Interoperable Technologies in International Development: Access to FrontlineSMS

August 4th, 2011
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Introduction

In order to survive in today's world, developing countries must find profitable ways to engage in the global economy. As the economic gap continues to widen across the globe, scholars like Paul Collier (2007) suggest that the worst possible outcome today is to be found amongst the bottom billion, left out of the economic discussion, and marginalized. Struggling nations may often find themselves trapped, whether it is by situations of conflict, bad governance, exploitation of natural resources, or the curse of poor geographic location. However, these development traps cannot be solved using soley bottom-down approaches; necessary solutions must be cultivated from within (Collier, 2007). Aid packages will not fix development problems; instead, these developing nations need to become more economically and globally fit if they wish to survive and rise beyond the bottom billion (Giddens, 2000). As we become a more globalized society, pressure is placed on developing countries to either catch up or be left behind. If they want to avoid this fate, developing nations can improve their global positions by increasing the value, not the volume, of their economic activities (Gereffi, 1994). To do so, they must focus on utilizing the resources and skills available to them in order to become more profitable and stable in today's economic climate.

Countries that have successfully risen from their bottom billion status have developed their own economic strategies. Groups such as the Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) chose to close off their interior networks by limiting the amount of imports permitted within their borders.

Simultaneously, they increased the amount of exports they were distributing and, thus, expanded their global networks and reach. By building on their ability to link to networks across the world and produce exports that were in global demand, these Tigers were able to become economic powers once again (Garcia, 2010).

Presumably, these lessons can be applied locally as well as globally. Groups can utilize their communication networks to build bonding capital and reciprocity while simultaneously reaching across their local communities to centers of power and resources (Narayan, 1999). As Allen Scott and Michael Storper have pointed out, these global networks, and globalization as a whole, only increase the need for development at the local and regional level (2003). Therefore, it is important to look at how development strategies are being employed locally in order to communicate more globally. New technologies, such as cell phones, are fostering much more crosscutting communication; these new technologies have the ability and potential to aid development goals and economic activities. However, in order to take advantage of these new technologies, these networks must be interoperable and open (Garcia, Kale, and Danish, 2007).

Today, new technologies are available that are both accessible and affordable to local groups around the world. Many that are based on open source are also interoperable and, therefore, well suited for diverse development strategies. It is this topic that this paper seeks to address. Specifically, this paper asks: How exactly are these technologies being used today? What are the specific benefits they offer? As importantly: Are they only being used for communication, or are they employed and designed for development purposes as well?

To address these questions, the paper proceeds as follows: First it conceptualizes the terms “flexible” and “interoperable” as they pertain to development strategies. Next, the paper discusses how interoperable technologies are operating today and how these technologies can be employed to meet development goals. Thirdly, the paper compares two case studies within

FrontlineSMS, an interoperable organization that leverages “basic tools already available to most NGOs – computers and mobile phones – enabling instantaneous two-way communication on a large scale” (FrontlineSMS, 2010). The first case study examines how the International Organization for Migration (IOM) was able to use the SMS platform to communicate with the Pakistani people after being displaced by the region’s devastating floods in July and August of 2010. The second case study explores FrontlineSMS’s ability to aid the Karnataka Health Promotion Trust and a team of students from the University of Southern California in building and communicating with a network of people currently living with HIV/AIDS in India. Finally, based on the analysis, the paper will lay out policy implications for how interoperable technologies can be effectively utilized in development today.

Flexible and Interoperable Development Strategies

To understand the role flexibility and interoperability play in development strategies, first we need to understand what these terms mean in the context of international development goals. By establishing a basic definition from which to explore this field, we can assess how these open forms of communication and technology play a role in development work. Working from the understanding that interoperability has already been established as a necessary component of any profitable and functional network and institution, we will explore how these terms are being employed today to aid development practitioners (Garcia, Kale, and Danish, 2007).

Development Strategies

Development strategies must employ both a macro and micro perspective if they wish to be successful in today’s economic climate. Scott and Storper suggest that,

Regional economic development involves a mixture of exogenous constraints, the reorganization and build-up of local asset systems,

and political mobilization focused on institutions, socialization, and social capital. More generally, the extent to which any region succeeds in creating localized increasing returns effects – which depend importantly on these cultural institutional foundations – is critical to the entire development process (2003, p. 24).

To this point, regional development must employ micro techniques if it wishes to build upon pre-existing cultural structures and asset systems to bolster a nation's local economy; but to launch a developing nation into the global economic sphere, it must also connect to the exogenous macro structures. Therefore, development cannot occur without networks or the ability to tap in to both local and global social systems and capital, which allow for the global diffusion of local asset systems (Narayan, 1999; Rogers, 2003).

The ability to connect the local with the global is a fundamental element of development strategies. The local must be able to communicate and connect with other local entities in order to become both mobilized and socially organized, and they must be able to network globally in order to open themselves up to economic opportunity and connect to systems of power and resources (Narayan, 1999). Deepa Narayan defines social capital as, "the norms and social relations embedded in the social structures of society that enable people to co-ordinate action and to achieve desired goals" (1999, p. 6). Social capital does not only exist on a local level. Social capital also occurs when cross-cutting ties are developed, which links local entities with global agents who wish to work together to achieve a common goal. For example, some global NGOs work to connect with local individuals in order to communicate their development message globally, and some local NGOs work locally and pass information along to the global public. These examples demonstrate a development structure that operates using human relationships as a means of communication, which, when connected to the correct people through cross-cutting ties, can both unite a global community and diffuse a local product or cause into the global arena. These are the current strategies of development

practitioners that this paper will employ.

Flexible and Interoperable Development

Interoperability allows independent systems, agents, and individuals to openly communicate with one another based on a common understanding, or across a communication interface or platform (Garcia, Kale, and Danish, 2007). D. Linda Garcia, Madhura Kale, and Sara Danish suggest in their paper "Structural Strategies for Promoting Network Interoperability through Openness" that the parts of this property:

Might be the words that together constitute a language; people that collaborate to carry out a common task; members of an organization, or the components of a network…[and] they must be able to interact in accordance with a common set of rules, recipes, algorithms, or grammars" (2007, p. 1).

As it pertains to the field of international development, it is this understanding of interoperability and flexibility that allows communication to occur between independent local agents and an NGO or a global development organization, which come together to work towards a common goal. For the purpose of this paper, the focus is on how interoperability affords independent individuals in developing nations access to open networks of communication from which to build bonding capital and reciprocity.

If a network is considered open or interoperable, it will be accessible at the local level (Garcia, 2010). While this paper's focus is not on measuring the level of openness or interoperability of today's development strategies, we must still conceptualize what it is that defines something as being open or interoperable. Garcia, Kale and Danish pose a helpful framework by utilizing the "Roadmap for Open ICT Ecosystems" to define open standards. However, this roadmap also provides a useful perspective from which to explore what qualifies something as open or interoperable. They suggest that to be open or interoperable,

access is:

- *not and cannot be* controlled by any single person or entity with any vested interests;
- *evolving and managed* in a transparent process open to all interested parties;
- *platform independent*, vendor neutral, and usable for multiple implementations;
- *openly published* (including availability of specifications and supporting material);
- *available royalty free or at minimal cost*, with other restrictions (such as field of use and defensive suspension) offered on reasonable and non-discriminatory terms; and
- *approved through due process* by rough consensus among participants (Garcia, Kale, and Danish, 2007).

This framework is included to help provide a backdrop for what is meant by open and interoperable as it pertains to development strategies. It is important to keep in mind that, though some of these points may not always apply to every strategy employed by development organizations when connecting to local individuals, openness and accessibility in general are essential to initiating and cultivating development locally and globally.

In the field of international development, these interoperable networks are necessary for individuals of a developing nation to gain access to information and assistance from available resources at all times. Nations or communities which suffer from what Collier defined as “development traps” need to be able to access a means to communicate with the global arena if they wish to pull themselves out of these traps of economic limitation (2007). Therefore, it is not enough to just have interoperable networks with which to communicate; developing nations must also have a means and an interface in which to gain access to these open networks and resources.

In this sense, interoperable technologies today play an important role in providing access to these network ties. These open and flexible technologies allow local individuals to access and communicate with global resources and become more aware of

opportunities available to them in the global economy. Additionally, the ability to be flexible means that the technology can be altered to meet the needs of development practitioners in order to accomplish their goals and to more thoroughly connect the local with the global. In order to provide this access, development organizations must use processes of diffusion to both distribute and persuade local individuals to utilize both interoperable networks and technologies, so that they may garner aid and support from the global community. Openness and interoperability can only be beneficial to international development if they are accessible to those who need it most. Today's interoperable technology makes access to these networks possible.

Diffusion of Interoperable Technologies in Development

Interoperable technologies present a means to connect and communicate with open networks. However, an individual must first have access to these forms of technology before they can be beneficial and developmental. In the past, powerful agents have at times infringed upon a developing nation's ability to access this open technology. When this access is denied, it prevents countries in need of development infrastructure and resources from being able to connect to the outside world and to the opportunities provided by interoperable networks and global social capital. Developing nations must be allowed the opportunity and the accessibility to these technologies if they wish to participate in the current globalized economy.

Between 2001 and 2003 China exemplified the practice of limiting access to these potentially interoperable systems when the nation's government attempted to adopt a new wireless protocol as a regulatory standard for all Chinese citizens. According to D. Linda Garcia and Kelsey Burns, this protocol, referred to as WAPI (WLAN Authentication and Privacy Infrastructure),

Was based on an encryption technology that 'differ[ed] significantly

from the internationally recognized standard that U.S. companies ha[d] adopted for global production.' By deploying the standard, China hoped to control royalty fees, as well as assure itself that no loopholes existed that might allow foreign entities access to sensitive information via wireless technologies (2010, p. 261).

In addition, this new protocol would have limited local Chinese citizens' ability to access information and resources from the outside world. From a political point of view, it appeared that the Chinese were creating these standards in conjunction with their security practices, which have been and continue to be notorious for censoring public information. By interoperable standards, this protocol was far from transparent or independent of a particular agenda or governmental goals. In the end, China's WAPI standards were voted against and were not established as the countries new wireless protocol, but this situation demonstrates how lack of transparency and lack of interoperability is in direct contrast to global standards of open networks and technologies (Garcia and Burns, 2010). Similar standards and practices stand in the way of development goals to build social capital and create reciprocity.

While representing a threat to some, the nearly-universal access to interoperable technologies provides opportunity to many. Information and communication technologies (ICTs), such as Internet-accessible computers and mobile phones, are quickly becoming diffusive technologies in even the most remote parts of the globe (Rogers, 2003). As both Internet access and mobile phones become more affordable and therefore widely used, local individuals are able to access interoperable development networks found both online and through mobile platforms. So, how exactly are these technologies being utilized?

The truth of the matter is that, for most individuals, mobile phones are more affordable and accessible than a computer (Trucano, 2009). Currently, there are 4 billion people in the world with a mobile subscription, and roughly half of the world's population is projected to have access to the Internet via their mobiles by the

end of this year (Vendel, 2010). The primary access point to the Internet for most of the world's population in the future will be via cell phone.

Many may wonder how many of these numbers represent individuals living in developing countries, and those numbers too are staggering. China and India currently have two of the largest and fastest growing cell phone markets to date. According to Wikinvest,

Markets in developing countries have continued to grow at double digit rates – some as high as 100% per year – and have penetration rates ranging from low double digits to 50%. Given these dynamics, several major carriers have decided to move into developing countries in a major way (2010).

Mobile phones present a point of entry for both local and global networks to connect using these interoperable technologies. The questions are: Why and how did citizens of developing nations begin to use these technologies, and will that use continue?

Utilizing Everett Rogers' theory of diffusion, we can examine how mobile phones came to be so widely used and adopted in the third world. Interoperable technologies are considered to facilitate communication on common ground between independent parties (Garcia, Kale, and Danish, 2007). Similarly, diffusion theory is considered by Rogers to be a process of communication and implementation. He describes this innovation-decision process as:

The process through which an individual (or other decision-making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision (2003, p. 168).

As mobile phones began to be used by early adopters in these developing societies, the benefits and ease of communication

became noticeable by neighboring citizens. Additionally, many of these communities had not previously had access to these communication technologies, as it was too expensive for land line companies to run phone lines through these remote regions. However, it is much less expensive to put up cell phone towers, which can provide access to many more local communities, and are not relegated to a single physical line (Green and Haddon, 2009). Cellular technology is to some degree an interoperable diffusive technology in its own right, and one that has opened up the playing field for countless individuals living in developing countries.

The wide reach of these interoperable and open technologies provides international development organizations with a means through which to connect networks and find out what citizens on the ground need. Those in the development business refer to this particular technology field as information and communication technology for development (ICT4D). Since most mobile phones in developing countries are still not Internet accessible, development goals have had to explore other avenues of connecting to the local populations. Short message service (SMS), also known as text messaging, therefore became the next best thing to communicating with these individuals through the Internet. According to Rogers,

From a user's perspective, a cellular telephone operates exactly the same way as a regular phone, and so it was unnecessary to learn any new skills. When short message service (SMS) became popular as a means of transmitting text messages, first among young people in Japan in the late 1990s, the needed skills were quickly learned. Today, about 1 billion SMS messages are sent every day! Telephone manufacturers were initially surprised by SMS, which represents a kind of re-invention by users (2003, p. 263).

This re-invention represents a form of interoperable technology that was made important and relevant by the user rather than the producer. For many people around the world it may be quicker

and cheaper to send a text message than to call someone, and these text messages can also be widely produced and sent to more than one individual, unlike a phone call. It is precisely because of this that development strategists have begun to use SMS as an ICT4D to communicate with large numbers of individuals on the ground in developing countries that may need immediate access to information or assistance. In this sense, mobile phones provide a link to networks of both resources and aid. Simply put, a mobile phone can connect an individual to a community of people that they would not necessarily have had access to before. Mobile phones build upon this concept of global social capital, which is now much more accessible and interoperable because of the SMS technology.

International Interoperable Development Strategies: FrontlineSMS

International development organizations are utilizing these interoperable technologies to their advantage and as a platform from which they can connect with those they are trying to help. FrontlineSMS is an example of an interoperable free-open source software, created in 2005, that specifically works with international development organizations to create a functional and affordable software through which NGOs can communicate with local markets. According to FrontlineSMS's website, the software "turns a laptop – or desktop – computer and a mobile phone or modem into a two-way group messaging hub" (2010). This interoperable technology works anywhere there is a mobile signal, and it is incredibly accessible to rural individuals because it does not need the Internet to function. Once an individual or an NGO has downloaded the software onto their computer, they can send and receive messages to and from as many people as desired, all via text message. For individuals on the ground in these developing regions, technologies like FrontlineSMS can help them communicate with both local and global networks and build their social capital via mobile connections (FrontlineSMS, 2010).

FrontlineSMS developer Ken Banks, of the UK, reasoned that he

created this software because:

The default position for many people working in ICT4D is to build centralized solutions to local problems – things that 'integrate' and 'scale'. With little local ownership and engagement, many of these top-down approaches fail to appreciate the culture of technology and its users. … My belief is that users don't want access to tools – they want to be given the tools. There's a subtle but significant difference. They want to have their own system, something which works with them to solve their problem (2009).

In this quotation, Banks captures the many positive components of an interoperable framework. A key component to this software is that, while it is owned and operated technically by FrontlineSMS, its open-source nature allows it to be flexible and amended by any of its users who are familiar with HTML coding. Essentially, this product can be streamlined to meet the needs and specific functionality purposes of the many NGOs using it worldwide. Advertised as "the complete text messaging solution for the non-profit sector," this software helps development organizations to:

- create and manage all of your SMS-related contact groups
- send and receive messages via special on-screen consoles
- provide incoming and outgoing message history for each contact
- engage with your contact groups – run surveys, competitions etc. via the SurveyManager
- run your own text-based information service via the automated ReplyManager
- export data to Excel and other programs
- [have] no need to be on-line – works on any GSM network via your own PC or laptop (FrontlineSMS 2010).

The technical elements of this software are important to keep in mind, as they foster the type of communication that can be conducted via this platform. However, what is also essential to this analysis is examining the social capital and types of communication that this software facilitates. Clearly, these tools are used to communicate between NGOs and local individuals of developing regions, but the focus of this research is to see how

these communication tools and this specific interoperable technology is being utilized to achieve development goals and connect the local with the global.

In order to do this, we will examine two particular FrontlineSMS case studies in which this interoperable technology has been used to assist an NGO to communicate with those in need of aid or assistance in a developing country. The first case study will explore The International Organization of Migration's use of the FrontlineSMS software to send health-related text messages to the people of Northern Pakistan who, in July and August of 2010, were displaced from their homes by devastating floods. This case will help focus on how access to these interoperable technologies may save lives and foster communication between local and global networks. The second case study explores FrontlineSMS's ability to aid the Karnataka Health Promotion Trust and a team of students from the University of Southern California in building and communicating with a network of people currently living with HIV/AIDS in India. This paper seeks to add light to how this interoperable technology fostered connections and helped an NGO unite a group of individuals under a common goal. The questions we are specifically seeking to address in this section are: how are these interoperable technologies being used in the development arena and how are they impacting development strategies?

Texting for Life in Pakistan

Between July and August of 2010, 14 million Pakistani citizens were affected by devastating floods that hit the Khyber Pakhtunkhwa, Punjab, and Sindh provinces (BBC, 2010). The International Organization of Migration (IOM) is one NGO that has been working to support the five hundred thousand individuals displaced by the disaster to return to their homes. This organization has been using FrontlineSMS for some months now to send mass-messages of basic hygiene and sanitation advice to Pakistanis that have been affected by the floods. Utilizing this open-source interoperable software has allowed IOM to both save

on transaction costs and reach a larger number of displaced Pakistanis.

IOM's Mass Communication Team focuses on distributing large amounts of information to local Pakistanis as a means for them to become more educated and informed on how they can better their current situations. This team realizes that

In emergencies around the world, access to information has been identified as a key gap in humanitarian response. For the first time in Pakistan, a concerted and consolidated effort is being made to ensure such a gap is covered. In support of the government and humanitarian clusters, the Mass Communication Project is a rapid, comprehensive and multi-medium information service for the conflict-affected population of NWFP and FATA in Pakistan (Pakistan, 2010).

In addition to this information-focused approach, IOM also appreciates and understands the importance of human and social capital, which they refer to as "human networks of information," in current-day development strategies. Therefore, in addition to spreading messages of information, IOM also works to reach out to key community members to act as liaisons between the NGO and the local Pakistan citizens. They employ multiple means of communication and information dissemination, stating, "These information networks will receive printed material, Pashto SMS and direct information from the Mass Communications Team for further propagation" (Pakistan, 2010). IOM's dissemination of information employs both Narayan's understanding of social capital, described as a valuable means to build reciprocity and spread information in a local community, as well as the benefits of interoperable technologies like SMS to spread information in an accessible manner (1999).

Being able to access the information that NGOs like IOM are distributing is important to the many Pakistani individuals who are in need of basic information that could save their lives. These helpful text messages remind the local individuals to be careful

and health conscious during this time, while also linking people on the ground with a larger network of activists who are aiding the flood victims. According to an operational update posted by IOM's Mass Communication Team on the FrontlineSMS website,

IOM are leading the communication response on behalf of the UN 'Cluster System' of humanitarian responders, and have developed over 50 Public Service Announcements (PSAs) in Pashto, Sindhi and Punjabi on topics including prevention of diarrhea and malaria, water purification methods, mother and child health during the fasting month of Ramadan, child protection issues, treating snake bites, setting up durable shelters and fire safety in camps (Ahmed and Leigh, 2010).

Access to education and information is essential for individuals of developing nations, and it is this access and information that IOM is trying to provide to the Pakistani people in hopes that it will help local community members foster their own sense of development during critical times. FrontlineSMS is able to work with IOM to meet the development strategies of uniting the local with the global and, in this case, potentially saving countless lives using this interoperable technology.

The FrontlineSMS software's interoperability and use of SMS text messages allows this flow of information and communication. As of July 2009, there were currently 95,547,285 cell phone subscribers in Pakistan, the majority of which use their phones to speak exclusively with family members in Urdu (Mobile Cellular Services, 2009). However FrontlineSMS makes it possible for IOM to translate their text messages into Urdu using their software so that no message is literally lost in translation. The openness of FrontlineSMS allows IOM to tailor the software to their needs, in this case utilizing Urdu translation capabilities, and the interoperability and accessibility of mobile phones makes it possible for organizations like IOM to connect with these individuals.

In this sense, this NGO, which has access to global information, is

able to reach out and affect the lives of displaced local individuals who may have very little access to the outside world, particularly in a time of natural disaster. IOM, in this case, is able to employ these interoperable technologies to their advantage and meet their development goals. Without access to interoperable technology, which both cell phones and FrontlineSMS provide, IOM may not have been able to reach the people of Pakistan most in need.

Additionally, using FrontlineSMS has brought down transaction costs for IOM, which allows them to expand their resources and tap into other technological networks. They suggest this, saying,

Using FrontlineSMS has saved IOM over $15,000 compared to the costs they would have paid to develop an organized, mass texting system using a commercial supplier. Supported by Zong, the Pakistani subsidiary of China Mobile, IOM is sending free, bulk, informational messages to affectees and humanitarian workers across Pakistan to enhance informational outreach (Ahmed and Leigh, 2010).

Not only has this interoperable technology aided them in diffusing important information throughout Pakistan, it has also benefited them in reducing the amount of money they are spending on this form of technology so that, in turn, they can use their additional funds on alternative means of development work. Additionally, IOM has also been able to reach out and connect with other companies like telecom operator China Mobile – Zong in Pakistan to further their mission and agenda, which builds upon the NGO's global social capital. In this sense, this network of individuals is able to utilize both their strong and weak bonding ties to work together under this interoperable system and communicate under a common cause of aiding the developing nation of Pakistan.

Jaalaka: Connecting the HIV/AIDS Community Through Technology

The Karnataka Health Promotion Trust (KHPT) is a government

organization that funds and administers public health programs in Hubli-Dharwad, a peri-urban district in Karnataka, India. This year, the Hubli-Dharwad district experienced a significant rise in the number of individuals infected with HIV/AIDS. This rise in infection is largely due to a significant lack of knowledge about sexually transmitted infection (STI) prevention and treatment among the local rural female sex-worker population. A lack of access to necessary knowledge prevents these women from protecting themselves and others from transmitting the disease, which ultimately creates a serious problem within the area. The KHPT has been working hard to spearhead several programs designed to collect information on the HIV/AIDS epidemic and educate these local sex-workers in hopes of combating the spread of this disease and other STIs in the district (Jaalaka, 2010).

In order to do this and meet their development goals, KHPT has begun to employ interoperable techniques to build “Jaalaka”, which means “network” in Sanskrit, among the local HIV/AIDS Habli-Dharwad public. They initially did this by

Forming a partnership with the Bhoruka Charitable Trust (BCT), a local NGO aimed at promoting health and livelihoods among female sex workers. Since the Hubli-Dharwad region includes over 372 rural villages, BCT employs both professional Outreach Workers as well as volunteer Peer Educators (whom [sic] are also female sex workers) to travel to distant villages to educate female sex workers about the risk of HIV/AIDS and to promote safer sex practices (Jaalaka, 2010).

By including fellow female sex-workers in the volunteer network, KHPT and BCT built upon the communities’ social capital and relationships among the sex-worker population. However, up to this point, the dissemination of information was based on word of mouth and peer-to-peer education, which, while beneficial, did not reach a large enough number of at-risk individuals. They needed to expand to interoperable technologies if they wished to reach more individuals and gain more access to the local community.

A group of students from the University of Southern California (USC) decided to help KHBT and BCT with their work by launching a pilot program using FrontlineSMS software in the summer of 2009. With financial and logistical support from the Deshpande Foundation, an organization that invests in similar projects as a means of "promoting entrepreneurship and innovation as catalysts for change," these students were able to utilize FrontlineSMS's platform to improve BCT's data collection and service delivery ("Our Story", 2010). This network of global individuals was able to come together in order to aid this local community and establish an interoperable line of communication. BCT currently uses two elements of the FrontlineSMS Form system to collect information in the field. This form version of FrontlineSMS allows the field development practitioners to collect information just like they would on a piece of a paper or on a computer, but with this technology they can use a mobile phone with SMS as the platform (FrontlineSMS, 2010). FrontlineForms advertises that the system

Allows you to create copies of very simple paper forms on your computer, which can then be sent to a Java-enabled mobile phone through a text message. This phone can then be handed to staff or partners who can then take it to the field and enter the information they are required to collect directly onto the phone (by following a trimmed-down version of the on-screen form you have created for them). Once the data input is complete, the information collected can be sent back to FrontlineSMS as a compressed text message, giving you up-to-date and real-time information (FrontlineSMS, 2010).

Using this technology, Peer Educators are able to collect information in the field once they make contact with these rural female sex-workers, and send it as a text message back to the BCT headquarters. This FrontlineSMS technology expedites the process of collecting the information in the field and gathering the information back at the NGO headquarters (FrontlineSMS, 2010). This expedition allows development practitioners to make contact with a larger number of individuals and collect more information,

which will hopefully result in educating and informing more rural women on preventative HIV/AIDS and STI measures.

FrontlineSMS presents a platform for both local and global individuals to connect and build a network of information from which to combat the growing HIV/AIDS epidemic in this district in India. This technology presents the development practitioners with an accessible tool with which they can collect information while still personally connecting with local individuals in the field. The USC students have voiced their desire to continue to work on this project in the future and further build upon the social capital that has been cultivated and created through this program. They are very focused on the interoperable technology that is utilized to create and build these relationships, and they hope to streamline the FrontlineSMS system further in the future to meet their data collection needs. On the USC project blog, the students lay out this future technological framework, stating,

We hope that a specific NGO can refer a patient to register for a support group via SMS, and the support group will receive a message regarding the referral. If the patient attends the support group, the support group can then send a SMS message back to the referring NGO to confirm the registration of the patient. All of these messages would go through the central database and a history of the patient will begin to accumulate ("Creating a Network", 2010).

This fine-tuned system would allow all parties involved to network with one another, and to have a means to communicate between the different parties of this development project. It also provides the patient, or the individuals of this developing region, an opportunity to be a part of this information and network-based transaction, which is imperative to the process. Those involved in this project realize that if they want to affect lasting change, they must personally interact and communicate with the rural female sex-workers who need this information the most. By engaging with this community through their peers, they are building upon these pre-existing networks and connecting them with organizations that

can help them on a more global and lasting level. One of the volunteer USC students stated on their project blog, “We still have much to do, but we definitely think that we can accomplish a great deal by remaining flexible and adapting to the needs of our NGOs” (“Creating a Network”, 2010). This network of individuals, and the work they have been able to accomplish in this case study, represents an example of how a community can be formed when interoperable and flexible technologies are accessible and utilized in the international development arena. It is this flexibility and interoperability that allows for lasting and progressive development strategies.

International Development Implications: Interoperable Conclusions

As we have seen from the two case studies presented above, NGOs, government organizations, students, and even development funders have already begun to utilize interoperable and flexible technologies for development purposes. Technologies like the FrontlineSMS software serve as communication platforms that keep both interoperability and development needs in mind. They were developed to encourage flexibility, accessibility, and to give development practitioners the tools to alter and amend the software to their various needs. In Pakistan, for example, the global NGO IOM is using the FrontlineSMS software to send mass text messages of health and sanitation information to countless displaced refugees, who need this information to remain safe and healthy during this critical time. The ability of these NGOs to access this technology and reach out to local Pakistani citizens by simply texting their mobile phones is a huge step for development and one that allows for an open line of communication with those who may need it most. Without this form of access, organizations like IOM would have no way of communicating with some of the Pakistani refugees. Interoperable technologies make these relationships possible.

In the case of the HIV/AIDS epidemic in the Hubli-Dharwad district of India, these flexible and open technologies are being utilized to

connect a network of development groups to the local sex-workers infected by or at-risk of the disease. The easily accessible FrontlineForms allows field workers to quickly collect important information on their mobile phones and export it to their headquarters to be gathered and documented for further development purposes. Interoperable technologies have helped development practitioners collect more information faster. This has provided them with a larger database of individuals to invite to support groups, educate about the disease, and ultimately protect in the future. In this example, it is incredibly promising to see how the USC students plan to further expand the flexibility of the FrontlineSMS software to meet their development needs in the future. Their ability to cultivate both a community and a network of individuals utilizing this software and its interoperable elements is truly what these technologies were created to do in the development field.

Drawing upon the theories of social capital, diffusion and interoperability, as well as these recent development examples, it becomes clear that openness and flexibility are necessary components to technologies promoting successful international development. These interoperable technologies help generate local and social capital. As well, they allow for the diffusion of information and communication in the international development arena. Access to these technologies, which harness the network capability of a common mobile phone, can provide the needed link and physical line of communication to countries that are isolated, or as Collier would say, “trapped” outside of the global network (Collier, 2007). The ability to edit the open-source software’s code in order to cater to the various development practitioners’ needs, both in the field and back at home, enhances international development opportunities. In this sense, interoperable technologies provide a flexible link between the local and global, and utilize the technologies that are already available to a majority of the world’s population. These technologies do not reinvent the wheel; rather, they utilize the technologies that are available and make them accessible and flexible for everyone around the world to use.

Interoperable technologies can effectively be utilized for a plethora of purposes in development today, as demonstrated by the above case studies. They can be used to network a group of development practitioners or to distribute mass amounts of information and assistance to a local community. They can be used to collect information in the field or to simply communicate between individuals. Regardless of the manner in which they are utilized, they can open up a path of communication between the local and global, ultimately building social capital on the local level and cultivating a more global sense of capital and reciprocity through working together and expanding these development networks. Interoperable technologies are being employed for more than just communication in development. They are being used to bring together networks of development individuals who have united under a common cause to help these developing nations connect with the global community. These open and flexible technologies can continue to provide the link developing nations need in order to gain access to the global economy and, one day, rise from the bottom billion.

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