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## **ICTs, Infrastructure and Entrepreneurship**

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abstract: This is a paper about one information and communication technology solution and its objective for sustainable development to reach rural, remote, and isolated communities across the African continent. With the knowledge that nothing happens in a vacuum Intersat Africa and Voices of Africa for Sustainable Development are rising to the challenge to meet the information and communications needs of rural communities, using a multi-sectoral social business approach to achieve universal, affordable and equitable access through the implementation of the Rural Internet Kiosk. The Rural Internet Kiosk (RIK) is an independent, self-contained, 100% solar powered kiosk featuring three industrial design computer terminals, an administrator terminal, and broadband wireless Internet connectivity. RIK has been designed to help bridge the digital divide in Africa by operating independent from any established infrastructure. The kiosks are designed for deployment in any location in rural Africa, from the farming village to the desert. By using solar panels and satellite internet access through Astra2Connect, we are able to reach those people waiting on the other side of the digital divide.

*keywords:* Internet, solar, Information Technology for Development, Infrastructure, Social enterprise

We live in a globalized world where everyone is interconnected. The food supply for the United States is connected to production in Africa while food production in Africa is linked to international market prices often set by traders in the developed world. The pollution unleashed by developed nations has caused climate change worldwide and the massive population boom in many developing countries has further exasperated the issue while also contributing to the burden of rural to urban and international migration. International trade and economic policy relations have come under the model of unfettered free market capitalism which has distributed the benefits and gains of globalization very differently around the world. We have seen the faltering of development ideologies, such as the Washington Consensus fail during implementation; and the global financial market crisis has served to provide further insight into the failures of the current market system. The Washington Consensus ideology is based on the

theory of the market economy that presumes perfect information, perfect competition, and perfect risk markets. It is an idealization of a reality which rarely happens in developing countries, or in developed ones for that matter.<sup>i</sup> An economic system based on the assumption of perfect information cannot work within a market where a vast majority of the participants lack central and timely information, work with inadequate communications technology and infrastructure, and face considerable risk when taking raw goods to market.<sup>ii</sup>

Those in developed countries with access to capital and information have been able to find comparative advantages in extracting raw goods from developing markets and selling them as finished goods with considerable mark-up to developed markets. This, however, leaves the producers in developing markets at a disadvantage. Lacking information on real market prices, being located in rural and remote locations and lacking widespread established cooperatives of farmers who share information on market conditions and buyer offerings, producers face perpetual poverty and asymmetrical information; which are understood to be a market failure.<sup>iii</sup> Large corporations, national trading boarders and international corporations add considerable value to their product by sending traders to individual farms in the interior and buying up raw goods, often below market prices, only to reap vast profits from the production of final goods marketed to consumers in the developed world.

In this sense globalized markets have completely failed to produce efficient outcomes resulting in massive wealth and income inequalities throughout the world with the top 20% of the world's population owning more than 75% of the world's capital.<sup>iv</sup> Simply put, the currently enforced economic system makes some people rich while it leaving others to die in poverty. The only way to correct this imbalance of power is to invest in education, which leads to skills development, information and communications technologies utilization, and capital formation at the grassroots level. According to Joseph Stiglitz, past president of the World Bank and globalization researcher, "What separates developed from less developed countries is not a gap in resources but a gap in knowledge, which is why investments in education and technology are so important."<sup>v</sup>

Information and communications technologies have the power to change the way we practice development throughout the world and how knowledge is diffused to people internationally. In rural Sub Saharan Africa lack of access to these educational and ICT development solutions places already isolated and marginalized populations at a further disadvantage at a time when information technologies are revolutionizing the way the majority of the world relates and operates. Though African countries are highly contextualized and no one truth holds unanimously there are general trends that provide some stark realities. The lack of opportunity to access and utilize existing information, popularly referred to as the digital divide, continues to cripple progress towards sustainable development across the continent. This is most easily seen in the rural agricultural sectors where up to 60% of all Sub Saharan Africans are employed.<sup>vi</sup>

This is a paper about one information and communication technology solution and its objective for sustainable development to reach rural, remote, and isolated communities across the African continent. With the knowledge that nothing happens in a vacuum Intersat Africa and Voices of Africa for Sustainable Development are rising to the challenge to meet the information

and communications needs of rural communities, using a multi-sectoral social business approach to achieve universal, affordable and equitable access through the implementation of the Rural Internet Kiosk. The Rural Internet Kiosk (RIK) is an independent, self-contained, 100% solar powered kiosk featuring three industrial design computer terminals, an administrator terminal, and broadband wireless Internet connectivity. RIK has been designed to help bridge the digital divide in Africa by operating independent from any established infrastructure. The kiosks are designed for deployment in any location in rural Africa, from the farming village to the desert. By using solar panels and satellite internet access through Astra2Connect, we are able to reach those people waiting on the other side of the digital divide.

The Internet is one of the single most powerful tools humanity has developed that is capable of realizing rapid development and broad informational access, provision and content generation. If implemented with long term sustainability in mind, it can be a catalyst for vast economic, political, and social growth. There are numerous examples of how a small amount of information can change the lives of rural people who were previously isolated. One of the most pressing challenges in Sub Saharan Africa is the assurance of food security and crop yields. Twenty minutes on the Internet can provide a rural farm with information on how to retrofit a coke bottle into a drip irrigation system effectively harvesting and storing water.<sup>vii</sup> As rainfall and water scarcity issues arise, Africa's farmers need solutions to the challenges in the village if they are going to be able to feed the cities. Simple life changing adaptations can be learned in minutes if individuals, particularly in rural areas, have an understanding of the capabilities of the Internet and the knowledge of how to access it informational resources.

In rural areas, the need for information cannot be overestimated as it is a major contributing factor to the high levels of unemployment among the youth and the lack of progress. In the remote countryside, there are few schools with adequate resources and almost no community libraries. The few libraries that do exist often have outdated materials and, particularly with regard to farmers, it is important for them to have new and up to date information on crops prices and weather reports. The lifesaving knowledge that can be disseminated through ICTs has until now been largely beyond the people's grasp. Access to the Internet can answer questions and provide solutions within minutes. As one rural woman in the Western province of Kenya exclaimed, "It is like being brought from the darkness into the light."

Material poverty, poor health, low levels of sanitation, low levels of education, lack of access to government services, and lack of access to finance are a few core issues found in rural communities. These issues can all be addressed through information and communications. Information poverty is a widespread social problem throughout developing countries that is a major contributing factor to the lack of development progress and cyclical poverty.<sup>viii</sup> The Rural Internet Kiosks can provide the following development solutions to communities: E-agriculture, E-commerce, E-health, E-government, E-banking, E-learning, Relief services, Local content creation, Skills training, Employment opportunities, Independent local media, and Knowledge diffusion from the North to the South and from the South to the North. With access to ICTs and the Internet the people can determine for themselves what type of development they want to pursue in their communities.

One of the main problems in the information and communications for development

(ICT4D) community is that there are a number of pilot implementations that have been done throughout Sub Saharan Africa, but few have been brought to scale and properly assessed for impact, efficacy or efficiency.<sup>ix</sup> The impact of the technology is of much greater importance than the diffusion of the technology itself. Much focus has been placed on the use of mobile phone technology as a development solution, which it unquestionably is, however there is little attention paid to how full Internet access or the mutually supportive application of these technologies together can assist a more sustainable development model. Rather than bringing the full range of knowledge opportunities to the doorsteps of the people, mobile phone development applications reshape and readapt the technology to the income level of the consumer.

The two greatest needs in Sub Saharan Africa are not food and water but knowledge and capital. Without these basic elements, the African people cannot actively participate in the economic system that controls their lives. Rather than ignoring the actual causes of the suffering and poverty, ICTs should be utilized to build the information and capital base of the people through program design and widespread implementation. Using a participatory-based approach with an emphasis on social enterprise the Rural Internet Kiosk can help the people to overcome the challenges that have plagued Africa for generations. It is the next step in the journey to equity and empowerment.

Diffusion of the RIK in rural areas gives people the tools they need to develop their own businesses and make their own choices about development. Amaryta Sen defines development as "a process of expanding real freedoms that people enjoy."<sup>x</sup> He defines 5 freedoms: 1) political freedoms, 2) economic facilities, 3) social opportunities, 4) transparency guarantees, and 5) protective security. The implementation of the RIK empowers the people to exercise and build upon these freedoms.

The consensus on and conviction of African professionals regarding the diverse potential of utilizing ICTs as tools for sustainable development, particularly for rural and local access, is widespread. ICTs are increasing access to healthcare and education; they are empowering citizens to engage with governments and institutions and as a byproduct decreasing vulnerabilities.

In 2008 the Economist magazine noted that due to a lack of connectivity, the developing world missed out on much of the excitement of the initial web revolution, the dotcom boom and the possibilities of Web 2.0, which has been attributed largely to a lack of internet infrastructure. Today there is no reason why Africa should struggle to follow the same path to development as the industrialized world, indeed SSA has the opportunity to blaze a new trail and leapfrog many hundreds years of technological development. Capitalizing on lessons learned from industrialized nations while utilizing new green technologies, such as solar energy, Africa has the capacity and capability to realize a unique development strategy.

Grid based rural electrification in most African Countries is around 2-8%, which leaves upward of 90% of rural Africans in the dark.<sup>xi</sup> Without electricity the challenges to full deployment and use of computers and information technologies are considerable. Rather than stumbling over this hurdle and forgetting those in need, VOA4SD and Intersat Africa began testing the capabilities of solar energy to run various computing solutions. VOA4SD has done solar testing with mobile phones, PDA, smart phones, Inveneo low power computers, new and refurbished computers, both laptops and desktops. Through our research we have found that by utilizing ultra low powered multi-computing using software based programs such as Userful the provision of a multi-workstation environment at an extremely low rate of power consumption is indeed possible.

For example, the typical desktop computer requires 210 Watts of electricity to operate, the opportunity costs of which are too high in the majority of rural locations without access to stable electricity. Solar installation with such high consumption technology is not cost effective as a typical installation costs \$5.00 per Watt. During the creation of the Rural Internet Kiosk, IAL began testing a number of different low power solutions and have chosen to utilize the Aleutia computer produced in Europe, a new computing product that can operate on less than 30 Watts of electricity. The decrease in power consumption resulted in an increase of hardware costs; keeping new technologies out of reach for the majority of rural users on an individual level. The Rural Internet Kiosk provides a community level computing solution with individual income generating opportunities to grow the base of knowledge and infrastructure available for everyone. With increasing incomes, the people who have access to technologies such as solar, computing, and the Internet will see the opportunities available through technological diffusion. Thus they will become consumers of technology that benefits their lives and spread infrastructure at an individual level benefiting the whole.

The lack of infrastructure within rural areas is what has left their human development so far behind. Beyond the challenge of a lack of electrical infrastructure posed by a lack of grid power we also faced the challenge of where to locate the computers due to the lack of permanent structures and instability. The majority of buildings in Africa are raised using mixtures of natural materials; straw, mud and cow dung. Permanent structures are typically constructed of concrete which is challenging to maintain and not environmentally conscious. In the absence of permanent buildings and limited sustainable building materials, we realized that we would have to build a structure that was easily transportable, structurally sound and able to withstand challenging environments. The kiosk structure has both permanence and sustainability and can be easily disassembled in case of conflict situations and political instabilities which are commonplace throughout the continent as evidenced by the 2008 Kenyan post-election violence.

The infrastructure and employment potential provided by the Rural Internet Kiosk will be a deterrent to future violence. Burgeoning youth populations and lack of employment and educational opportunities further complicate conflict and political instabilities in many African nations. Particularly under conditions of economic stagnation large youth population bulges have a direct link with domestic armed conflict.<sup>xii</sup> Every unemployed, hungry youth becomes a possible conspirator to violence and instability. A young and able-bodied individual who is denied any opportunities for advancement, moves into hopelessness and becomes a victim of the system. When these youth are offered a week's wages to commit violence and convinced they are striking out at those "blockading their progress" the connection and vulnerabilities in many African nations becomes clear. Yet if these same youth are given employment, access to education, and business capital, they can be the development leaders in their communities. Indeed, a wealth of empirical research and qualitative literature from around the world regarding the positive correlates between development and education has proved that educational access is

central to broad national and economic development.xiii

The implementation model being used for the RIKs implementations in East Africa is one that encourages youth to work together within their communities to ensure mutual beneficial results are achieved. The Concentric Circles of Impact, shown below in Figure 1, illustrates how the RIK impacts at its center the youth who become the kiosk operators and are co-owners with the community. The youth operators are all members of a local youth group. The youth operators are paid a base salary and the remaining profits are invested into additional social business enterprises. The youth group owns the kiosk as a business venture in partnership with a local community based organization. The co-ownership model allows for the community based organizations to make investments into agricultural projects that reduce costs and add value to their products that generate an income for the wider community. The youth group will utilize the remaining portion of the profits in partnership with community based organization to meet the needs of the most vulnerable members of the community; who in most cases are HIV/AIDS patients, orphans, widows, and vulnerable children, most notably those in female headed households. By contributing to the economic activity of the area, the RIK brings with it more opportunities for the youth in employment and through its educational training program, encourages entrepreneurship. This affects the entire youth population as information has proved to spread quickly through this subset of the community. As the youth are more productive and active members of their community, they will be able to greatly influence and impact the socioeconomic status of their villages.

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Concentric Circles of Impact<sup>xiv</sup>

The RIK quickly becomes a hub of economic and educational activity and actively promotes knowledge development among the community members. Knowledge development can be defined as the process of changing attitudes and mindsets towards learning new things. As computers and the Internet, alongside proper training and information, reaches rural people an understanding develops on how these tools can be used beneficially, assisting the accumulation of knowledge on how to improve their socio-economic status. Changing attitudes towards technology is the first step in knowledge development and technological diffusion. As the mindsets of people change the desire to learn more about information technologies; this information once absorbed and utilized becomes knowledge and the cycle begins to perpetuate itself.<sup>xv</sup> But learning about information technologies is only a primary step. The real value in knowledge development is the utilization of the information for development.

In facilitating knowledge development, it is vital that development professionals keep in mind the challenge of linguistic differences. First, local and indigenous knowledge should be recorded and stored before it is deemed unimportant by the youth generation. Second, content development in local languages should be encouraged to benefit the entirety of the community. Although literacy rates are rising, large numbers of illiterate people need access to information now. The lack of content generated in local languages makes it difficult for people with little or no education to receive the benefits of technology. Local content creation is critical to knowledge diffusion. The Rural Internet Kiosks promote local knowledge capture and sharing through digital media. Each RIK comes equipped with a simple to use digital camcorder that also takes still pictures. These images and videos will be uploaded to the web at least weekly allowing people to generate their own content. Videos will also be created specifically by the local community for the local community in their native languages. This ensures that the languages are captured for posterity and that those with limited education and literacy are still able to benefit from the diffusion of knowledge.

One of the main challenges to the RIK project in Kenya is the lack of a Universal Connectivity Fund to ensure all members of the society are given equal opportunities to access ICTs. Uganda's Rural Connectivity Development Fund has been able to bring the Internet into rural community schools throughout the country. Yet even with the funding, there is still a lack of capacity building programs, local content development and concerns about financial sustainability. VOA4SD and Intersat Africa plan to launch into Uganda under this fund within the next year. The 2008 Global Information Society Watch Report highlights the need for revising universal access funds to support the roll-out of community wireless networks in rural areas as well as capacity building programs and local content development that enables citizens to utilize ICTs effectively in local languages.<sup>xvi</sup> The Rural Internet Kiosks meets these needs and provides a service to the community that is also profitable.

The other challenge in knowledge development is the lack of technical computer skills among the rural people. As the Rural Internet Kiosks rolls out, the kiosk operators will be trained at training centers by qualified international volunteers in Basic Computers Skills, Web 1.0, Web 2.0, Content Generation, and Social Enterprise. The kiosk operators will be supported to develop the capacity to teach their community to use the computer in a holistic manner that allows for easy use of new software with emphasis on Cloud computing. When the people have access to the Internet they will have access to online trainings in a wide range of subject areas that further increase their employment potential and broaden their horizons. The central theme in all RIK trainings lies with empowering people to seek knowledge and find solutions to their local development issues and to create sustainable employment solutions to address these challenges. ICTs can help create and sustain new opportunities for economic development. Accelerated knowledge transfer and technological diffusion amplify the competitive advantages of fastlearning economies. As the largest percentage of the population and the highest number of unemployed are the youth, the RIK focuses on training youth to be social business entrepreneurs who earn a living by solving the needs of their communities.

The youth of Africa are the key stakeholders in the future of the continent and comprise the majority (up to 80% in some countries) of the population.<sup>xvii</sup> Equitable development demands that there are new opportunities for these youth in the Information Society. Currently more than 20% of the US workforce is employed in the Knowledge Economy as a part of the Information Society. This field should be highly encouraged for young people as it reaches beyond local and national barriers and allows everyone to compete internationally. The youth of SSA have been recognized by most international organizations in ICTs as the engines of change. It is the youth who are critical in realizing the Information Society objectives in the World Summit on the Information Society (WSIS) Plan of Action outlined by the United Nations and the International Telecommunications Union (ITU). This plan of action seeks to promote the diffusion of Internet internationally and consistently recognizes the need for youth empowerment and involvement. Implementation of sustainable ICTs as per the Millennium Declaration, the Monterrey Consensus and the Johannesburg Declaration and Plan of Implementation will require training in hardware, software, the Internet, business skills, and computer science. There are young people across the continent willing and eager to take part in this Digital Age. What they lack is access to the opportunity. Opportunities such as education and capital for business development could lead Africa into a knowledge economy. If the roll out of Internet services is accompanied by low cost training and access, it will be able to easily educate the population. The central component missing in the ICT and development field today is the provision of accessible training in the rural areas where there is a high youth population, high unemployment and a lack of services.



Concentric Circles of Economic Development Impact

Figure 2.0

Empirical research done internationally shows that access to high speed Internet can be a tool for economic growth particularly for the development of human capital.<sup>xviii</sup> A number of

studies have shown that growth in broadband directly correlates to growth in Gross Domestic Product.<sup>xix</sup> A recent World Bank analysis of 120 countries showed that for every 10-percentage point increase in broadband service penetration there is a 1.3 percentage point increase in economic growth.<sup>xx</sup> In its ICT4D 2009 report the World Bank noted that broadband has considerable economic impact at all levels of the economy; household, firm and communities. Individuals increasingly use broadband to acquire knowledge and skills to increase their employment opportunities. Where broadband has been introduced in rural areas of developing countries, villagers and farmers have gained better access to crop market prices, training, and job opportunities.<sup>xxi</sup> Unfortunately none of these studies has actually accounted for the changes in terms of real standard of living for the poor. The research derived from the RIK project will highlight the changes in socioeconomic status at both the individual and community level.

When the Internet is introduced to rural areas it creates income generation potential and stems the rush of rural to urban migration. Providing opportunities for income generation on the ground has a much greater impact than provision of cybercafes and secretarial services trainings. Providing access in the rural locations at the community level provides easy access to those who would otherwise have to travel great distances for information. Farmers whose incomes increase with greater access to market information and training also have the opportunity to reduce fertilizer and pesticide expenditures through the application of sustainable pest control techniques such as mixing cow urine and peppers and spraying crops.<sup>xxii</sup> Innovations such as intercropping and composting are disseminated from farm to farm producing high crop yield at low costs. With increasing revenues, the children of the farmers are more likely to consider the occupation of their parents as rewarding and continue the trade. More than 70% of Kenyans are employed in the field of agriculture<sup>xxiii</sup> and timely, accurate information is vital for them to compete in local and global markets.

The RIK course for kiosk operators focuses on the RIK as a social business. This social business approach to income generation provides a way for the youth and the community to address the issues that face them in a way that builds local employment and is not dependent on outside donor funding. In the farming communities where the RIK is being implemented, the people are reinvesting their profits in bee keeping, dairy production, fish farming, tree planting, and other agricultural products. These projects benefit more community members over time and bring the farmers into co-operative agreements where they are working together to reach their goals. The growth of the farmer's co-operatives leads to their ability to borrow from co-operative organizations to continue to increase their production and adds value to their commodities.

Farmers are not the only ones in rural areas who stand to benefit from increased access to knowledge. Craft artisans benefit from access to wider markets through e-commerce. They are also able to further develop their craft skills through information found on the web and connections made with other craftspeople via Web 2.0 technologies. Terra Phoenix, a small collective of women's groups living on the slopes of Mount Meru in Tanzania has been able to redesign their products to attract international clients as a result of information gained on the web. As a result the group's sales have increased by 400% and their new e-commerce website is now in development.<sup>xxiv</sup> Today the greatest obstacle faced by the group is the cost of international shipping.

The growth of ICTs in rural areas and informal settlements has created a new local industry in music and media production. In areas with access to a single computer and a microphone, youth have created recording studios and radios stations. In the informal settlement of Likoni on the south coast of Mombasa, Kenya, there are three recording studios that produce demonstration CDs for local musicians and churches. Hatua Likoni, a youth led collaborative in Likoni, has actively been producing and recording music that targets youth and spreads information on HIV/AIDS, the negative impacts of teenage pregnancy on household income and development and additionally addresses gender and tribal stereotypes that inhibit community engagement and dialogue. The demand for these types of services are growing and fueling a Kenyan music and film industry. Without access to ICTs and training these groups have a limited market for their music and film. Through sharing on platforms such as Facebook and YouTube, they are able to join the international market. The music entertainment industry is one area where Kenyan youth are venturing.

African youth have a great interest in the entire field of media generation. This media generation is able to create a number of citizen journalists. There are a large number of youth training to be journalists and photographers, but currently a limited number of employment opportunities in the field. Both fields become more open and accessible through the use of ICTs and can lead to social and political change. With increased rural connectivity the list of opportunities for the economic empowerment of individuals is endless: teachers, social entrepreneurs, tourism, telecommuting. One of the groups participating in the RIK program, Voice of Diani is using their profits to create a program to provide nutritious porridge to children in their service area. They are producing this flour from ingredients grown within the country and selling it at an affordable cost to orphanages, schools, and the general public. Most of their buyers could not otherwise afford to purchase the prepared flour at a cost reasonable enough to be consumed consistently. The children who are regularly fed the nutritious porridge do not have issues with malnutrition and are less prone to disease and infection. This is a social enterprise business that was designed to meet a need in the community and to provide employment.

Intersat Africa and Voices of Africa for Sustainable Development are committed to bringing innovative ICT4D projects throughout Sub Saharan Africa and to creating an international knowledge sharing network for sustainable development. By building on the existing, albeit currently limited, knowledge base of experience and incorporating successful program applications in the RIK model, this program has immense potential. Active collaboration with existing NGOs and community based organization in addition to community development workers who have been operating in these communities this program will prove useful in further expanding the reach and impact information and communication technology for development Along with other strategic partners we will empower development innovators to create tangible, on the ground evidence of the social, political, and economic change possible through ICT4D and Internet access. We can eradicate poverty in our lifetime and level the playing field for future generations.

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