ICTs, Social Networks, and Development

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Introduction

As a green Peace Corps volunteer in 2002, I found myself in the odd position of talking about open source software in international development to an audience of Jamaican Linux professionals and aficionados, as well as Linus Torvalds[1], Eric S. Raymond[2], and a few other luminaries of the Free/Libre and Open Source Software (F/LOSS) community. They were docked in Ocho Rios, Jamaica as part of the "Linux Lunacy II" GeekCruise, and the Jamaican Linux Users Group (JaLUG) had arranged a quick meeting/discussion panel. I didn't realize it then, but that moment exemplified a key to information and communication technologies (ICTs) in international development which I'd spend the rest of my service groping for – bridging of local and global networks engaging in cooperative problem solving.

This paper explores theory and case studies to reveal common themes of successful ICT projects. It begins by framing the discussion around the digital divide as re-imagined by Hargittai and Warschauer, who focus on the social aspects of ICT usage over merely physical access to it. The paper then explores technology diffusion and adoption using Rogers' and Watt's models. Lessons drawn from these are echoed in the successes and failures shown in the case studies.

Background

This paper does not see ICTs as a panacea, but as an important step for developing nations to reduce their dependency on and influence by first world nations. ICTs are useful in a spectrum of cases, from creating a local industry to improving small farmer access to local and

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[1] Linus Torvalds is the eponymous “father” of the Linux operating system.

[2] Eric S. Raymond (ESR), author of “The Cathedral and the Bazaar” and avid open source software advocate.

even international, value-added markets, but basic needs such as health and nutrition must come first.

New technologies create losers as well as winners (Easterly 2002), and increased ICT usage will eliminate lower-skilled paper management jobs in favor of higher-skilled data entry and manipulation jobs. This is Schumpeter's "creative destruction," but in development projects, care must be taken to soften the destruction and not overly increase inequality. This can be done by including those whose roles are at risk in the creation and implementation of the ICT projects, using their tacit knowledge of the existing process, and training them in the new system.

What is the Digital Divide?

In Spring 2006, the Economist Intelligence Unit, in co-operation with the IBM Institute for Business Value published their "E-readiness rankings," expressing the evident defeat of the digital divide:

> "This is particularly evident in basic connectivity: Emerging markets are providing the vast majority of the world's new phone and Internet connections... This is the first time we see a level playing field between developed and developing nations, in terms of connectivity." - Peter Korsten, European director at IBM's Institute for Business Value.

This study focuses on “emerging markets,” conveniently excluding the 72 worst-performing countries (mostly Sub-Saharan Africa and some Latin American countries) in their analysis. The International Telecom Union’s (ITU's) Digital Access Index[3] captures data for these countries, reveals a persistence of low numbers of computers, low teledensity, and underutilization of the Internet in many developing countries. This is not to say that these are areas where developing countries are improving, but the digital divide, as measured by physical

access to ICTs, does remain.

From Boxes to People to Communities

Warschauer summarizes traditional ICT project approaches using the lenses of devices and conduits. Devices are the easiest to track and quantify; they are one-time equipment purchases with no recurring costs. Radio and TV are good examples of devices, with one-time technology purchases and one-way, free access to programming. The device model does not account for ongoing costs of Internet access.

The conduit model adds on recurring payments for services, and can be seen historically through electrification and phone line penetration. Both of these introduced new opportunities and potential for growth, and in the US were examples of markets failing to provide service to rural and remote areas. Conduits have a more difficult diffusion than devices because of their infrastructure requirements, particularly the “last mile” connections.

Devices and conduits are the metrics used to discuss the digital divide, and even including the worst performing countries, there is overall improvement. Computing power is getting cheaper, and teledensity is increasing at a faster rate in LDCs than in the OECD nations[4].

People and "Digital Inequality"

The device and conduit models fail to capture actual usage of new technology. Warschauer compares ICT usage to literacy with the “device” of the book being only as

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[3] See http://www.itu.int/ITU-D/ict/dai/

[4] This is more due to LDCs being at a different point on the S-curve of adoption than developed nations, which have reached near-saturation in landline connections.

important as the content it conveys. Content not in the learner's language, containing important information, has little value (Freire in Warschauer, 2003). This builds on Hargittai and DiMaggio's concept of "digital inequality," which views the problem through five different lenses; raw access, unmonitored access, skills needed, social support, and goals in usage (Hargittai 2004).

Where does this content come from, however? The most relevant content of course comes from the users and those closest to them (their local government, markets, and so on). Warschauer sees this as the "social inclusion" of technology by incorporating the strengths of these local networks and institutions. Beyond the social inclusion of a technology, fully thought-out ICT projects must also engage the entire community in the ongoing creation of content.

Communities

Local networks have a wealth of relevant information that needs to be tapped for successful development projects, and provide communities of practice and support as well as content. Engaging the local network to introduce new concepts is a common goal of many development projects, particularly as in health, where cultural relevance in such sensitive topics as HIV/AIDS is a prerequisite for success. However, this does not enable the community to continue to develop along their own lines without continued outside aid. This externally-driven development does not create a sustainable situation. The community must also be empowered to seek out its own solutions to current and emerging problems.

ICT development projects need not only local networks and content, but also connections to global networks, providing greater resources for more complex problems and a wider scope for the application of "third world" problems such as unreliable power or low bandwidth.

Social Network Theories

This section explores theories of networks to provide a framework of connecting local networks to global ones to evaluate case studies. We pull from Rogers' diffusion theory, Jacobs and Granovetter, and network theory.

Diffusion

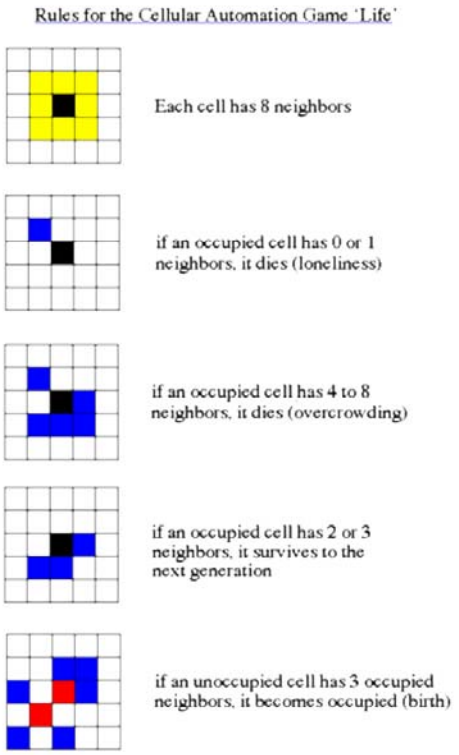
Rogers' Diffusion of Innovation (first published in 1962, 5th Edition 2003) provides a strong model for not just allocation of technology, but its usage and incorporation into the lives of those in possession.

Among individuals, there is a normal curve distribution of the groups in any diffusion process, which are *innovators*, the creators of new technologies; *early adopters*, those who are most likely to begin using a new technology first; the *early majority* who will adopt next, and then the *late majority* and *laggards*. The most important actors in innovation diffusion are the change agents, who are generally external entities bringing new technology to a community and the opinion leaders within each community, who have immense influence over the adoption of a new technology by their peers. Organizations have different methods for deciding and diffusing technology based on their more hierarchical natures, but within an organization, the same individual adoption patterns above hold.

Separate from these social structures surrounding a diffusion process, the attributes of an innovation affect its adoption. Primarily, a new technology has a *relative advantage* over current methods, including a basic cost/benefit analysis and any incentive structures for adoption. The *compatibility* of the technology with local cultural values, beliefs and needs; the lack of *complexity* (or at least, perceived difficulty) of the technology; its *trialability*, the possibility of

using the innovation before committing to it; and the *observability* of an innovation, whether its benefits can be seen in current users.

Network Theory



One of the first computer "games" I remember playing is John Conway's Game of Life[5], a grid with very basic rules. If an active cell has two or three cells adjacent to it, it doesn't change. If it has fewer, it becomes inactive (starvation), if it has more, it dies (overcrowding). Inactive cells become active if there are exactly three adjacent active cells. This bare-bones set of rules leads to a complex world of emergent, self-sustaining patterns and "lifeforms." The complex interactions and occasional production of stable areas of activity can be explained well by network theory.

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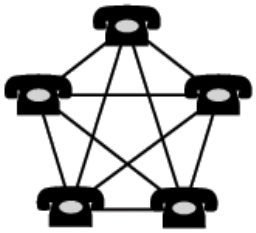
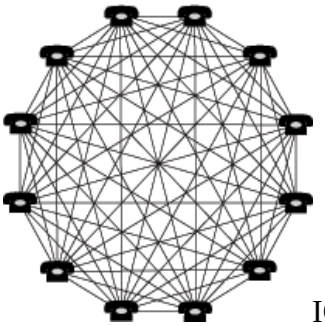
[5] Image from . See for an online version, for an overview, and and for mathematical analysis

Network theory also provides a more rigorous way to look at these network linkages and explores how weak ties provide so much more utility. In Six Degrees, Watts gives us some terminology to explain network effects.

Externalities and Collective Action





ICTs are no doubt technologies with network effects[6], where the number of units in a network increase the value of each unit (see figure below). This can be seen in fax machines, phone lines, and computers. Cell phones took advantage of the existing and market externalities of the landline phone networks to give them a head-start getting over the hurdle of having enough units distributed to have utility (Kelly). Complementary systems, such as hardware and software[7] can further accelerate these effects when each individual object

[6]Watts uses the more specific term, "market externalities"

[7]The hardware/software case is interesting in this situation - originally, software was given away with mainframe computers (the utility of a mainframe without an operating system was not sufficient, perhaps?), but as it became

increases the value of the other. The inherent "network effects" of the technology means that its adoption rate has a positive feedback mechanism, lowering thresholds even as the technology spreads.

Networks and Diffusion

Network connections introduce new ideas to individuals through a social connection, but simple exposure does not necessarily lead to adoption. The more that the spread of an innovation is visible, and the easier it can be experimented with without commitment, the easier it spreads. This is a more precise working of the Rogers' observability and trialability aspects. The percentage of an individual's connections who have adopted the new technology impact the individual's decision on adoption. This is their threshold value -- at what point will an individual adopt a technology based on the number of adopters around him or her?

Watts argues that everyone has a threshold value for a technology, though it may be very high. Watts finds that threshold values fit a standard distribution, much like the adopter types described by Rogers. In fact, Watts draws parallels between innovators, who in his model are randomly activated at the beginning of a cycle, early adopters, whose thresholds approach zero, who need only to know of a technology to implement it, and the late majority and laggards, who need higher rates of network saturation before they adopt.

The size of an individual's network matters in making decisions -- larger networks have

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monetized and divorced from the hardware, the market externalities caused a lock-in effect with Microsoft Windows, where Microsoft products inter-operated poorly, if at all, with competing products. With such a strong market position due to enjoying network effects, Microsoft is able to express almost monopoly power through the peer pressure of its existing users.

Collective action in the form of open, shared standards and F/LOSS licenses which enforce a shared commons have provided a way to create and protect a commons of software and tools to prevent vendor lock-in problems.

more diffuse effects as any one decision by a neighbor has less share in the individual's adoption. A person with four friends can meet a 50% threshold if just two neighbors adopt, but with a network size of 20, it takes five times the number before the threshold is reached. This leads to Watts' key finding, that the spread of an item in a network depends more on the network structure than the item itself.

Network Structures

There is a boundary beyond which innovations cannot diffuse, as a combination of increasing threshold values and large raw connection numbers effectively clog the adoption process, as no percentage of the highly-connected network can overcome even modest threshold values (Watts 2003).

Below this boundary, however, “cascades” of adoption can happen. Within this area, there are "vulnerable" areas of a network where the connections and low thresholds of the individuals can create a topology which is very favorable to new technologies. These cascades can overwhelm the network and cause a global cascade. This runaway effect is similar to Conway’s Game of Life. This triggering is due solely to the network topology, not to attributes of the innovation itself. Obviously achieving this cascade is the goal of any technology diffusion process, but, if Watts is correct and only network topologies matter, then any project will work in the right community, and even the best project will fail in the wrong one.

Communities and Linkages

Watts begins to connect local networks in isolation to networks of networks. While it is important to remain connected to the specific local situation as above, we must also find and exploit appropriate bridges from the local into the regional, national and global. Jane Jacobs and

Mark Granovetter provide some important insights into these inter-community linkages.

Cities and the Wealth of Networks

This is the essence of Jane Jacobs' Cities and the Wealth of Nations, which explores the pivotal role of city-centered economies in trade. There are three lessons to be extracted from her treatment as relevant to ICTs and development.

Jacobs' view of cities is situated in economics of agglomeration, where physical proximity of diverse but complementary skillsets and production provides a positive feedback mechanism. ICT projects also benefit from this context. Jacobs' solution to one of her "transactions of decline", advanced-backwards trading, reflects the difficulty of connecting a community to the vast resources of the Internet without some form of mediation. Advanced-backwards trading is a microcosm of the core-periphery dependency model of development, but is increasingly visible in modern globalization. It takes place when highly advanced first world nations engaging in trade directly with developing economies, disadvantaging them by offering goods which the developing nation can neither offer anything of comparable value in trade, nor hope to reproduce locally (Jacobs 1985). Jacobs' solution to this is for cities or nations to trade with partners both more and less advanced, but not overwhelmingly so. By trading with only slightly more advanced regions, Jacobs argues, the region in question can hope to learn and begin to produce locally the other's technologies and bootstrap themselves up the development ladder through this import-replacing (but not full import-substitution industrialization/ISI) model. This is not easy in the globalized economy nor in ICTs, but the argument is nevertheless strong, and to the extent that an ICT model can find regional linkages to other projects with similar goals and levels of progress, the same advantages in incremental development can be

achieved.

Weak Ties

In 1972, Granovetter formalized the concept of "weak ties" as connections between an individual and their acquaintances who are not in this individual's close knit circle of friends. However, these distant relationships are each members of other clusters of their own circles of friends. This shifts the importance of this weak tie to being an important bridge into "outside" and possibly remote networks of information and people. This delinks the strength of a connection from the content of it. In fact, the content of more distant links is more valuable, as the content of strong ties is most likely not new. Individuals with few weak links are more likely to be insulated against new innovations. Rogers, above, describes this as having localite tendencies, as opposed to more cosmopolitan, widely connected ones. These connections bridge between the individual adopters in Rogers' diffusion theory, are similar, if at a lower level, to Jacobs' trading among regions of similar development, and are explored more precisely by network theory.

Positive and Negative Network Effects

Despite their diversity, these theories have many commonalities, leading towards a similar view with regards to ICTs in development. These common lessons provide paths to focus our attention as well as illuminating obstacles to work around or avoid. This section attempts to pull out these connections.

Positive Effects

The positive effects below increase capacity and empower communities through

knowledge transfer, suggesting strategies for successful ICT projects. These effects are seen in increased linkages between distant networks (Granovetter's weak ties), Roger's diffusion and Watts' treatment of network theory. Some of these require certain conditions to be met, and some are difficult, if not impossible, to predict or plan for.

Local Content and Production - Having locally relevant content inspires increased participation and creation of more content in a virtuous circle. Closely tied to initial adoption, supported by peer-based risk reduction and network effects is active participation. Rogers categorizes this as user customization.

Yochai Benkler, in The Wealth of Networks talks about the value of networks (specifically, Internet/computer networks) furthering the production of culture and local content, and creating a more democratized and transparent culture available for all its participants to modify and add to (Benkler 2006)**.** The downfall of this (online) peer production is that it requires ubiquitous network access and excess capacity among the participants. Ubiquitous access is obviously not available in the developing world, and excess capacity is a rare commodity itself. Benkler argues that even when there a relatively scarce amount of this excess capacity, the fact that the produced goods are non-rivalrous changes the equation and makes this allocation worthwhile (Benkler 2006). Nevertheless, in Wikipedia, the poster child for non-market peer production, we see a sharp increase in non-English entries:

> "Most of the early growth was in English, but more recently there has been an increase in the number of articles in many other languages: most notably in German (more than 200,000 articles), Japanese (more than 120,000 articles), and French (about 100,000), but also in another five languages that have between 40,000 and 70,000 articles each, another eleven languages with 10,000 to 40,000 articles each, and thirty-five languages with between 1,000 and 10,000 articles each" (Benkler, 2006, pp.70)

These languages of course are all of OECD nations, but there are 466 entries in Quechua, a South American indigenous language from the Inca, and 11 pages in Akan, a Western Africa language, among others[8]. As Warschauer points out, there are Western concepts built deeply into modern computing; the ASCII text standard being the most difficult with its failure to support extended characters in non-English languages, which has "infected" the URL system for webpages. The newer UTF-8 system is addressing this ().

ICT projects deliver large quantities of explicit knowledge – transferable, quantifiable data and basic instructions. However, without the tacit understanding of the new systems, there is no base to build with, no connection for this new technology[9]. This gap underscores the need for some amount of mediation in the form of training, assistance and support to bridge initial interest to relevant content so as to build this tacit knowledge.

Network Effects - Most ICT projects benefit greatly from market externalities/network effects in a variety of ways. There is the basic telecommunications model, exemplified by Metcalfe's Law. The more people in your network (with a phone, fax machine, email address, IM handle, and so forth) the more valuable access to these resources (and therefore the network) becomes, at a rate greater than the number of individuals. On a more general level, however, the more people in a community who have word processing skills and access to a computer, the

[8] See http://meta.wikimedia.org/wiki/List_of_Wikipedias for a current list of entries by language

[9] Knowledge is increasingly being codified and transmitted through computer and communications networks in the emerging “information society”. Also required is tacit knowledge, including the skills to use and adapt codified knowledge, which underlines the importance of continuous learning by individuals and firms. In the knowledge-based economy, innovation is driven by the interaction of producers and users in the exchange of both codified and tacit knowledge… (OECD 1996 The Knowledge Economy)

more likely that using a word processor is of more value than writing a document out. While ineffective at the outset, creating projects with network effects can lead to cascades of adoption and usage, and make the difference between Microsoft Windows and OS/2 Warp[10]

Access to New Information - Distant connections have the most valuable "content" in a network, providing information beyond what is already contained within a person's close circle of friends. Watts takes a mathematical view of this, while Rogers introduces presumptions about the specific actors and their interactions which are not as easily modeled - what type of people, for example, are the innovators? Who is bringing this innovative technology to a community (particularly in development situations, where a community may be isolated by a variety of geographical, infrastructural, or social reasons)? Rogers' approach is meant to be a method to encourage diffusion and, through convincing opinion leaders within a community, turn that community into a percolating cluster for the technology being introduced.

Watts states emphatically that it is not possible to predict or take advantage of the networks to create a cascade of adoption. Rogers argues that you can at least encourage this process by examining the strong ties within a community to reveal opinion leaders whose adoption of a technology carries more weight than other neighbors. Similarly in organizational or hierarchical settings (such as within a Ministry of Education), certain structures pre-exist to encourage or coerce usage of a new technology. The different "weight" of opinion leaders is hard to quantify, but provides a valuable tool for policy guidance that, as some of the case studies will reveal, is beneficial to the final project.

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[10] My point exactly.

Risk Reduction - This new information can then be adopted or not by individuals, depending on its popularity within their network and the individual's personal threshold. Their peer group acts as an informational resource, assisting the individual in making their adoption decision, providing visible trials of its success, possibly creating market externalities increasing the utility of the technology and overall reducing the risk of adoption.

Outside of pure network solutions, there are many risk reducing strategies to encourage the adoption of new technologies. Microfinance, service-based, as opposed to product-based approaches (providing ongoing maintenance and training), and cost-effective insurance against technology failure are all possibilities. These often clash with technologists who are over-sold on the value of the product and uninterested in providing hedging methods that raise the overall project cost.

Equality among peers - Granovetter, Jacobs and Rogers all posit that not all network connections are equal, and this is reflected in Watts, when certain active clusters can cause a cascade effect through their “weak links” to other clusters. Jacobs, unlike Granovetter and Rogers, warns us that some of these more "distant" connections may in fact be dangerous. Connections, even perceived connections through media exposure, which bring in new information are good, but if this information cannot be localized, it runs the risk of overloading the local community with cultural imports.

Negative Effects

Largely, the negative effects are the inverse or failures of the above positive effects.

Overload - Essentially this is a restatement of the last point above, a network could be

overrun, to its detriment, in being too closely connected with a net full of information that is not localizable or "digestible" for the local community. Overload can also be seen by the creation of needs through first-world media and advertising that are not locally relevant, and may even by harmful.

Language statistics from Wikipedia, while inspiring in that local and indigenous languages are appearing, is also evidence of the vast head start in not only physical access but skill and utilization by the first world. Benkler tackles this information overload problem, the "Tower of Babel" objection, from a community aspect, in that we use "strong filtering" (Benkler, 2006) on information from the Internet, preferring that which comes through us through close ties, as well as use networks to continue to thicken these ties, which begins to address community-harming problems.

Community-harming effects - Whether focusing on weak ties comes at the expense of strong, local ties has been the topic of much debate, particularly with Internet usage. Benkler finds studies (by Kraut, as well as Keith Hampton and Barry Wellman) that past an initial decrease in strong local ties, Internet usage increases global weak ties without harming personal relationships (Benkler 2006). Indeed, Benkler argues, we work to use these new methods to thicken strong local ties at the same time as overlaying a new network of global weak ties. Whether the addition of these weak ties reduces our embededness in the local society (and whether the benefits of the new information this disconnection enables) is on par a good thing or not is "interpretive" (Benkler, 2006).

Pushback - One of the interesting revelations from Watts' exploration of networks is the problem with highly connected communities -- the extreme interconnectedness makes it difficult

for any innovation to make headway as even individuals with low thresholds will require such a high raw number of neighbors to adopt before they reach their percentage value. Many development situations will exhibit this exact problem, and finding a way to break through this barrier to adoption is central in technology projects. This is the strength of diverse pilot projects. One of the best techniques that the development organization Oxfam uses is to introduce communities which are in different stages of a development project[11] .

This allows communities who are at the initial stages of implementation to discuss both positive and negative issues with communities further along on the same project and thereby make more informed decisions, independent of Oxfam. If the project is proving beneficial in these other communities, this exposure helps to overcome local thresholds; if the project is not being successful, then it's most likely not worth pursuing further in any case.

Case Studies

This section looks at actual case studies to compare the theories and rubric of positive and negative effects above to realities in ICT projects. The cases follow the theories, starting with local networks and diffusion, then looking at the role of communities and larger networks. The first case study looks at two strikingly similar projects I was tangentially involved with in Jamaica revealing the importance of working with local networks.

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[11] "Oxfam supports exchange visits between a community that is interested in a particular initiative (be it a breed of goat or a new crop) and a community that has recently adopted it. Field workers regularly tell stories late into the night of what happened in other communities (the good and the ill) or instigate role plays, acting out what people most want their grandchildren to remember. Formal meeting employ case studies or a panel of speakers from different backgrounds analyzing a society's future or scenario-building or futures analysis presented by facilitators (in an accessible manner, one hopes).Yet remarkably few of these participatory mechanisms have been employed deliberately for the purpose of identifying cultural consequences of poverty-reduction activities explicitly" (Alkire p.196)

The "AlphaSmart" in Jamaica

The AlphaSmart is a keyboard/word processing device which was adopted by two different programs within the Jamaican Ministry of Education, Youth and Culture. This sets a number of variables, such as culture, social network infrastructures, institutional structures, and physical infrastructures constant, providing a strong case for close comparison.

Alphasmarts are portable and rugged keyboards that inter-operate with computers to provide a multiplier effect. AlphaSmarts are cheaper than most computers (still running upwards of $300 USD per unit for the more advanced models), and can be bought on a per-unit basis, so can be rolled out in pilot projects before committing to a large purchase.

The Primary Education Support Project

The Primary Education Support Project (PESP, http://moeyc.gov.jm/projects/pesp/index.htm) is a continuance of the loan-based Primary Education Improvement Projects (PEIP). PESP has inherited a wide scope, covering quality

assurance (including curricula implementation and usage of instructional technology), institutional development (teacher training) and civil works (physical infrastructure repair/maintenance).

The AlphaSmart was initially introduced to a Ministry officer of PESP at an educational technology conference, where it was seen as a cost-effective way to introduce elementary school children to basic keyboarding to better utilize available computer resources. Children could take the keyboards with them and type a number of short stories into their onboard memory, which could be uploaded to a computer afterwards. This connected to the instructional technology subcomponent of PESP's quality assurance goal. The initial pilot AlphaSmarts were distributed to select schools with poor results. Due to lack of funding and staff, there was minimal training or integration into the curricula, and their usage largely tapered off.

The New Horizons Project

The USAID-funded New Horizons for Primary Schools (NHP), was aware of the AlphaSmarts through the PESP pilot project, and chose to use the AlphaSmarts in their own schools after hiring the PESP director as their own educational technology specialist. The overall NHP mission was to increase literacy and numeracy, with a strong focus in the last two years of the project on innovative and affordable technology usage. The AlphaSmarts matched with these goals even more closely than they had with PESP.

NHP arranged their pilot schools in a hierarchy, where the most capable and well-located schools received a larger share of training and equipment in return for opening their schools up as "Professional Development Centres" (PDCs), for surrounding, less-equipped schools, with the goal of a cascade of skills out to the peripheral schools. NHP also identified a small set of

schools with opinion leading teachers and administrators to be technology intensive schools, with the goal of using them as pilot project sites and also for their own cascade with ICT usage.

NHP was able to integrate training on the AlphaSmarts as part of their larger training program among their pilot schools, demonstrating in what ways they could be integrated into the nationwide curricula. This training drew on the former experience as teachers of NHP training personnel to better influence the teachers. Although centrally distributed, a more network-based model was created within the NHP pilot schools, but allowing the central ministry to undertake the procurement tasks and hold most of the implementation risk.

Schools with supportive leaders displayed extensive and innovative use of the AlphaSmarts, adapting lesson plans, and re-inventing the technology. The AlphaSmarts in the PDCs came with a large storage/recharge/synchronization cabinet that was designed to be rolled between classrooms. In Jamaican schools, however, elevators between different levels are absent, and the sidewalks connecting different rooms and buildings were not exactly smooth. The cart then became a fixed feature of the school's computer lab or offices, and padded boxes or coolers were modified to carry the AlphaSmarts between classrooms. Some of the schools with heavier usage indicated that they had added the purchase of more AlphaSmart units into the school's own technology plan, indicating successful diffusion and plans for continuance.

Differences between NHP and PESP

Obviously, the move of the primary change agent from PESP to NHP crippled PESP's influence in the diffusion process to their schools. NHP was able to incorporate AlphaSmart training into their already-funded training program, increasing awareness and enabling the

trialability and observability of the technology, whereas PESP was restricted to only a few site visits to conduct training, with little follow-up. NHP had more personnel resources to bridge the gap between the new technology and the schools. The teachers were thus exposed to a wider variety of peers and experts, including a sales technician from the company itself who all contributed to overcoming threshold values for adoption. The NHP conferences brought teachers interested in new technology (and therefore probably with lower thresholds) together from different schools, which further assisted percolation in this artificial network, as exposure to external, adoptive linkages combined with the lower threshold value members in the conference to overcome higher threshold members. Repeat contact and support from the NHP staff helped to cement the Alphasmart's usage in daily lessons.

Local Mediation

One of the strengths of the NHP AlphaSmart project was its use of former teachers and peers in encouraging adoption and usage of the laptops. The Village Phone project, below, uses this as its main instrument for spreading phone access.

The Village Phone

The rapid diffusion of mobile telephony in India, China, and Africa is the common citation for leapfrogging and successful ICT diffusion. Muhammad Yunus, the founder of the most well-known project based on microcredit, won the Nobel Peace Prize as a result.

Cell phones have an obvious relative advantage in underserved rural communities where no wired infrastructure is available. They enable community members to connect with family members, and link to needs for information and communication. Cell phones are not overly complex, in that the basic functions of it do not differ from existing phones, though basic literacy

and numeracy are needed for the person administrating the phone.

The Village Pay Phone Project evolved out of Muhammad Yunus' Grameen Bank microfinance project, which provided small loans to entrepreneurial women in rural India ("Grameen" means village in Bangla). The for-profit Grameen Phone sold their phones to Bank borrowers in partnership with their non-profit sister institution, Grameen Telecom. Grameen Telecom provided a cell phone and training to this group. These entrepreneurs could then supplement their income by operating the cell phone for their entire village (Cohen, 2001).

Grameen Telecom personnel find local Grameen Bank members with a sufficient skill level to take advantage of being the initial operator for a village. These people are encouraged to apply to the bank for an unsecured loan to purchase the phone (Cohen, 2001). These initial entrepreneurs see the phone as an additional way to earn money for their household. The villagers become aware of the cell phone technology and can connect it with their communication needs, primarily for economic communication (almost 50% of all calls were for economic purposes, Bayes 1999). We see in the Village Pay Phone example two levels of adoption; the actual phone operator who has purchased the phone and mediates its usage, and the village members themselves, who use the service. For the villagers, the risk for use and threshold for decision-making was very low, as their individual decision did not affect the availability of the service for their future usage –they could implement or discontinue at will. Without the availability of the phones through microcredit loans and the multiple levels of mediation (training the original phone vendor, and then the vendor mediating the technology for her village peers), this project would not have been as successful.

The village phone operators have enjoyed economic success and empowerment through

their new social position. This empowerment is the main goal of the project, so additional spread of the technology beyond one phone per village is limited. In some cases where Grameen Telecom becomes aware that the operator is charging exorbitant rates, they have assisted others to provide competition. There has been a remarkable increase in rural cell subscribers, from around 1,000 in 1999 to over 4,000 in 2001 (Cohen, 2001). While the aims of the program were not to necessarily increase cell phone penetration, it has encouraged more individual adoption through the mediation of the service, its proven value, and the economic success of the mediators.

Some criticism exists that the microcredit plan is a dangerous debt trap aimed at those most vulnerable, the Grameen project so far seems to be a resounding success, and the Grameen Foundation has begun extending it to other areas of the world, such as Uganda and Rwanda.

Kiosks and Cybercafés

Centralized computer labs, public kiosks and cybercafés are all ways of getting beyond the "last mile" problem of providing communication; cell phones or wireless/mesh networks are other options to defray the costs of individual hookups of housing in remote areas (Garcia). These forms of public access allow people who would be unable to absorb the fixed costs of computer ownership, regardless of ongoing conduit costs such as Internet connection, to rent access time. At the same time, they can provide opportunities to local entrepreneurs to serve as mediators for this technology.

Similar to the Grameen phone project, where the initial phase has a phone operator making phone calls for her customers, successful kiosk and cybercafé projects are not necessarily used directly by the customers, but by entrepreneurs who are more familiar at navigating the

system for the information the customer wants.

The Gyandoot, kiosk system in India, as well as similarly successful cybercafés in Mexico focus not on the technology, but the services that can be provided. The spread of ICTs becomes more organic and driven by the demand for these improved services. The Gyandoot project, for example, allows citizens to interact efficiently with their local government, reporting problems and providing informational services (land titles, for example) as well as supporting a local e-marketplace. The online complaint form has led to improved services from water pump functionality to more reliable educational services for the communities involved. While most people pay the kiosk's manager a fee to access the services and information for them, parents send their children to the kiosk for lessons in ICT usage (and sample tests for the educational system are available through the kiosks as well).

This mediation of the information is combined with high-value locally-relevant content and online services, and provides a "win-win-win" situation as the government is able to be more efficient and transparent, the citizens are able to extract higher value from their government, and the entrepreneurial mediators make a profit off of the system.

The cybercafé similarly can offer training courses and support to its users:

> ...cybercafes are not only sites for technical access, and for consumption and use of multimedia content and services, but public, physical, community and cultural spaces... Cybercafes may service and reflect the communication and information needs of people living in a global society, but they place this in a local context, providing a social space and a convenient and hospitable location for technology access: the 'human face' of the information society. The cybercafe can act as a gateway or portal between a local community, represented by individuals and formal and informal groups, and on-line communities and individuals.(Stewart 1998)

The Mexican project mentioned above focused on information policy over ICT

proliferation, desiring to raise the level of policy debates among the poorer populations of Mexico City, in turn leading to improvements in government and educational opportunities (Robinson, 1999).

By being projects about improving the citizen/government relations, and not "about" technology, these two cases both end up providing highly successful technology projects, reminding us of two important concepts. First, technology is rarely if ever an end unto itself. Second, and more central to this paper, is that technology projects must involve locally relevant content and local mediators. These projects illustrate one way to ensure that, which is to make the project actually about the content and mediators, and have the technology fill its role as needed.

Global Linkages

The final link that must be made is connecting development projects and grassroots organizations to the vast resources of the Internet. The Internet however should not enjoy any special status as a thing apart. Just as successful projects bringing in new technology have involved mediation, so must the introduction of the Internet be somewhat mediated and localized to the needs of the community.

Transnational networks have proved their value in a wide range of projects from economic empowerment to providing political, legal, and media voices to marginalized groups. The fair-trade, often organic movement now reaching mainstream was incubated by solidarity networks in the first world working with cooperatives and small farmers in the LDCs. Human rights and environmental groups have provided legal representation and media awareness for marginalized groups suffering from corporate or governmental abuses.

The Internet provides a valuable tool for any grassroots movement as a cost-effective way to reach advocates internationally. It also enables global collaboration and information sharing which previously was too costly to engage in.

Open Source Communities

Global communities organized around Open Source projects are a model for transnational linkages. Linux Users Groups (LUGs) have been an important part in "technology transfer" within developed nations, wherein hobbyists and self-taught experts share tacit knowledge about Linux and related open source program usage and development.

These LUGs continue to provide high quality peer assistance in developing countries, and when they manage to align themselves with influential benefactors (local universities, companies or ministries), they can serve important advisory functions and raise awareness. Their members will be devoted "techies" interested in both their community and expanding technology usage. These are early-adopters and innovators, and linked with an organization with opinion leaders, provide a powerful recipe for technology adoption.

This brings us back to the introductory story with JaLUG and Linus Torvaalds. This community worked with a local network of cybercafés, the local universities, and had many events sponsored or otherwise supported by IBM's Jamaican offices. They provided informational sessions to the public, hosted Linux "InstallFests" for new users, worked with other LUGs in the Caribbean towards policy changes, and participated in global Linux and open source projects. There was a wide range of skills, from one user set on (and capable of) developing a Jamaican-specific Linux distribution to new computer users and teachers interested in the open source alternatives. Beyond these external effects, the group also was its own

powerful resource for technology tips. The network of users traded job tips and cell phone tricks in addition to computer hardware and software advice.

Discussion and Policy Recommendations

ICTs provide a unique opportunity to connect local networks to a global network of information, peers tackling similar problems in different regions or countries, and development professionals. ICT development projects should then focus on connecting these local networks to global resources via the Internet. However, providing Internet access is not essentially different from providing computers themselves -- the process must be initially mediated, and the local network should be introduced to globally dispersed communities of practice in similar stages of emergence. This helps bridge both the digital divide of physical computers and Internet access as well as Hargittai's digital inequality of learning ICT skills.

This leaves development agencies in a difficult position. Creating successful ICT projects is not delivering computers, or even in bringing Internet access, it is fostering a community of practice and making a seed of locally relevant content to provide the demand for the ICT systems, as well as providing mediation and training to ease people in to using the technology. It is connecting these local communities to the global Internet with mediation of relevant, but international, content and communities.

The Importance of Local

The somewhat obvious tact of focusing on the local situation by involving local leaders and resources and providing content relevant to local users in their own language is unfortunately not well integrated in most ICT projects. The measurement and evaluation of these projects, by

excluding more qualitative adoption and usage data pushes projects away from digital inequality measures of skill transfer and digital literacy.

Locally relevant content and services in local languages provide motivation for new users to spend the money and time needed for learning the skills to go online. It cannot be expected of people whose first priorities are daily survival to invest valuable time or money without some direct benefit that compensates them for this time, such as accurate prices, providing feedback to local government, or accessing information otherwise important to their daily lives.

This can be hard to understand for technology implementers in development situations where the implementers see obvious benefits to the technology, and get frustrated by a lack of interest in the community, but as we saw in the theoretical frames and case studies, this obstacle will always be a factor, and must be overcome. Working within the local framework is critical to ICT implementations regardless of how basic and global the project may be.

Foster communities, not technologies

Technologies thrive in healthy, strongly interconnected communities. ICTs specifically benefit from and feed back into such communities. Therefore, focusing on improving the personal networks within a community, as well as their "weak ties" to other communities goes hand in hand with successful ICT projects. These networks provide their own locally-relevant content given some "seed" infrastructure and existing directions. The Gyandoot kiosks with forums for local selling of goods and interfacing with government are a strong example of this.

One way to avoid the trap of device and conduit metrics is to create projects focused on training or education, subsuming the access component into an overall program designed to

foster communities and skills transfer.

Global Linkages

ICTs open the door to a new level of networking through the global Internet. Helping communities connect with global communities facing similar challenges enables information sharing and can foster a better intercultural understanding. Improved machine translation and embedded translation tools into communication programs will further facilitate this exchange.

The best technology projects aren't

Warschauer focuses on the social embeddedness of ICT projects, and the importance of, as above, focusing on the content more than the technology itself. I posit, based on the pattern emerging out of the case studies this paper looked at, that we must go one step further. The ICTs themselves should be the means, not the ends, of projects. Is it imperative to close the global "digital divide" of ICT skills (and access to a lesser extent)? Certainly; but not for its own sake. We need to remember the very arguments we use to justify this – that it is yet another limiting factor to economic advance, political democratization, and social well-being. These goals should remain the driving force of projects, not merely implementing new information technologies.

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