Connected Agriculture
Developing Smart, Connected Rural Communities

Author
Bharat Popat

Contributors
James Macauley
Gustavo Menendez-Bernales

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The Internet as a Pathway Out of Poverty

Some 2.5 billion people in the developing world depend upon agriculture for their livelihood. More than 1.5 billion of these are smallholder farmers,[1] defined by the United Nations as working on family farms of less than two hectares, or 4.9 acres.

These smallholder farmers are at the bottom of the pyramid in terms of income, literacy, and access to information and services—yet they represent, on average, more than a third of economic activity for the world's least developed countries.[2]

To escape poverty, smallholder farmers need to enhance their skills and knowledge, and the entire smallholder-dominant value chain needs to become more competitive. The combined effect of these two factors can improve agricultural productivity and raise the incomes of rural dwellers.

The Internet can play a pivotal role by providing a cost-effective way to deliver information services to a large, dispersed population. Internet technology can deliver knowledge to farmers and planning tools to agribusinesses, and connects the various players in the value chain so they can conduct commerce more efficiently.

Despite the challenges of providing and adopting information and communications technology (ICT), use of the Internet for rural development is about to reach an inflection point. Nations that lead in the deployment and use of Internet technology for agriculture will gain an economic and social advantage.

Successful nations will execute on a roadmap that covers the broadband infrastructure, a rural service delivery infrastructure, and the platform of services that enables rural, agriculture-based transformation. Each of these elements depends on the following critical success factors:

- A shared computing architecture to reduce the cost and complexity of technology
- New business models that attract private investment for deliberately targeting those who live on less than $2 a day
- Active collaboration among a complex global ecosystem of stakeholders to turn vision into reality

The public sector's role is to orchestrate all of these elements.

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1. World Development Report, World Bank, 2008.
2. FAO, 2007; Cisco IBSG, 2009.

Challenges: Computing for the Poor

Providing ICT access to smallholder farmers is enormously challenging. They are among the poorest people of the world, they tend to live in remote areas, and they have little experience in using and applying technology. Making matters more difficult is that, to have an impact on reducing poverty and encouraging rural economic development, millions must be touched with ICT, not just a handful.

The cost in the developing world for a "basket" of ICT services—including fixed and mobile telephony, and basic Internet access—averages 20 percent of per-capita income—more than 10 times that of developed countries.[3] The complexity and slow pace of ICT delivery is magnified in the developing world by an immature IT industry, a scarcity of skills, and the need to deliver services in a widely dispersed rural environment.

Attracting private investment to support ICT delivery often results in a "chicken-and-egg" game of rural demand not being high enough to generate financial returns, and the cost of access being too high to generate further demand.

It is a daunting task to align interests and resolve a myriad of interdependent issues among the various stakeholders, including multiple government agencies, international funding and donor organizations, foreign technology providers, new local enterprises, and the various communities to be served. The hurdles can be overcome only with extensive knowledge sharing, discussion, and innovation at multiple points as the initiative progresses.

Trends: Changing the Paradigm

Several significant trends are coming together to create the opportunity to address these challenges. These trends include a new model of shared computing, an increasing ability to attract investment in rural ICT, and new tools to enable ecosystem collaboration.

Shared Computing

Developments in shared technology, under the umbrella of cloud computing, are reducing costs and changing the equation on speed, complexity, and risks associated with deploying both application and computing services.

An increasing number of technology providers now offer services based on remote computing and on a subscription or pay-for-usage model. For example, Software as a Service (SaaS) providers host applications that are offered on demand or by subscription. Infrastructure as a Service (IaaS) models provide remotely managed hardware services, enabling customers to pay based on their use of servers, storage, and networks.

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3. ITU, 2008; Cisco IBSG, 2009.

Since the 1990s, there has been increased attention among developing nations on providing different forms of shared access or community computing, commonly delivered through "telecenters." These shared technology access centers offer rural communities the ability to use Internet-based services in a publicly shared manner.

Telecenter pilots in multiple countries have led to innovative economic models around such centers, and have sparked the development of rurally relevant ICT-based services. Typically, these include education, microfinance, and government-to-citizen services.

Attracting Investment

Over the last decade, there has been a quiet revolution in the ICT sector of countries in the International Development Association (IDA)—countries that can least afford such investments. A total of US$16 billion was invested between 1997 and 2006, more than 80 percent of it from the private sector.[4] The World Bank has been working actively with governments to establish an Internet backbone infrastructure and to increase Internet access through public investments that, in turn, attract additional private investment.

Globally, the 3.7 billion people at the bottom of the economic pyramid have incomes averaging about $2 per day, totaling $2.3 trillion annually and growing at 8 percent per year.[5] Private-sector companies are showing an increasing interest in serving this large potential customer base with innovative services based on new business models.

Various microfinance initiatives illustrate the capacity of rural citizens to operate businesses and profitably serve their fellow citizens. For example, the Grameen Bank provides non-collateral credit to the poor for microbusiness in Bangladesh,[6] and Kiva.org provides similar credit funded by individual donors.[7] The entrepreneurs helped by these programs range from women who operate cell phones for community use to people who sell and maintain solar-powered home systems. These innovative experiences in microfinance provide valuable insights into how to attract entrepreneurial talent and microinvestment.

Ecosystem Collaboration

Social networking and emerging tools such as wikis, blogs, and video sharing have dramatically changed the ways people collaborate. It is now easy for dispersed communities to share, discuss, and develop solutions.

These tools and a new culture of open sharing are enabling dynamic collaboration within organizations, between organizations, and among communities. Collaboration technologies can bring together a deep and broad ecosystem of stakeholders to solve complex issues. Global alliances such as the United Nations Global Alliance for ICT and Development (GAID) illustrate the use of such technologies. GAID's online community has many emerging social networking features that encourage both individuals and formal groups to join, contribute, and collaborate.[8]

4. World Bank, IDA, 2008.
5. The Next Billions: Unleashing Business Potential in Untapped Markets, World Economic Forum. January 2009.
6. Grameen Bank (www.grameen-info.org), 2009.
7. www.kiva.org, 2009.
8. www.un-gaid.org, 2009.

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The Opportunity:
Architecting Smart, Connected Rural Communities

Connect the dots among the various trends and you see a major opportunity to attract private investment, tap the energy of rural entrepreneurs, and unleash the power of the Internet for rural economic development. To be successful, national leaders need to orchestrate a holistic approach comprising three elements:

1. **Connectivity to the last mile:** Extending last-mile connectivity requires a framework that drives "coopetition" among telecom service providers to spur innovation and drive down costs; a program that combines rural demand generation and initial public investment to attract private investment; and collaboration among an ecosystem of partners to implement the connectivity infrastructure.

2. **Telecenters:** Attracting private investment for telecenter operation requires the establishment of regional services agencies that develop locally relevant service offerings and market them to rural entrepreneurs who set up and run the telecenters. Telecenter operators act as facilitators for the local community's flow of information. The regional services agencies should be for-profit enterprises, supported by public-sector policies that offer some level of exclusivity for a region or for certain e-government services. This gives the agencies time to recoup their initial investment.

3. **Smart services:** Telecenters provide the delivery mechanism for a wide range of solutions, including those that improve the quality of life via healthcare education, those that reduce the cost of needed services such as land registration or subsidy applications, and those that enhance agricultural productivity and commerce.

The public sector's role is to lead by creating government-to-citizen services and by promoting the creation of critical agricultural information services.

Global technology companies provide proven and rich software platforms for the various services, and can accelerate adoption of shared computing models by forming local alliances and bringing proven technology platforms and skills to developing countries.

Solution: E-Agriculture Services

ICT-based agricultural development services focus on enhancing the skills and knowledge of smallholder farmers and enabling smallholder value chains to improve their competitiveness and flourish.

To identify the right services to offer, public-sector planners need to understand where ICT can have an impact and which services are likely to attract private investors. They can build these insights by synthesizing three areas of analysis:

1. **Agricultural value chain analysis** helps identify the value chain issues to be addressed and the size of the opportunity for improvement.

2. **ICT analysis** looks at the feasibility of ICT to address those issues and the size of the opportunity that can be captured.

3. **Service value chain analysis** determines the financial viability of the ICT services and identifies the ecosystem partners who are willing to invest and deliver those services.

Figure 1 summarizes the overall solution platform for Connected Agriculture. It is based on research and analysis by the Cisco Internet Business Solutions Group (IBSG), as well as engagements where IBSG has helped national agencies, agribusinesses, and donor organizations develop roadmaps for using ICT in agricultural development.

Figure 1. Solution Set for Agricultural Value Chains

Value Chain Players	Input Suppliers	Smallholders	Processors	Retailers	Exporters	Institutions

Knowledge Delivery						
Information Services	Agriculture Academy			Entrepreneurial Academy	Advisory Services	

Applications	Farm Planning	Quality Assurance	Procurement Portals	Supply Chain Visibility	Finance Services	Community Services
	Production Planning	Standards	Commerce Portals	Real-Time Receipts	E-Loans	E-Government
	Field Monitoring	Input Tracking	Trading Exchanges	Transport Planning	E-Payments	E-Healthcare
	Accounting	Audit	Sourcing Exchange	Export Administration	E-Insurance	E-Learning

Source: Cisco IBSG, 2009

ICT delivers value for value chain stakeholders through:

- **Knowledge delivery**, including access to information, e-learning, and advisory services
- **Farm planning** to help create efficiencies in agribusiness operations
- **Quality assurance** through communication of standards and capture of auditable data
- **Procurement portals** that facilitate input commerce and output trading exchanges
- **Supply chain planning** to reduce cost and create visibility for logistics
- **Financial services** that give greater access to capital and help reduce the cost of financial transactions
- **Community services** that enable rural citizens to access basic healthcare, education, and e-government services

Benefits Extend to the Whole Community

The benefits that flow from rural ICT extend to many segments of the rural community, beginning with the agricultural value chain. Agricultural value chains with a dominance of smallholder farmers face particular challenges that can be addressed by ICT.

For example, to generate income, farmers need to select profitable crops, reduce the cost of inputs such as seeds, fertilizers, and pesticides, and manage the quality of their production. Telecenter services can provide farmers with information, training, and access to competitive input and output markets. Connected Agriculture solutions increase farmers' incomes and their contribution to the overall agricultural sector.

Those who buy agricultural outputs from smallholder farmers face particular challenges in ensuring product quality, planning their operations, and managing a large number of microtransactions. With access to planning applications, the ability to capture data at the farm level, and access to rural e-finance services, these buyers and processors can substantially reduce operating costs, thereby improving their competitiveness in national and global markets.

Multiple players across the entire agricultural value chain can benefit from access to financial services and skill-building resources. Financial organizations can use the rural telecenter network to provide their services to rural citizens at a low cost. E-learning platforms can help develop both vocational and entrepreneurial skills among farmers and other citizens. Both of these solution areas add significantly to the agriculture sector's overall development and competitiveness.

ICT can also provide access to relevant services for the broader rural community. For example, important government services, such as land registration and subsidy or aid applications, typically require rural citizens to travel long distances to reach a government office to file or check the progress of their claims. Telecenters can deliver those services locally, saving time and money.

Telecenters themselves create employment and provide access to markets for local production that would otherwise not be easily accessible. An example is an "eBay" type of service to help local artisans market their wares.

Telecenters can also provide access to basic education, thereby improving literacy and strengthening opportunities for schoolchildren to access additional material. Access to basic healthcare education through telecenters can improve the overall well-being of the entire community.

Overall, ICT solutions delivered to rural communities through local telecenters can help reduce poverty, increase employment, build knowledge and confidence, and contribute to growth of the rural economy.

Real-World Examples

The Community Service Center (CSC) Program in India (Figure 2) represents a powerful example of this framework being implemented on a large scale. By the end of 2010, more than 100,000 village telecenters will be operational in India, delivering multiple services to millions of rural citizens.

Figure 2. Community Service Center Program: The Holistic Approach at Work in India

Citizens	Farmers are targeted as consumers of services		
Public Sector	Statewide 2-Mbps network to within 10 miles of most villages	india.gov.in The national portal of India	National and local government-to-citizen services
Private Sector	Multiple services agencies offering business-to-consumer and business-to-business Internet services		100,000+ "for-profit" village centers to deliver citizen services

Source: Cisco IBSG, 2009

The Indian Ministry of Information Technology orchestrated the public- and private-sector roles and attracted much private-sector investment. The public sector created the backbone infrastructure to deliver a nationwide Internet service of up to 2 Mbps to within 10 miles of most villages.

The government of India also orchestrated federal and state e-government services to anchor the program and to provide a foundation for the private sector to build upon. The private sector role has been to create services agencies that aggregate and localize services for a particular region, and to create a network of for-profit village telecenters.

The private sector has been enthusiastic about the program, increasing the estimated number of CSC telecenters from an originally planned 100,000 to 113,000 by 2010. In addition to the estimated 225,000 rural jobs created for educated youth, affordable access to information and services is seen as the biggest benefit. Electronic Land Registration projects in just two states have benefited 17 million farmers. Villagers paid $4.3 million in utility bills through rural telecenters in the state of Andhra Pradesh in just the first five months of the program.[9]

Next Steps: Lead and Orchestrate

Rural agricultural transformation depends on the public sector's willingness and ability to take the lead and orchestrate the many players in the value chain. Governments need to develop a vision and roadmap that include the three key elements of the infrastructure discussed earlier: last-mile Internet connectivity, local telecenters, and smart services platforms. This entails the following steps:

- For broadband infrastructure, explore funding opportunities with organizations such as The World Bank. At the same time, develop a regulatory framework and demand-generation plan that will offer telecom operators an incentive to invest.

- Establish model telecenters to showcase this approach, with e-government services acting as anchor services. Provide incentives for investors to establish services agencies to innovate and localize high-impact services.

- Examine and prioritize the agricultural value chains in each region. Start the program with those that would benefit most from the use of ICT to raise productivity, rural incomes, and competitiveness.

The impact can be transformational for those who need it most, elevating standards of living in developing countries and stimulating economic development.

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9. CSC Newsletters, Department of IT, Government of India, 2009; Cisco IBSG, 2009.

Notes

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More Information

The Cisco Internet Business Solutions Group (IBSG), the global strategic consulting arm of Cisco, helps CXOs and public sector leaders transform their organizations—first by designing innovative business processes, and then by integrating advanced technologies into visionary roadmaps that address key CXO concerns.

For further information about IBSG, visit http://www.cisco.com/go/ibsg

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