaged in the study of IT recognize that it has potential to be leveraged for positive social change and improved community welfare. The question they face is what they can personally do to further those objectives. Perhaps the simplest action they can take is to include social value as a dependent variable, in addition to traditional performance indicators. This makes it possible to address several related challenges:

- *Broadening the range of socio-technical systems to be considered.* The technology du jour is always the faster, smarter, smaller, stronger, more ubiquitous, and more capable. The leading edge of technical development is seductive to researchers, and almost by default, it attracts most of their attention and available resources at the expense of everything else. So far, mainstream scholarship has focused on technical superiority in pursuit of economic value from productivity or organizational effectiveness (see King and Lyytinen, 2006, for definitions of the field). With few exceptions (e.g., the ETHICS framework of Mumford and Weir, 1979), researchers have seen ordinary technologies as irrelevant and insufficiently interesting to warrant attention. A broader view of social value requires a broader view of technology, and requires attention to mundane and simple technologies that can make a big difference in underserved communities.
- *Broadening the array of objectives to be sought.* Technologies in the service of the bottom of the pyramid require greater sensitivity to cost, simplicity, energy consumption, durability, and environmental impact. New taxonomies of IT may be required to account for effective design and adoption of services, artifacts and systems in impoverished contexts.
- *Rethinking new models of configuration, organization and delivery*. Services and features relevant to wealthy and information-rich environments might not yield the benefits of social growth, community learning, and sustainable economic development in more impoverished settings. Different infrastructures may be required and a different view of economics might be warranted for provision of "world-class" services where cost can only be a small fraction of what wealthy societies can pay. Models based on goals such as cost-plus and monopoly rents are very different from those based on goals such as "affordable price less reasonable profit."
- *Rethinking the objective and subjective in research design.* Scientific objectivity presumes distance between the researcher and the subjects of study. Yet, many of the challenges at the bottom of the pyramid require the research to "go native" in the manner of action research (Baskerville and Myers, 2004; Checkland, 1991; Mathiassen, 2002) in order to truly understand the issues at stake. Working with and through INGOs and similar organizations with on-the-ground presence and relationships in the local communities brings researchers close to the phenomena of study, enhances data reliability and research validity, and helps the agencies improve program delivery and capacity building. It also enables scholars to have a more direct impact on those who need help. Ultimately, new paradigms of scholarly work must emerge and be

incorporated into tenure and promotion policies if the most talented scholars are to invest their efforts at the bottom of the pyramid.

- *Rethinking values in defining the scope of research.* Positive social change might require different presumptions of competitive advantage, productivity, and profit. It might require, for example, more carefully elaborated understanding and operationalization of quality of life, personal growth and sustainable communities. Furthermore, the range of research issues considered "acceptable" in disciplinary communities might have to be expanded in order to address complex global problems in a proactive rather than reactive manner. The scale of research projects must be adjusted to examine local phenomena while accounting for global context. Even units of analysis might have to expand beyond users, groups or organizations to cover families, communities, regions, societies, cultures, and so on. In all, research paradigms and methods must change to accommodate the new questions that come with the new challenges.

The inertia of the dominant research traditions should not be underestimated. Most scholars would prefer to conform to mainstream norms and may reframe their paradigmatic stance only if they are confronted with convincing evidence that makes them breaking away from the comfort zone of the beaten track. Asking why X causes Y, or the extent to which X causes Y, will remain important, but to these classic questions must be added the question of what is worth studying and why. Work at the bottom of the pyramid also entails pragmatic questions such as whether X is actually Y in the context of Z, or what we can do with X to pursue Y in the context of Z and with what implications. In the spirit of Van de Ven and Johnson (2006), scholars should take ownership of and care for the consequence of their studies within a broader view of human welfare.

VI. CONCLUSION

Scholarly effort around IT should strive for positive social change; the effort should be multidisciplinary and promote the exchange of ideas across the practitioner-scholar gap. Such work is seldom rewarded in academic contexts, but that can change if scholars aspire to change it. Academic performance is, after all, determined by peer review. If the peers are of a mind to change the game, then they might have a chance to do so. Positive social change resulting from IT requires three complementary perspectives: that of the individuals living in underserved communities who might benefit from the right kinds of IT support; that of organizations striving toward corporate social responsibility; and that of scholars seeking to understand IT as an agent of positive social change.

As information technology advances, it can be expected that new methods of production and distribution will emerge and disrupt established practices (Schumpeter, 1943). The last decade has witnessed a redesigning of many organizations and the creation of new organizational forms to take advantage of new and pervasive communication technologies inaugurated by the Internet. Firms such as Amazon, eBay, Expedia, and NetBank have pioneered new ways of delivering information and services to customers. Similar changes are taking place in the arena of social innovation, providing opportunities to benefit society at large. Further rigorous research that examines the relationship between IT and social innovation with an emphasis on working with underserved communities can help in the following ways:

- Exploring information technology-based artifacts, systems, and theories that can help produce and empower agents of social innovation and positive change.
- Finding and applying ways of using information technology for fulfilling the complete spectrum of human needs.
- Reframing discourse in line with the aforementioned mission and values.
- Reconstructing value chains to include social components.
- Investigating how to mobilize grassroots action through use of information technologies.
- Partnering with INGOs and other field-based agencies in developing ways to leverage IT for improving their program delivery and capacity building.

- Examining how to unite the strengths of IT and business with universal values like the eradication of poverty and the restoration of environment and peace.

Academic research can help create a world that works for everyone, that is more sustainable and less prone toward destructive conflict. Every scholar related to the study of IT might well ask, "Where is my opportunity and what can I do?" The ethical and pragmatic challenge is then to follow through with action.

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