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INFORMATION COMMUNICATION TECHNOLOGY FOR SMALL ENTERPRISE CAPACITY BUILDING PROGRAM

**FINAL REPORT
SEPTEMBER 29, 2006– SEPTEMBER 28, 2009**

Cooperative Agreement No. EEM-A-00-06-00018-00

December 2009

This publication was produced for review by the United States Agency for International Development. It was prepared by ACDI/VOCA under Information Communication Technology for Small Enterprise Capacity Building Program.

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

ACRONYMS

APMC	Agricultural Produce Market Committee
COP	Chief of Party
CSR	Corporate Social Responsibility
CTO	Cognizant Technical Officer
ERP	Enterprise Resource Planning
GMED	Growth-oriented Microenterprise Development Program
ICT	Information Communication Technology
IGP	Implementation Grant Proposal
IKSL	IFFCO Kissan Sanchar Limited
IT	Information Technology
MOU	Memorandum of Understanding
MSE	Micro and Small Enterprise
USAID	United States Agency for International Development
USD	United States Dollar

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I. EXECUTIVE SUMMARY

In 2006, ACDI/VOCA received an Implementation Grant Proposal (IGP) award from the United States Agency for International Development (USAID) to develop Information Communication Technology (ICT) enabled applications to improve the efficiency of private sector extension services and fresh produce supply chain management in India. The award was based primarily on the achievements of ACDI/VOCA's Growth Oriented Micro-Enterprise Development (GMED) program, which focused on the integration of smallholder fresh fruit and vegetable (FFV) farmers into organized retail supply chains, as well as the significant improvement of the operations of these chains.

The IGP India Program partnered with Infosys Technologies (NASDAQ: INFY). Infosys has consistently defined, designed and delivered Information Technology (IT) enabled business solutions. Infosys has over 88,000 employees in over 40 offices worldwide and is part of the NASDAQ-100 Index.

The IGP program developed ICT-enabled wireless software applications that are accessible on handheld devices. These applications enable field extension agents to address information gaps that constrain vegetable and fruit farmers and permit other supply chain participants to monitor and control both back- and front-end supply chain functions. Specifically, the applications:

- Facilitate production planning, coordination and provision of extension services for fresh produce— processes that integrate multiple actors in the supply chain (i.e., farmers, retailers, exporters, input providers, logistics providers)
- Provide technical information and expert advice to farmers on demand through handheld devices, thereby ensuring that the fresh produce grown meets buyer specifications
- Improve the quality, food safety and reliability of the fresh produce supply through a traceability function
- Enable smallholder horticulture farmers to profitably participate in these supply chains

The IGP applications were designed as a backbone to connect an entire fresh fruit and vegetable (FFV) supply chain and to provide management functions. It was not meant to be an overall solution that would “fix” the entire supply chain; instead, the IGP applications and other program elements function as a set of tools that greatly increase the effectiveness of the FFV supply chain.

Project Objectives

- Integrate large numbers of smallholder horticulture farmers into organized commercial supply chains and facilitate mutually beneficial partnerships between smallholder farmers and large organized retail, wholesale, processor and export buyers
- Increase smallholder farm family income
- Provide technical information and recommend best practices to smallholder farmers
- Link smallholder farmer production to specific market needs

OUTCOMES

- 550 farmers from the Nandani Cooperative Society have been integrated into organized commercial supply chains and are currently producing for leading retailers like Foodland, HyperCity and Adani AgriFresh.
- In partnership with IFFCO Kissan Sanchar Limited (IKSL) which provides automated voice-based messages in local languages to farmers, IGP applications were integrated into the IKSL platform thereby providing technical information (weather, pest related alerts, improved production practices) and market information as voice messages to 750 farmers from the Nandani Cooperative Society and Adani producers. Farmers also received a helpline number which connects farmers directly to field experts who provide advice in local languages.
- Farm-to-Market losses have declined to less than 10% in the case of farmers associated with HyperCity, and 15% in the case of farmers associated with Foodland.
- The IGP applications have offered better control over stock and inventory costs, benefits that have been realized by retailers HyperCity and Foodland. The IGP applications facilitate advance and on-demand order placement, assignment, collection, shipment and fulfillment functions that directly connect farmers with the retailers.
- Farmers are earning 15 – 20% more by using IGP applications as demonstrated in the direct linkage model with HyperCity and Foodland.
- Infosys was nominated as one of the finalists of the coveted NASSCOM India Innovation Awards in 2008 in the Business Innovation category. They were declared the runner-up in the competition and received a citation in recognition of their efforts.
- IGP applications are commercially viable and Infosys has invested sufficiently to extend and deliver new service capabilities

II. PROGRAM BACKGROUND & IMPLEMENTATION

Farmers in India are poorly rewarded for their laborious work. The average farmer receives less than one fifth of the elevated price charged to the consumer for their products. The majority of the consumer's money is distributed among the assortment of middle-men, transporters, wholesalers and retailers who transport the produce from farm to market.

India is one of the world's largest producers of horticultural products; growing nearly 11 and 15 percent of the world's vegetables and fruit, respectively. India's production costs are less than half of those in other parts of the world, but despite being a large, low-cost producer, India's share in the global market is relatively insignificant. Fruits and vegetables from India account for only 1.7 percent of the global trade in vegetables and 0.5 percent in fruits.

Multiple reasons have been identified for why one of the world's lowest-cost producers has been unable to compete globally:

First, the high cost of transporting agricultural produce from farm to market erodes any advantage of being a cheap producer that the Indian farmer enjoys. Transportation costs in India are, on average, 20-30 percent higher than in other countries mainly due to a fragmented supply chain.

Second, there is a huge gap between the stringent health, safety and quality standards required by foreign governments and buyers, especially in richer countries, and the weak standards and assessment mechanisms in India. In fact, some of the most demanding standards are not imposed by foreign governments but by foreign buyers reflecting the increasing consumer preference for quality in all product dimensions.

The concerns voiced by foreign consumers today will be the concerns raised by domestic consumers tomorrow. Unfortunately Indian products may not even be able to compete at home if this is the case. The GMED team has worked in India to achieve a better outcome for farmers by preparing them for risks and opportunities.

Poor logistics lead to delays and wastage and weaken farmers' incentives to improve quality. Limited standardization makes physical inspection a necessity before any transaction can take place, further adding to costs. Hence, it is essential to create an integrated and competitive domestic agricultural market, and improve communication, transport, storage, distribution and agricultural support services. The GMED team has strived throughout the project to improve quality standards of fresh produce by providing technical advice and suitable agricultural support services. The project has also succeeded in bringing the farmers closer to greater earning opportunities by directly integrating them with organized retailers.

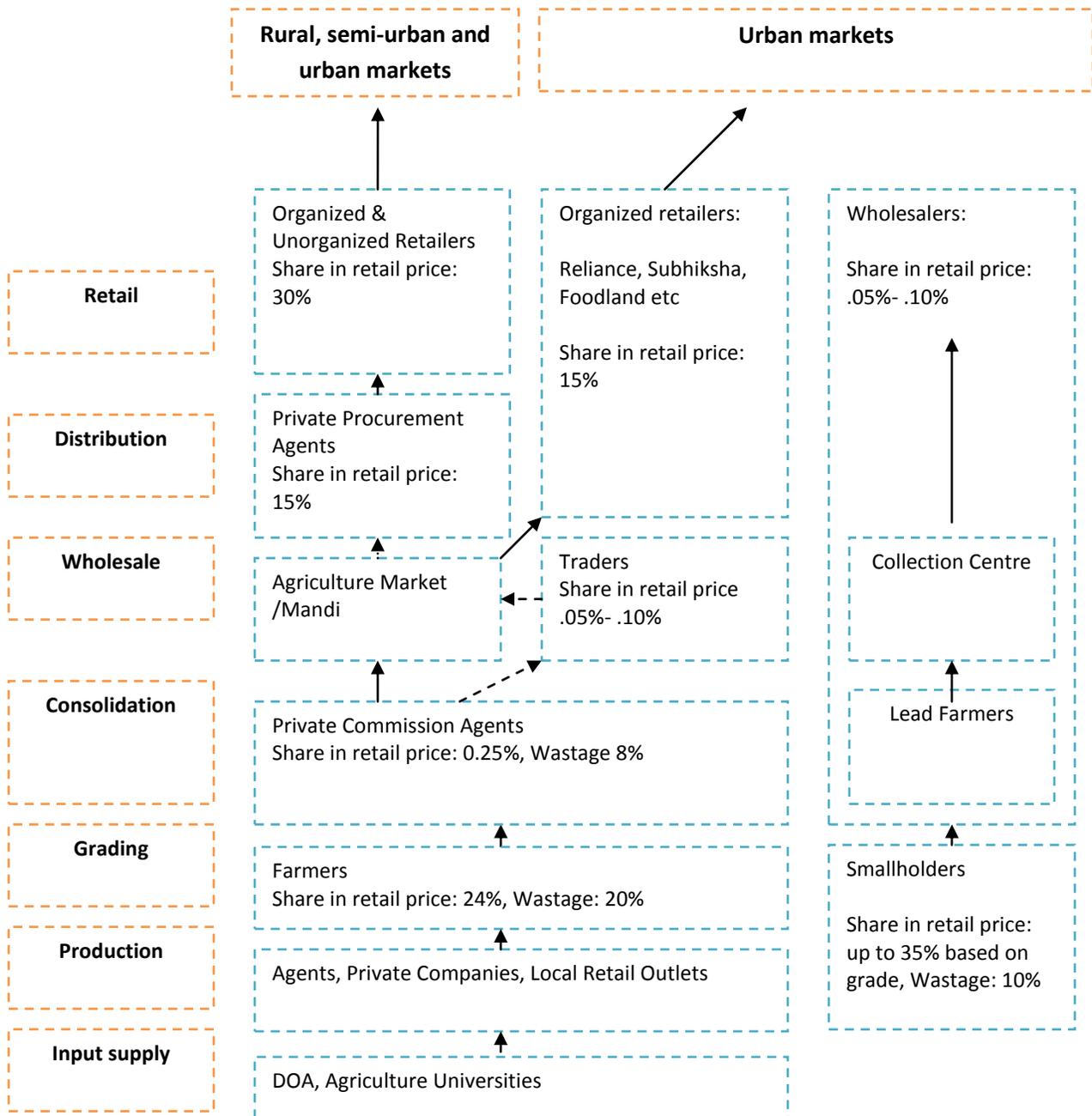
Finally, remedying bottlenecks from the transportation process from farm to market is arguably a higher priority than raising farm productivity. While 20% higher yields will lower the final product price by about 3%, a 20% reduction in transportation costs alone will reduce final prices by as much as 10%.

In fact, without more efficient logistics, increasing production can lead to overproduction that will hurt rather than help farmers. IGP applications were designed to provide a platform for information dissemination, but

most importantly, they were designed to connect all the actors in the supply chain. As the commercial supply chain often ignores the farmers, the IGP applications were expected to change that scenario by placing farmers on an equal standing with the rest of the supply chain actors.

VALUE CHAIN ANALYSIS & DESCRIPTION

There are a number of different value chain models currently operating in the Indian vegetable and fruit sector. Our analysis presented the following value chain scenario:

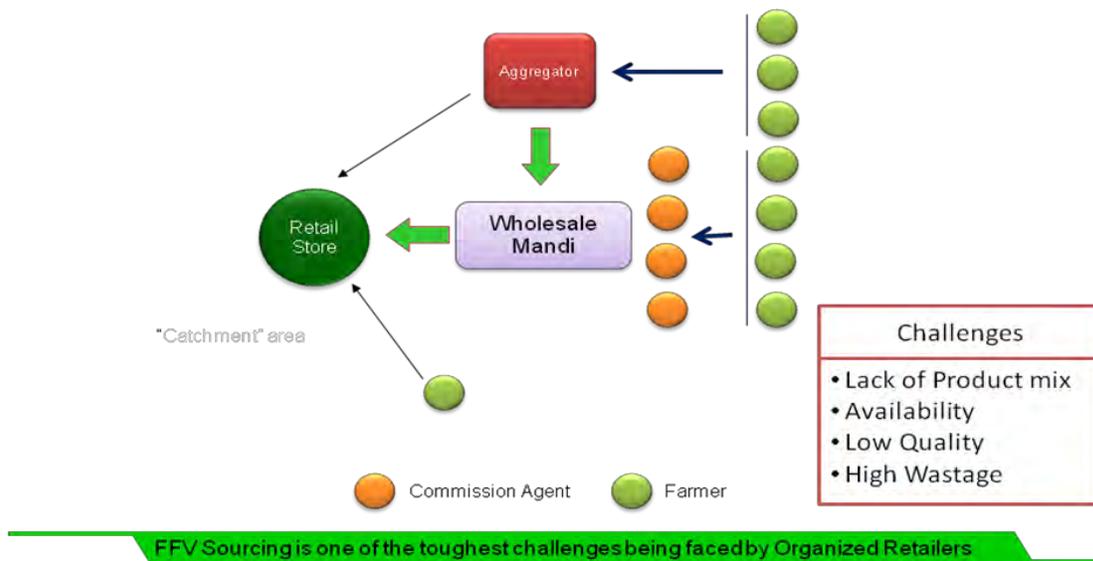


The constraints and problem areas in the supply chain management of fresh produce in India were identified by the predecessor of the IGP India project, the GMED program. The goal of GMED was to develop viable, commercially sustainable and scalable approaches to fostering the growth of micro- and small enterprises. The project focused on linking smallholder vegetable and fruit producers with organized wholesale, retail, export and processing enterprises, and on helping to build farmers' capacity to meet the requirements of those enterprises.

Over the course of GMED (2004–2008), a number of different value chain models were operating in the Indian fresh produce sector. The traditional model was, and still is, directed by the original Agricultural Produce Marketing Committee (APMC) Act. This Act mandates the sale of all fresh produce through the Mandi system, which consists of government-sanctioned markets located throughout the country. In the Mandi system, farmers make initial sales to brokers through commission agents. The produce then goes through the hands of several vertical layers of brokers and, finally, to buyers. Unfortunately, the system is nontransparent, often exploitative of farmers, and leads to excessive wastage and value loss due to over handling and inadequate storage and transport conditions.

About 18 states have revised the APMC in whole or in part to allow farmers to sell their produce through alternative channels, although the new system is not yet working smoothly in many of the states.

FFV Sourcing – Traditional APMC Model



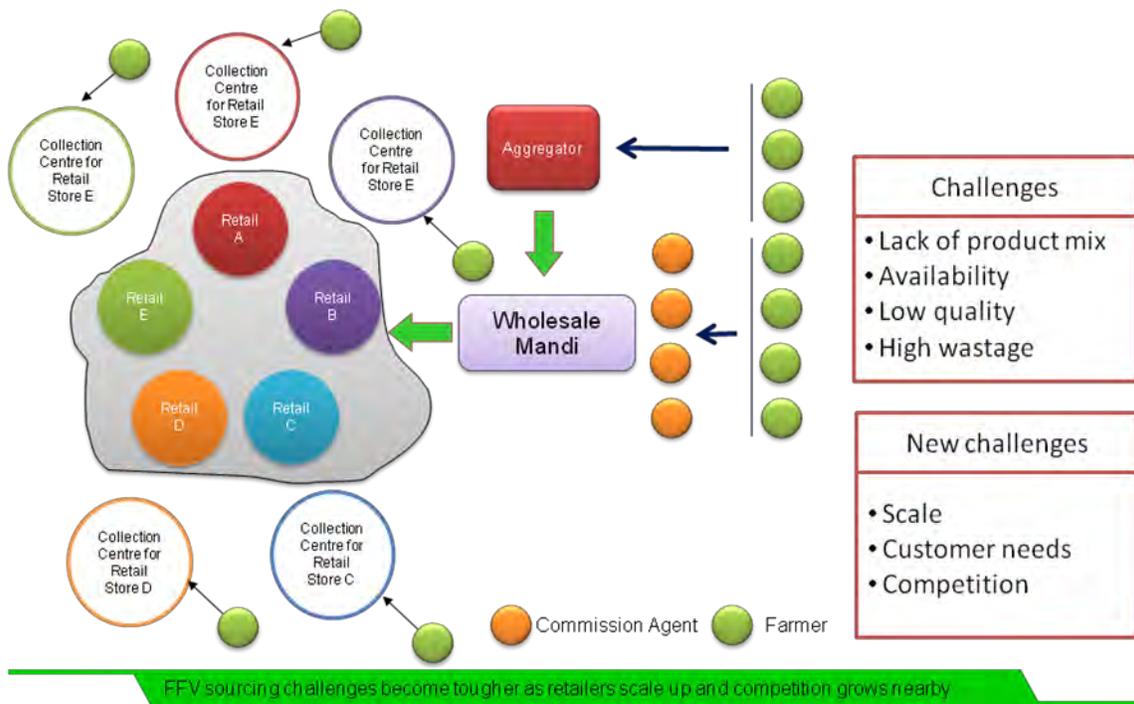
The amended APMC and the rise of organized retail have given rise to several other fresh produce procurement models. The most common model consists of the organized wholesaler or retailer purchasing directly from the Mandi. This eliminates several layers of middlemen and somewhat reduces wastage and value loss, but does not allow the farmer to reap any of the benefits, nor does it provide the buyers with any guarantee of reliability of supply or appropriate quality. A second model consists of the organized wholesaler or retailer operating country collection stations and buying from walk-in farmer suppliers. This tends to

provide greater financial benefits to the farmer, but again, allows the buyer very little control over quantity received or level of quality.

Given the challenges in the models described above, the GMED program pioneered two additional models, which have attracted a considerable amount of interest among organized wholesalers, retailers and exporters:

- I. **Direct Buyer-to-Farmer/Deep Procurement model.** Under this model, the actors enter into non-binding agreements and organize a group of farmers to supply the needs of the buyer. The procurement is based on partnership arrangements between the farmers and buyers and does not generally constitute contract farming under a strict definition of the term. The continuity and adherence to the agreement is maintained through frequent interactions, technical assistance and extension services and the realized mutual benefits. As a result, the Direct Buyer-to-Farmer model is designed to provide maximum benefits to both sides, including technical support, better returns to the farmers and the assurance of a reliable supply of fresh produce of the preferred quality to the buyer.

FFV Sourcing: “Direct” Procurement Model



- II. **Farmer-Intermediary-Buyer model.** Under this model, a commercial intermediary establishes a partnership with organized groups of farmers, and acts as the link between the farmers and the buyers. A cooperative society is a perfect example of the intermediary given its capacity to provide extension services and logistical support. The technical assistance and extension services are offered by the intermediary, and the buyer interactions stop with the intermediary. This model works well and is very attractive to the retailers, since dealing with farmers is not one of their core competencies or primary business interests.

The primary change in the relationship between the supply chain actors during the GMED program was the growing realization among the buyers that they must depend on smallholder farmers for the bulk of their fresh produce supplies. Thus, the only means of guaranteeing a reliable supply and remaining competitive is through the establishment of ongoing and mutually beneficial partnerships with organized groups of farmers.

The models pioneered under the GMED program still had key constraints among the fresh produce supply chains which warranted the development of an ICT solution. Some of the constraints were:

1. Absence of smallholder horticulture farmer organizations
2. Production base made up of thousands of small-scale farmers
3. Farmer skills not meeting the level required by organized retail
4. Lack of smallholder farmer access to improved production, post-harvest technology and the assistance in applying post-harvest technology
5. No effective market information systems directed to smallholder vegetable and fruit farmers
6. Lack of data collection, processing systems and facilities that are necessary for monitoring and evaluation and traceability in smallholder vegetable and fruit production
7. Lack of coordination and control over fresh produce field operations and supply chain logistics
8. Lack of control over quality and product mix
9. Excessive wastage and value loss from farm gate to retail store
10. Less possibility of implementing crop scheduling or crop rotation methods

To resolve constraints #1 and #2, GMED took a market driven approach by engaging the private sector, which had invested heavily in the organized retail businesses, in forming and supporting farmer organizations to ensure sustainable demand and technical and logistical support for farmers.

Constraints #3 and #4 required significant technical assistance and training to the farmers which ACDI/VOCA provided in two different regions. Given the difficulty of reaching the large number of farmers in India and thus the inability to provide the necessary assistance required in the FFV markets, these constraints justified the need for IGP applications.

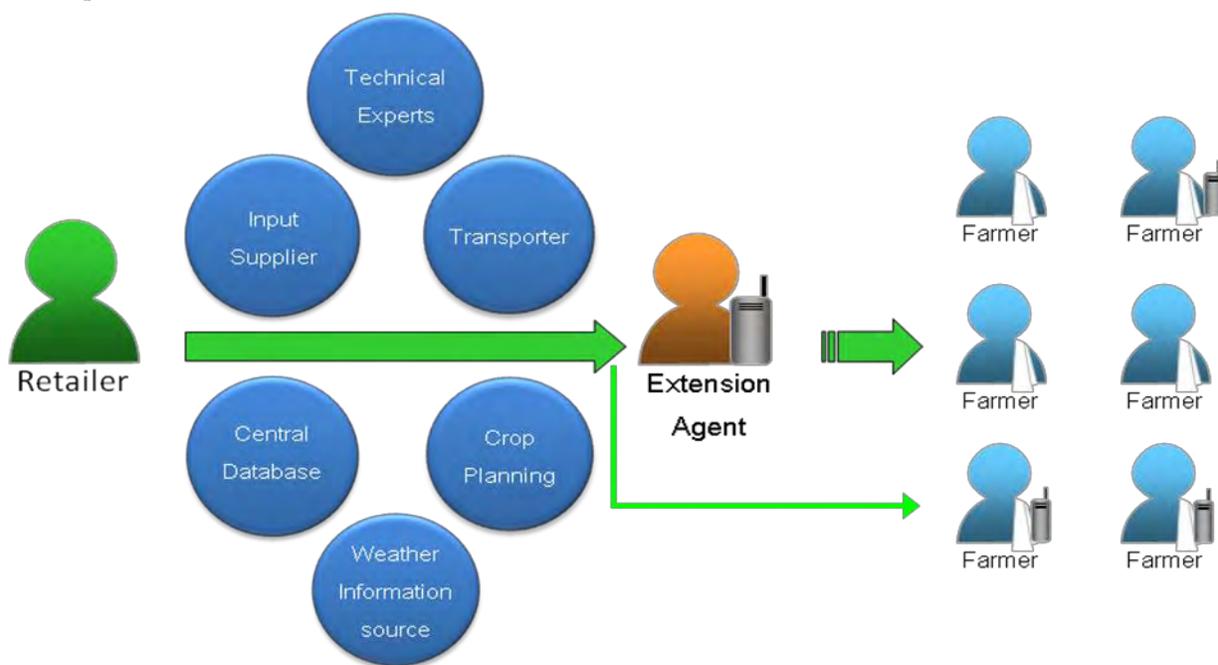
Constraints #5 through #10 were given high priority as a lack of information in these areas resulted in failure to promote inclusive growth among the farmers while the organized retail sector in India grew at a faster rate.

IGP applications made information available to farmers and kept them informed at all levels of the supply chain, as well as providing necessary product traceability to all supply chain actors.

SOLUTION OVERVIEW

The IGP applications include the following features:

- Retailer/Buyer orders for produce for the entire season across outlets using IGP applications.
- Split orders across various regions supervised by various field extension agents (FEAs)
- FEA assignments of orders across the farmers/production base through the application
- FEA assistance for farmers during production, harvest and post harvest phases using technical information made available in the handheld or accessed from an external server.
- FEA “Ask an Expert” module which allows farmers to ask a query which will be answered by experts associated with the region in the application.
- Regular alerts to the FEAs and farmers on their cell phones during the entire production cycle
- Once the produce is harvested, the FEAs collect and ship the produce to various distribution/collection centers. Details of collection and shipment are recorded in the application. The FEA usually take upon the role of the procurement agent, even if the procurement agent is different from the FEA, since it is the responsibility of the FEA to enter details of collection and shipment into the handheld device. In future versions, more role-based responsibilities can be added into the application.
- Application alerts to the retailer with consignment details and an ability to trace produce to the production base.



Ecosystem of IGP applications

IGP application screens are explained in the following pages:



All users of the IGP applications have roles and can access credentials setup. Users login through the application launch/login screen.

The roles used in the application are

- Field Extension Agent (FEA)
- Retailer/Buyer
- Technical Expert
- Input Supplier



Once logged into the application, every user views an alert screen which displays the alerts applicable to the role of the user. To the left, there is a screenshot of the application alert screen for FEAs. Here the three types of alerts are visible.

1. **New Orders** – States if any retailer/buyer has placed a new order which is yet to be assigned to a farmer/production base.
2. **Order Collection** – States if any farmer is going through a harvest session. Post-harvesting, the FEA assists in the collection of the produce to be sent to the collection center or terminal market.
3. **Ask An Expert** – States if any expert has responded to a query raised by a farmer or FEA.



The dashboard provided here is the default view of the application. Using the dashboard:

- The FEA assigns an order placed by the retailer to a group of farmers/production base in a region.
- Upon full harvest, the FEA records order collection details.
- When produce is moved from a distribution center to a terminal market or storefront, the order shipment details are recorded by the FEA using the handheld device. The produce can be traced to a production base at any point in time using the “Traceability” feature.
- The “View Technical Information” feature enables the farmer/FEA to access technical information about the crop production, pest and weather management.
- The “Ask an Expert” feature allows farmers to reach out to an expert and ask questions. Experts provide answers/solutions which are received by the FEA on their high-end phones and they pass them on to the farmers. Farmers will receive a simple alert message on their cell phones, low-end or otherwise, about the availability of a solution
- At the end of the day, the FEA uses the “Synchronize” feature to push data from the handheld device to the server and pull relevant data as needed or marked for distribution to a particular handheld device.



In the screen to the left, using the “Order Assignment” feature, the FEA selects a production base and assigns a part of an order. The FEA then enters assignment details like “Quantity Allocated, Soil Preparation Date, Seed Implantation Date, Harvest Date” and saves the information by clicking the “Save” button.

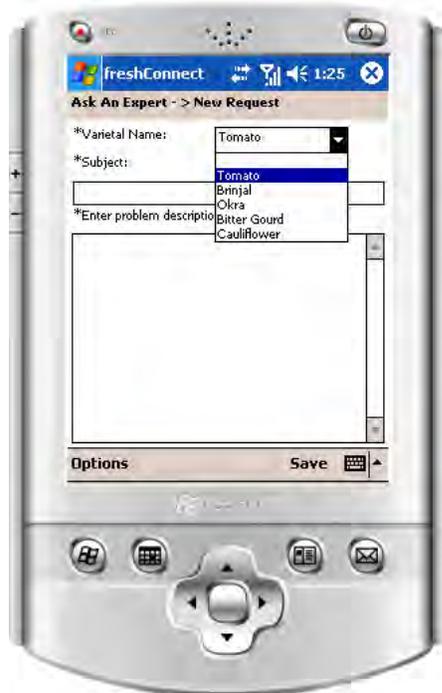
Additionally, the FEA can trace back a batch number and extract the associated details like lab reports, source, etc.



In this screen the FEA enters order collection details like “Quantity Collected” and “Date of Collection”. The batch number is generated once the user saves the details. The batch number is displayed for traceability purposes.

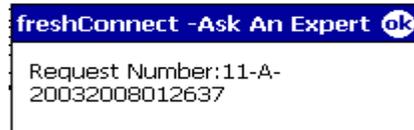


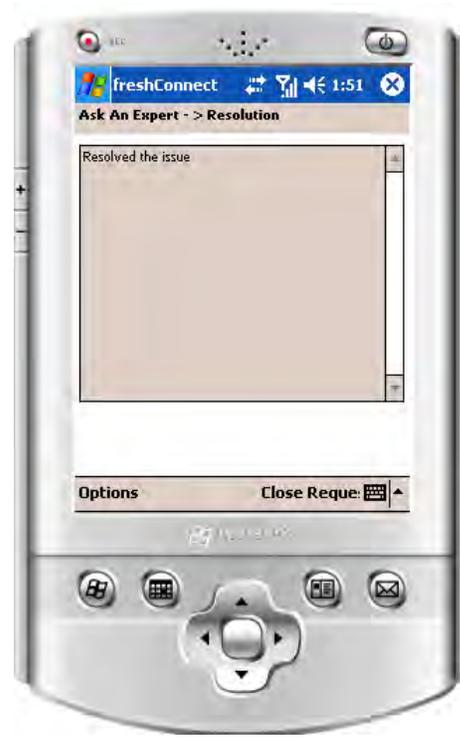
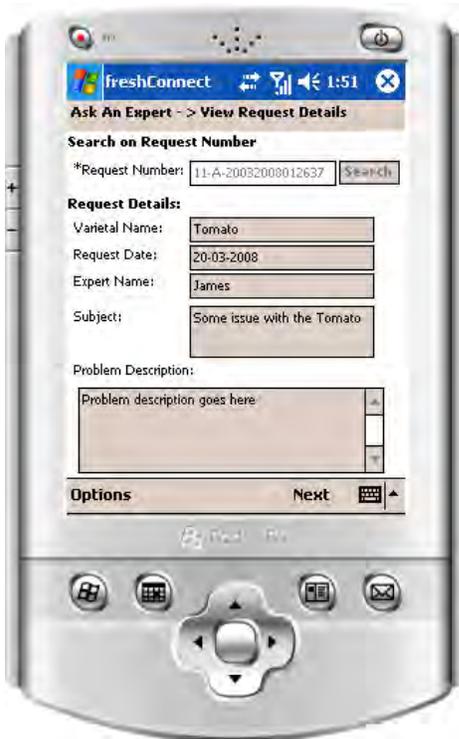
In this screen the FEA enters order shipment details like “Quantity” and “Shipment Date”. A consignment number (see below) is generated once the shipment details are updated in the database.



Using the “Ask an Expert” feature, a farmer or FEA will select the varietal from the list and enter the problem details like “Subject” and “Description of the Problem”.

A request number is generated and displayed to the FEA once the request details are saved in the database.





Once an expert provides a comment or solution to the query entered by the FEA/Farmer, the application receives the solution and displays it on the screen.

Once a consignment arrives at a distribution center, the FEA or the retailer can track a particular batch and view lab reports using the “Traceability” feature. The screen to the left displays results for a batch number.



An “About Us” screen provides credits and other relevant information about the IGP applications.



IGP applications can be accessed on Smartphones and laptops. The technical information database can be accessed by laptops, smartphones and GPRS phone devices. The low-end devices used by farmers can receive market and weather information alerts as shown by the sample screens.

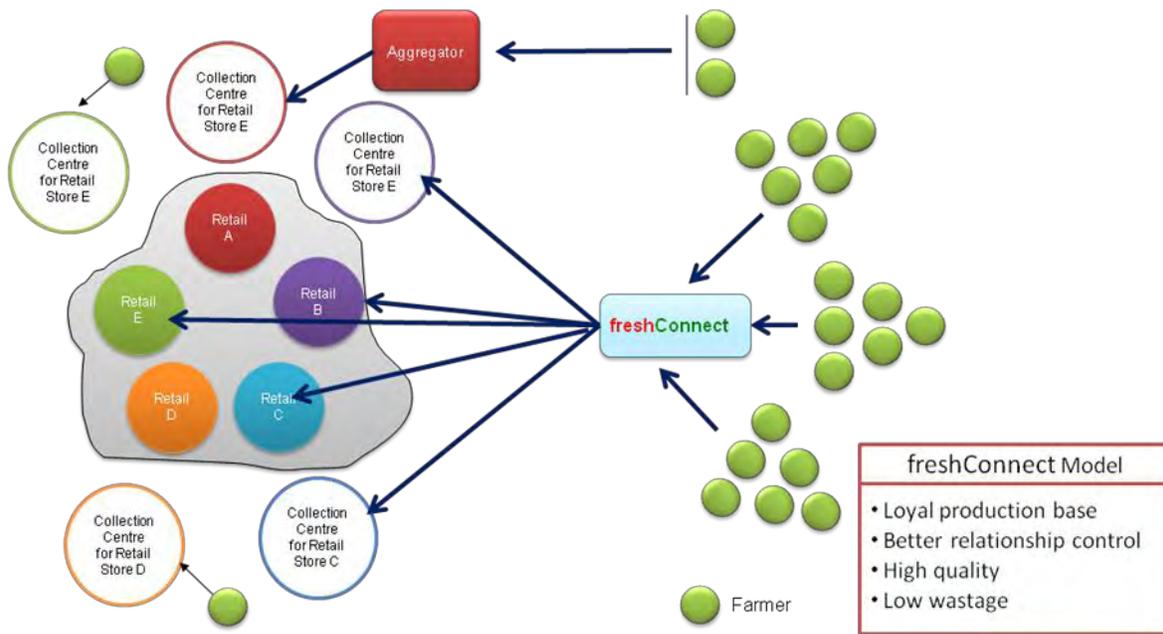
Upon developing the applications, per recommendation from the pilot phase, the IGP team and Infosys moved the application into the commercial phase in July 2008. Radhakrishna

Foodland and HyperCity were the initial two buyers/retailers who expressed interest in deploying the IGP applications in their organizations.

Based on the store requirements, 150 farmers were selected by the intermediary to supply for Foodland, and 200 farmers were selected to supply for HyperCity. Adani Agrifresh later subscribed to the IGP applications for use among its apple growers.

With the introduction of IGP applications to the actors in the supply chain, the buyers and the suppliers exchanged real-time, bi-directional information and thereby paved the way for the “freshConnect” model of procurement. This procurement model is an improvised model that works with the previously stated models pioneered under the GMED program and is explained in the graphic provided below:

FFV Sourcing: “freshConnect” Model



A different approach to tackle disproportionate management attention to FFV sourcing

PROGRAM BENEFITS

Introducing IGP applications among farmers reported:

- Higher Incomes through:
 - Increased Yields
 - Improved Quality
 - Reduced Transaction Costs
- Power of Scale to the Small Farmer
- Customized Knowledge against Heterogeneity
- Real-time Information against Physical Distances

The buyers reported the following benefits:

- Better supply chain for Agri-businesses
 - Costs, Quality, Traceability
- Access to the Underserved Rural Markets
 - Through a promise of “Larger Incomes” and founded on built-up “Farmer Loyalty”
- Better control over Stock and Inventory Costs
 - On-Demand Order Assignment and shorter cycles of Order Realization



Pictures: Nandani farms that grow tomatoes and cauliflowers using the IGP applications; farmers, IGP program staff, Infosys team members and field extension agents are featured.

III. EVALUATION

Surveys were conducted among 250 farmers and a retailer involved in a backward linkage facilitated by the IGP applications. The project evaluation questions are given below. Results from the survey were collated against M&E indicators.

FARMER INTERVIEW QUESTIONS

1. What's your household size?
2. How many acres of land do you own?

Repeat the following questions for the "Before" and "After" scenarios of using the IGP applications.

3. What produce do you usually grow in a year?
4. What is the average production (tons per season)?
5. What is the average sale (kg per day)?
6. Where do you sell your produce? What is your nearest and farthest Mandi?
7. How do you decide where to sell?
8. How often do you visit the Mandi(s)?
9. How do you sell at the Mandi?
10. How are you informed of the Mandi auction prices? What is your main source of price information?
11. How often do you get paid?
12. How much do you pay as commission rates to the agent?
13. Other than the commission rates paid to the agent, who else do you pay for?
14. How do you know what quantity to sell at the Mandi?
15. How do you know what quality to sell at the Mandi?
16. Do you sell any produce locally in the village?
17. What is the wastage level of your produce? (Wastage reported by farmer during transport)

-
18. Do you own a mobile phone?
 19. How much do you pay for using IGP applications on your mobile phone?
 20. After using IGP applications, how much has your mobile phone charges increased?
 21. In IGP applications, which do you use the most? a. Technical Information; b. Market Information; c. Weather Information; d. Ask an Expert;
 22. By using IGP applications, is there any impact to the production capacity/yield?
 23. By using IGP applications, is there any impact to your daily farm income?
 24. By using IGP applications, is there any impact to wastage level of your produce?
 25. According to you, what is the single most beneficial part of using the IGP applications?

RETAILER INTERVIEW QUESTIONS

1. How many “fresh” retail stores do you operate in the country?
2. How many collection centers do you operate in the country?
3. Do you operate your own logistics division?

Repeat the following questions for the "Before" and "After" scenarios of using the IGP applications.

4. How is your current fresh produce procurement process structured?
 5. How many fresh produce suppliers/sources do you procure from?
 6. Along what criteria do you select your fresh produce suppliers?
 7. Do you have contracts with your supplier/s?
 8. How is your demand planning currently organized? What systems or tools are in use?
 9. What is the typical lead time for fresh produce orders?
 10. How do you ensure constant and reliable supply for you?
 11. How often do you face stock-outs?
 12. How much do you procure fresh vegetables & fruits on an average (tons per day)?
 13. Do you participate in Mandi auctions?
 14. Do you buy through commission agents/brokers in the Mandi?
 15. How much do you pay as commission rates to the agent?
 16. How are you informed of the Mandi auction prices? What is your main source of price information?
 17. Do you directly buy from farmers?
 18. How do you determine how much to pay the farmers if working directly?
 19. How often do you pay the farmer?
 20. Do you provide extension services to the farmers/suppliers you work with? Do you provide transport and labor support to your suppliers?
 21. How do you measure quality?
 22. How do you know what quantity to buy at the Mandi?
 23. How do you know what quality to buy at the Mandi?
 24. Has there been a difference in quantity ordered?
 25. Has there been a difference in quality ordered?
 26. If there is a difference, or an order unfulfilled, when (how much time in advance) do you hear it?
 27. What is the wastage level of your produce? (Wastage level reported by buyer after purchase)
-
28. Do IGP applications provide for better control over stock and inventory costs?
 29. Do IGP applications provide for increased availability of safe and hygienic fresh vegetables and fruits to consumers?
 30. According to you, what is the single most beneficial part of using the IGP applications?

RESULTS

OBJECTIVE #1:

Integrate large numbers of smallholder horticulture farmers into organized commercial supply chains and facilitate mutually beneficial partnerships between smallholder farmers and major organized retail, wholesale, processor and export buyers

- Total beneficiaries from the IGP program equaled around 1,300 farmers and 3 lead firms when the project intervention ended.

OBJECTIVE #2:

Increase smallholder farm family income

- Farmers are earning 15 – 20% more by using the IGP applications as demonstrated in the direct linkage model with lead firms such as HyperCity, Foodland and Adani Agrifresh.
- Farm-to-Market post-harvest losses have declined by 10 - 15% due to production planning, effective logistics management and quality awareness.
- Direct linkages established between the buyer and the supplier removed the dependency of traders and agents thereby saving the farmers an additional income of 6 – 8%.
- Retailers with a niche fruits and vegetable focus offered to pay an additional premium of 5% if farmers produced and delivered to the quality, quantity and varietal needs of each of their stores.

OBJECTIVE #3:

Provide technical information; recommend best practices to smallholder farmers in real time

- Farmers received the latest and current information on market prices, demand, weather forecast, package of practices, pest management techniques and post-harvest management techniques; such a facility was welcomed by 64% of farmers.
- Farmers received access to experts' advice on-demand and this service was the most valued among the survey participants. About 87% of farmers rated this service as the primary requirement of any extension service and were even willing to pay for the service.

OBJECTIVE #4:

Link smallholder farmer production to specific market needs

- Direct linkages established through the IGP applications created maximum benefits and value for the retailers as it offered better control over stock and inventory costs. Retailers reported a reduction of 18% of inventory costs among their collection centers and at the storefront.

IV. LESSONS LEARNED & FUTURE DIRECTIONS

LESSONS LEARNED

The IGP Project's experience from developing an IT solution and a partnership with Infosys was one of both successes and challenges, which can provide some key lessons and recommendations. Some of the key lessons learned are:

1. Establish data collection & processing systems to create transparency among transactions between the buyers and the suppliers.

An ICT application that can gather, record and make data available to value chain actors to facilitate transparent parameters to establish maximum and minimum prices is highly recommended. With a transparent pricing model, prices are set and updated according to actual market conditions and meet both buyers' and producers' expectations. An ICT application can be one solution to address the issue of no effective market information systems and the lack of data collection and processing systems that monitor and evaluate smallholder vegetable and fruit production.

As such, IGP applications are able to monitor prices of up to six pre-selected wholesale markets of a farmer's choice based on the selection of markets to watch, crops grown and other factors. The prices for fresh produce decided upon in various Mandi are syndicated in government-run websites. IGP applications monitor the price movement in these websites to provide the market information to farmers. The buyer and the supplier establish minimum and maximum supply prices for a given crop or variety, based on market rates published from one of the various Mandi, which then is recorded in an agreement between buyer and seller. As the market price can fluctuate, the minimum and maximum supply prices agreed upon in the contract are subject to reconsideration when the market price exceeds or goes below a tolerable limit. Thus, IGP applications make reliable market information available to both the buyer and supplier, making the pricing transparent and fair to all the value chain actors.

2. Train and motivate local field staff to become change agents

This solution goes considerably further in value chain actor interaction than a simple exchange of market information. It is essentially a tool that is used in the integration and management of a complete supply chain and as such it is actively used to handle several areas at the back end of the supply chain, including quality and quantity control, and will assist both producers and retailers to more effectively manage inventory. It is therefore extremely necessary that the systems at the back end of the supply chain, primarily those that deal with the farmers and field extension staff, are firmly in place and operational if the application is to work at

optimal capacity. Actors at the upper end of the value chain, retailers, procurement agents and brokers, are usually more aware about the use of ICT in the dissemination of both market and technical information.

However if the system is to truly create vertical integration of the value chain with benefits to all users, farmers need to understand very clearly what is expected of them not only in terms of production techniques, associated technical improvement packages and the requirements that revolve around product quality, but also have a very firm grasp and understanding of cropping calendars and production cycles. The field staff has a very significant role to play here as they need to interact with the farmers on a regular basis and promote the use of the ICT solution.

By merely making information available and accessible through an ICT solution doesn't integrate the entire supply chain. The field staff needs to educate the farmers about the role of the ICT solution and help alleviate any threats perceived and doubts that exist among the farmers. As the introduction of the ICT solution changes the way the farmers transact with the buyers and how trust relationships are formed, the field staff must be close to the farmers, be available on call and bring about this behavioral change among the farmers gradually.

3. Be aware of market forces and help create benefits for both ends of the supply chain

It is important that the ICT solution helps both buyers and suppliers perceive benefits on a continuing basis. Focusing on driving benefits towards one end of the supply chain would result in a less effective adoption of the proposed ICT solution. The ICT solution must also be capable of supporting market-driven factors and engage the actors appropriately. In the case of IGP applications, the buyers could better manage stock and maintain inventory control significantly thereby reducing waste and spoilage loss. IGP applications allow buyers to make decisions based on demand forecasts, actual product attributes and available or expected quantities, and allows buyers to reach out to farmers from nearby production areas who can supply the entire basket and also meet the product specifications. It also provides for verifiable traceability through the supply chain.

The IGP applications allow the buyer to place orders on a daily basis and also place bulk extended orders for months together. This facilitates better crop planning and scheduling to farmers who now operate in a demand-driven market condition. By working directly with the buyers and producing for the quality standards established by the buyers, the farmers were able to increase their yield and earnings substantially. So clearly, when both the buyers and the suppliers see direct and tangible benefits from using the ICT solution, their involvement and commitment is continuous. However, the use of an ICT solution is considered an additional investment by the buyer and market dynamics can influence the adoption of an ICT solution and abandon new procurement models. This project faced such a scenario.

In early 2009, the financial condition of the organized retail market worsened in India, forcing several big retailers to withdraw from their plans because of stores closings (Subhiksha) or downsizing (Reliance Fresh). Unfortunately, this created a situation where there were not enough direct buyers among organized retailers to buy a substantial quantity of what farmers produced. While growth rate in the organized retail sector dipped and consumer confidence diminished, the existing retailers competed amongst each other for footfalls

by offering lower prices instead of high quality and variety. IT budgets were recalled or cancelled and the demand for an ICT solution in the organized retail market almost vanished.

However the export and processing markets continue to pursue high quality and variety of fresh produce, the ICT solution, with some quick small changes, stayed relevant and offered benefits to these new buyers.

4. Choose strong local development partners

During the GMED project, ACDI/VOCA's technical experts worked closely with fruits and vegetable farmers offering technical expertise for about 3 years. As the GMED project ended, a handful of technical experts continued to work with the IGP project. As the number of farmers involved in the IGP applications increased, the team quickly realized the challenge of providing uniform technical assistance services with a reduced number of technical staff available. In order to make applications sustainable, the team needed to identify a viable and sustainable provider for these services and slowly phase out any direct involvement from ACDI/VOCA with that aspect of the project.

ACDI/VOCA partnered with IFFCO Kissan Sanchar Limited (IKSL), a local organization that provides a voice message platform for disseminating technical information to farmers and builds on existing IGP applications. ACDI/VOCA has documented all the technical information developed during the course of the GMED and IGP projects and the same information is now sent through IKSL's voice messaging channel. While the IGP project impacted only a few farmers in 3 states, a tie-up with IKSL allows the solution to leverage its 1.5 million subscribers that are spread out in all parts of the country. IKSL has a profitable business model and a risk appetite that makes it a strong partner to take this initiative forward.

Infosys, IGP's software development partner in this initiative, handles application development, hosting and maintenance, technical support and also provides end-user training to organizations/stakeholders using IGP applications. During the 3-year long association, Infosys was viewed as capable of making quick tweaks to the ICT applications, responding quickly to feedback provided by end users and also working closely with all stakeholders to build new features to the ICT solution. It experimented with several business models and established several types of revenue streams to keep the ICT solution commercially viable. Infosys also committed to significant investments in the project as the ICT solution evolved through several of its business models.

5. Define and Establish Intellectual Property Rights

Intellectual Property is defined as legal rights that result from intellectual activity, undertaken by an individual or by a joint effort. In donor-funded projects, it is important to define and establish the Intellectual Property Rights on the basis of the relationship formed among actors. It is also important to understand the different initiatives and laws to protect the Intellectual Property for Computer Software that exist in the country in which the IP is being developed and implemented. Projects could be fully or partially funded by the donor and the IP rights are established accordingly.

If fully sponsored, donor-vendor relationships become straightforward and the entire IP for the computer software developed belongs to the donor/implementer. An ongoing evaluation of the vendor's work entities to identify copyright protection/patents is very critical. In executing a contract with the vendor, it is important to define a separate Intellectual Property Violation clause and define the consequences of Intellectual property violation.

If partially sponsored and a partnership relationship is formed between the donor and the vendor, it is necessary that the donor/implementer and the development partner/vendor share equal IP (Intellectual property) rights. In this scenario, the donor will own all IP on assets developed using funds provided. A joint license and ownership of IP to these assets are provided to the partner as well. This way, either party would be capable of taking the application development further and beyond the scope of the contract put together.

Existing inventions developed by the partner/vendor (IP provider) must be audited at the time of signing the project contract and listed for clarity. Through pre-negotiated contracts, IP rights, grant-back license to the donors/implementers and pricing for existing inventions must be established. These could be time-bound and also have region-based exclusivity of use.

Partnerships between the donor/implementer and the software development vendor must be close, and requires transparent communication, especially with new IP still under development.

FUTURE DIRECTIONS

While the emerging businesses continue to use the traditional markets in some cases, they are also putting in place direct procurement practices by which they try to overcome some of the coordination failures in traditional markets or by which they can economize on transaction costs. Innovative solutions like the IGP applications bring about an impact on food prices, labor markets, input markets and farm production which then will determine their influence on rural poverty. It seems that emerging modern markets might increasingly challenge the traditional markets, which in their current form seem most attuned to dealing with small-scale producers and retailers. When more consolidation takes place on the demand side, or when food quality and food safety become an overarching concern, there will most likely be a movement away from the use of brokers. Only brokers who are able to adjust their service delivery are able to be part of these emerging value chains, but more often they could increasingly be bypassed. Given that these developments often benefit the small producer, through higher prices or lower transaction costs, this trend should be encouraged.

In its current form, the traditional system seems poorly adapted to deal with the food safety and traceability demands of modern local or export horticultural markets. Buyers obtain little information on the unobservable characteristics of the product, and the regulated broker system— through its anonymity—is seemingly a hindrance to the development of closer vertical coordination and better information transmission between producers and buyers, which is much needed in modern markets.

The impact of the transformation in the supply chain is related to the strength of the linkages between urban and rural areas. For example, rural areas with good access to urban markets generally have better opportunities to take advantage of the growth in demand for high-value agricultural commodities. Thus, there

are significant spatial patterns in the degree to which rural households are influenced by the market in general and by urban demand in particular.

Research is urgently needed on how the changes taking place in the rural-urban food supply chain affect poverty, and what the appropriate role can be for public policy to ensure positive impacts. USAID could play a pivotal role in this area.

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