Can Technology End Poverty?

Kentaro Toyama

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A ten-year-old boy named Dhyaneshwar looked up for approval after carefully typing the word "Alaska" into a PC.

"Bahut acchaa!" I cheered—"very good."

It was April, 2004, and I was visiting a "telecenter" in the tiny village of Retawadi, three hours from Mumbai. The small, dirt-floored room, lit only by an open aluminum doorway, was bare except for a desk, a chair, a PC, an inverter, and a large tractor battery, which powered the PC when grid electricity was unavailable. Outside, a humped cow chewed on dry stalks, and a goat bleated feebly.

As I encouraged the boy, I wondered about the tradeoff his parents had made in order to pay for a typing tutor. Their son was learning to write words he'd never use, in a language he didn't speak. According to the telecenter's owner, Dhyaneshwar's parents paid a hundred rupees—about $2.20—a month for a couple hours of lessons each week. That may not sound like much, but in Retawadi, it's twice as much as full-time tuition in a private school.

Such was my introduction to the young field of ICT4D, or Information and Communication Technologies for Development. The goal of ICT4D is to apply the power of recent technologies—particularly the personal computer, the mobile phone, and the Internet—to alleviate the problems of global poverty. ICT4D sprouted from two intersecting trends: the emergence of an international-development community eager for novel solutions to nearly intractable socioeconomic challenges; and the expansion of a brashly successful technology industry into emerging markets and philanthropy.

The latter prompted my own move to India. I was working as a computer scientist for Microsoft Research in the United States during a time when India's rise as an information-technology superpower drew to that country increasing investments from multinational firms. In 2004 I was asked to help start a lab in Bangalore, and I jumped at the opportunity. While the lab's broader mission was to engage India's science and engineering talent in computer-science research, I would have the chance to start an ICT4D research group, where I hoped to devote my expertise to something of wider societal value.

At the time, telecenters were the poster children of ICT4D. Telecenters are like Internet cafés, except they are placed in impoverished communities with the intention of accelerating socioeconomic growth. The telecenters are often sponsored wholly or in part by outside agencies—governments, NGOs, academia, industry—harboring a variety of secondary aims, from profits and publicity to increased interaction with a voting constituency.

In Retawadi the telecenter was created jointly by a for-profit start-up company and a local nonprofit. The partners believed that the telecenter would provide social services to the community and income for a local entrepreneur, and, in fact, it did a bit of both. When I visited, the telecenter had two students. Occasionally, a college-aged youth would come in to use the Internet for the equivalent of $0.25 per hour. And the owner boasted that he earned additional income by using the PC himself to provide a local hospital with data-entry services.

Some telecenters have been successful. One operator in South India reported saving a farmer's okra crop by enabling a timely video teleconference between him and a university agriculture expert. Another boasted a threefold increase in income after opening a computer-training center. The press headlines have been unabashedly flattering: "India's Soybean Farmers Join the Global Village" (*The New York Times*); Village Kiosks Bridge India's Digital Divide" (*The Washington Post*); "Kenyan Farmer Lauds Internet as Saviour of Potato Crop" (BBC).

These stories have sparked high hopes for telecenters: distance education will make every child a scholar; telemedicine can cure dysfunctional rural health-care systems; citizens will offer each other services locally and directly, bypassing corrupt government officials. Ashok Jhunjhunwala, a member of the Indian Prime Minister's Science Advisory Council, suggested that telecenters could double incomes in rural villages. M.S. Swaminathan, widely credited with India's "Green Revolution" in agriculture, called for a telecenter in each of the country's 640,000 villages. Other countries have followed suit, proclaiming their own national telecenter programs.

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The excitement around telecenters has spread to the rest of ICT4D. Prominent people in both the technology and development sectors eagerly fan the flames, and proponents of ICT4D increasingly wrap it in the language of needs and rights. Nicholas Negroponte—founder of One Laptop Per Child (OLPC), a project devoted to getting inexpensive laptops into the hands of every poor child—claims, "Kids in the developing world need the newest technology, especially really rugged hardware and innovative software." Kofi Annan has publicly backed the project. Edward Friedman, director of the Center for Technology Management for Global Development, epitomized engineers involved in ICT4D when he wrote, "There is a pressing need to employ information technology for rural healthcare in sub-Saharan Africa." One recent worldwide survey commissioned by the BBC found that 79 percent of the nearly 28,000 adults polled—mainly from richer countries and those with Internet access— strongly agreed or somewhat agreed with the statement, "Access to the Internet should be a fundamental right of all people."

Yet the successes of ICT4D are few, fleeting, and very far between. In Retawadi the telecenter owner made approximately twenty dollars per month, but monthly costs of hardware, electricity, connectivity, and maintenance were a hundred dollars. The telecenter closed shortly after my visit.

Over a span of five years I traveled to nearly 50 telecenters across South Asia and Africa. The vast majority looked a lot like the one in Retawadi. Locals rarely saw much value in the Internet, and telecenter operators couldn't market even the paltry services available. Most suffered the same fate as the Retawadi telecenter, shutting down soon after they opened. Research on telecenters, though limited in rigor and scale, confirms my observations about consistent underperformance.

As I soon discovered, these mostly failed ventures reflect a larger pattern in technology and development, in which new technologies generate optimism and exuberance eventually dashed by disappointing realities.

Academic observers have deconstructed telecenters and other ICT4D projects, enumerating the many reasons why the initiatives fail: ICT4D enthusiasts don't design context-appropriate technology, adhere to socio-cultural norms, account for poor electrical supply, build relationships with local governments, invite the participation of the community, provide services that meet local needs, consider bad transportation infrastructure, think through a viable financial model, provide incentives for all stakeholders, and so on. These criticisms are each valid as far as they go, and ICT4D interventionists sometimes focus narrowly on addressing them. But this laundry list of foibles ultimately provides no insight into the deeper reasons why ICT4D projects rarely fulfill their promise, even as their cousins in the developed world thrive in the form of netbooks, BlackBerrys, and Facebook.

Nothing would have pleased my group more than finding a way for technology to advance the cause of poverty alleviation. But as we conducted research projects in multiple domains (education, microfinance, agriculture, health care) and with various technologies (PCs, mobile phones, custom-designed electronics), a pattern, having little to do with the technologies themselves, emerged. In every one of our projects, a technology's effects were wholly dependent on the intention and capacity of the people handling it. The success of PC projects in schools hinged on supportive administrators and dedicated teachers. Microcredit processes with mobile phones worked because of effective microfinance organizations. Teaching farming practices through video required capable agriculture-extension officers and devoted nonprofit staff. In our most successful ICT4D projects, the partner organizations did the hard work of real development, and our role was simply to assist, and strengthen, their efforts with technology.

If I were to summarize everything I learned through research in ICT4D, it would be this: technology—no matter how well designed—is only a *magnifier of human intent and capacity*. It is not a substitute. If you have a foundation of competent, well-intentioned people, then the appropriate technology can amplify their capacity and lead to amazing achievements. But, in circumstances with negative human intent, as in the case of corrupt government bureaucrats, or minimal capacity, as in the case of people who have been denied a basic education, no amount of technology will turn things around.

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Technology is a magnifier in that its impact is multiplicative, not additive, with regard to social change. In the developed world, there is a tendency to see the Internet and other technologies as necessarily additive, inherent contributors of positive value. But their beneficial contributions are contingent on an absorptive capacity among users that is often missing in the developing world. Technology has positive effects only to the extent that people are willing and able to use it positively. The challenge of international development is that, whatever the potential of poor communities, well-intentioned capability is in scarce supply and technology cannot make up for its deficiency.

This point may sound reasonable enough when stated in the abstract, but it has an important consequence for anyone expecting to save the world with technology: you can't . . . at least, not unless the technology is applied where human intent and capacity are already present, or unless you are willing also to invest heavily in developing human capability and institutions.

The converse belief—accepted as faith by technocrats and techno-utopians—is that the large-scale dissemination of appropriately designed technology, per se, can provide solutions to poverty and other social problems. Believers jump to

address the scale of global problems before confirming the value of the solution. They equate technology penetration with progress. For example OLPC seeks to enable "self-empowered learning." Teachers can be altogether absent; OLPC has consistently sold its technology with little discussion of the realities of pedagogy—training teachers, redesigning curricula, strengthening weak school systems. As for technical maintenance, the students are supposed to provide it themselves. OLPC's very name implies that its goal is, primarily, widely disseminated technology. Yet, few of us would choose PC-based education for our own children.

This *myth of scale* is the religion of telecenter proponents, who believe that bringing the Internet into villages is enough to transform them. Most recently, there is the cult of the mobile phone: one *New York Times Magazine* headline ran, "Can the Cellphone Help End Global Poverty?" The article went on to assert, "the possibilities afforded by a proliferation of cellphones are potentially revolutionary."

"Revolutionary." The myth of scale is seductive because it is easier to spread technology than to effect extensive change in social attitudes and human capacity. In other words, it is much less painful to purchase a hundred thousand PCs than to provide a real education for a hundred thousand children; it is easier to run a text-messaging health hotline than to convince people to boil water before ingesting it; it is easier to write an app that helps people find out where they can buy medicine than it is to persuade them that medicine is good for their health. It seems obvious that the promise of scale is a red herring, but ICT4D proponents rely—consciously or otherwise—on it in order to promote their solutions.

Estimates of annual, worldwide ICT4D expenditure are hard to come by, but they range from hundreds of millions to tens of billions of U.S. dollars, depending on what is counted. Given the extent of the investment, the opportunity costs become significant. OLPC's target cost of a hundred dollars or less per laptop (in practice, the machines have been more expensive), sounds affordable, but that's about half of India's per-student education budget, most of which is currently devoted to teachers' salaries. Does a hundred dollars for a computer make sense when $0.50 per year, per child for de-worming pills could reduce the incidence of illness-causing parasites and increase school attendance by 25 percent?

Despite critical needs in all areas of development, ICT4D proponents tend not only to ignore the opportunity costs of technology, but also to press for funding from budgets allocated to non-technology purposes. Presumably, this was one of the reasons behind OLPC's brazen doublespeak in claiming to be "an education project, not a laptop project," while expecting governments to spend $100 million for a million laptops, the original minimum order. In a fine example of the skewed priorities of ICT4D boosters, Hamadoun Touré, secretary-general of the International Telecommunications Union, suggests, "[governments should] regard the Internet as basic infrastructure—just like roads, waste and water." Of course, in conditions of extreme poverty, investments to provide broad access to the Web will necessarily compete with spending on proper sanitation and the rudiments of transportation.

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Disseminating a technology would work if, somehow, the technology did more for the poor, undereducated, and powerless than it did for the rich, well-educated, and mighty. But the theory of technology-as-magnifier leads to the opposite conclusion: the greater one's capacity, the more technology delivers; the lesser one's capacity, the less value technology has. In effect,

technology helps the rich get richer while doing little for the incomes of the poor, thus widening the gaps between haves and have-nots.

Technology widens the gap through three mechanisms. First, differential access. Technology is consistently more accessible to the rich and the powerful. Technology costs money not only to acquire, but also to operate, maintain, and upgrade. And this "digital divide" persists even when the technology is fully sponsored. For instance, most public libraries in the United States provide free access to the Internet, but poorer residents have less leisure time in which to visit them and a harder time reaching them because of transportation costs. There may be social barriers, too: many of the rural telecenters I've visited in the developing world were not accessible to the least privileged people in their villages due to social injunctions against comingling of caste, tribe, or gender.

Technology producers also reinforce the digital divide. As for-profit companies, by and large, they naturally cater their products toward larger groups of richer customers, who are more likely to buy. Technology amplifies shareholder interest in profit, and, globally, this means hardware tends to be designed for people working in climate-controlled offices with stable AC power; software tends to be developed in languages understood by the world's largest, wealthiest populations; and content tends to be written for audiences with the greatest disposable income. Even when products appear to be free, as with TV or Google, they are frequently supported by advertisers who seek consumers with more disposable income. The result is, again, that the disadvantaged are further disadvantaged. India has more than twenty nationally recognized languages, yet almost all of the software in use there is in English, making it difficult for those literate only in their local languages to use computers. And this inclination reinforces itself: if a technology is not designed for someone, she won't buy it; and if she doesn't buy it, the producers won't design for her.

It is possible to fight against this differential access. Telecenter projects, in fact, typify such efforts, as the centers are always targeted at poorer clients. But progressive practices with respect to technology are not particularly effective on their own because of other differentials that technology doesn't undo. A level playing field doesn't address the underlying issues, which are the inequalities among the players themselves.

This brings us to the second mechanism: even if differential access to technology could be countered through universally distributed technology, differential capacity—in terms of education, social skills, or social connections—remains. Consider the following thought experiment. You and a poor farmer from a remote village are each given 24 hours to raise as much money as you can for the charity of your choice. You are both provided unfettered access to an Internet-connected PC, and nothing else, with which to fulfill the task. Who would be able to raise more money? You would, because of your education, social ties, self-confidence, and organizational capacities. The technology is exactly the same in both cases, so the difference is due to qualities associated with the person. It could be argued that telecenter projects are not far off from a real-life version of this experiment. Clients of telecenters are limited in literacy, education, social ties, political influence, etc., and are therefore constrained in the value they can extract from the Internet. With limited capacity, technology's value is minimal.

Along with differential access and capacity, a third mechanism—differential motivation—contributes to the widening divergence between the privileged and the marginalized. What do people want to do with the technology they have access to? Those of us who have worked in interventionist ICT4D have often been surprised to find that poor people don't rush to gain more education, learn about health practices, or upgrade vocational skills. Instead, they seem to use technology primarily for

entertainment. Telecenter surveys find that when a village has ready access to a PC—connected to the Internet or otherwise—the dominant use is by young men playing games, watching movies, or consuming adult content. Many become proficient at the software incantations required to download YouTube videos from a PC onto a mobile phone. But these same users typically forsake software-based accounting and language lessons. What interventionists perceive to be "productive" use of technology is trumped by the "frivolous" desires of users. Even users in the developed world rarely take advantage of their technologies for purposes of self-improvement—the most popular iPhone apps are games and other entertainments, nothing that would improve productivity or health—but this tendency is exacerbated among those who have grown up with lessons of learned helplessness and low self-confidence.

I'm not blaming the victim. None of the three mechanisms necessarily speak to failures on the part of those who are poor or poorly educated. Blame, if it must be attributed, falls readily on historical circumstances, social structures, and the rich world's unwillingness to invest in high-quality, universal education. In fact, one reason for valuing education is that it generates the appetite for and capacity to use modern tools—all the more reason to focus on nurturing human capability, rather than trying to compensate for limited capacity with technology.

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The problem is that ICT4D assumes the very results it seeks to achieve. The human intent and competence ICT4D aims to generate must already be in place for the technology to work. But if developing economies had the capacity, there would be no need for an external technology push: capable people attract, or develop, their own technology.

North America, Western Europe, Japan, and several other economically blessed regions are cases in point. They attained their status as economic powerhouses well before digital technologies had a measurable impact of any kind. Their advanced production and consumption of information technology can be interpreted more as a result of economic advances than as a primary cause.

Computers, guns, factories, and democracy are powerful tools, but the forces that determine how they're used ultimately are human.

There is also evidence that previous applications of information and communications technology in developing countries have not led directly to socioeconomic progress. Consider television. In 1964 Wilbur Schramm, the father of communications studies and a cofounder of Stanford University's Department of Communication, wrote a book eerily prescient of ICT4D discourse, though its focus was on the technologies of its day—print, radio, and television. In one section of *Mass Media and National Development*, Schramm highlights the potential of television:

What if the full power and vividness of television teaching were to be used to help the schools develop a country's new educational pattern? What if the full persuasive and instructional power of television were to be used in support of community development and the modernization of farming?

Since then television has had some positive impact. Economists Robert Jensen and Emily Oster have found that exposure to cable television empowers rural women in India. Anthropological evidence suggests that television shows depicting urban values can shift social attitudes in rural areas. One nonprofit organization, the Population Media Center, explicitly applies this principle in order to influence birth rates and health-care practices in developing countries by running soap operas with positive social messaging. These are encouraging points.

Yet the sum total of television's development impact comes nowhere near even Schramm's measured expectations. Half a century later, we find that television has not been consistently beneficial to national education or agriculture, either in the developed or the developing world. A visit to a poor household with a television suggests how appropriate the "boob tube" nickname really is. TV is not an effective guard against illiteracy, poverty, or poor health, as India, where about half of households own TVs, demonstrates. Whatever television's potential, society—both as producer and consumer of technology—has failed to apply it consistently toward development on a large scale.

My point is not that technology is useless. To the extent that we are willing and able to put technology to positive ends, it has a positive effect. For example, Digital Green (DG), one of the most successful ICT4D projects I oversaw while at Microsoft Research, promotes the use of locally recorded how-to videos to teach smallholder farmers more productive practices. When it comes to persuading farmers to adopt good practices, DG is ten times more cost-effective than classical agriculture extension without technology.

But the value of a technology remains contingent on the motivations and abilities of organizations applying it—villagers must be organized, content must be produced, and instructors must be trained. The limiting factor in spreading DG's impact is not how many camcorders its organizers can purchase or how many videos they can shoot, but how many groups are performing good agriculture extension in the first place. Where such organizations are few, building institutional capacity is the more difficult, but necessary, condition for DG's technology to have value. In other words, disseminating technology is easy; nurturing human capacity and human institutions that put it to good use is the crux.

The claim that technology is only a magnifier extends beyond international development and beyond information and communication technology. Nobody expects to turn around a loss-making company with the injection of newer computers, but well-run corporations can benefit from, say, computerized supply chains. A gun in the right hands protects citizens and maintains peace; in the wrong hands, it kills and oppresses. (Alas, the gun lobby is right—"guns don't kill people; people kill people.") Modern industrial technology magnifies our ability to produce, but it also magnifies our desire to consume. On a planet with finite resources, the latter could be our ruin. And history suggests that even the political "technology" of democracy is all-too easily subverted in the absence of an educated, self-confident citizenry, willing and able to implement checks and balances against the abuse of power. Computers, guns, factories, and democracy are powerful tools, but the forces that determine how they're used ultimately are human.

This point seems obvious but is forgotten in the rush to scale. Currently the international-development community is having a love affair with the mobile phone. Rigorously executed research by Jensen and by fellow economist Jenny C. Aker demonstrates that cell phones can eliminate certain kinds of information inefficiencies in developing-world markets. Encouraged by such findings and by the sheer depth of mobile-phone penetration, foundations and multilateral agencies have formed task forces and entire departments devoted to mobile phones for international development. In these circles, it is not possible to discuss microfinance without "mobile money," or health care without "mHealth" (short for "mobile health").

The magnification thesis, however, suggests that this is a one-sided view of mobile phones. Certainly talking is something that all human beings, as social animals, not only want to do, but are well equipped for. Phones multiply that intent and capacity, and some of the resulting value is positive—no point in being an indiscriminate Luddite.

But, it's not just productive intentions that are magnified by technology. When a dollar-a-day rickshaw puller pays a large corporation for the privilege of changing his ring tone, does he generate a net benefit to himself or society? Companies pump out such questionable, "value-added" services, and millions of impoverished consumers readily pay for them. Kathleen Diga of the University of KwaZulu Natal observed that some households in Uganda prioritize talk time over family nutrition and clean water. Sociologist Jenna Burrell found that destructive patterns of gender politics are exacerbated by mobile phones, as men wield phones as tools of sexual exchange. Meanwhile, in the developed world, there is mounting evidence that mobile phones contribute to distracted driving, fractured attention, and reduced cognitive ability.

We are in the midst of the largest ICT4D experiment ever. In 2009 there were over 4.5 billion active mobile phone accounts, more than the entire population of the world older than twenty years of age. The cell phone is overtaking both television and radio as the most popular consumer electronic device in history. Some 80 percent of the global population is within range of a cell tower, and mobile phones are increasingly seen in the poorest, remotest communities.

These numbers prompt suggestions that there is no longer a "digital divide" for real-time communication. Yet any demographic account of mobile have-nots will show them to be predominantly poor, remote, female, and politically mute. Whatever the case, if the spread of mobile phones is sufficient to help end global poverty, we will know soon enough. But, if it doesn't, should we then pin our hopes on the next new shiny gadget?