Developing Alternative Innovation Pathways based on the Market Chain Approach: the Case of Rootcrop Chips In Leyte, Philippines

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Abstract

This paper presents the case of *gabi* chips processing enterprise in a community in Leyte, Philippines as proof of concept of the Continuing Improvement and Innovation (CI&I) approach to micro-enterprise development. Using specifically-designed tools at each defined stage, the CI&I process is characterized as focused in objective, which is achieved through a series of incremental, measurable and time-bound improvements. Mixed with participatory processes shared by stakeholders, the approach proved effective in the final implementation of the *gabi* chips business plan in only one-and-a-half years. This consisted of the establishment of a "good manufacturing practice" facility, market and supply strategies.

The context of market chain is embedded in CI&I. The approach was able to surface out the different value-adding activities from farm to market; a holistic strategy necessary in dealing with the complexities of enterprise development, especially among resource-poor housewives and farmers. Skills building and effective collaboration resulted in the process, and were critical in the coordination and provision of natural, infrastructure, financial, human, and social capitals.

Introduction: the rootcrops program and participatory research

Rootcrops contribute important food and cash sources to mostly poor farmers; grown in about half a million hectares of largely ecologically fragile environments. Thus, the Philippine Rootcrop Research and Training Center (also PhilRootcrops) was created by Presidential Decree 1107 in 1977 to oversee and implement a multi-pronged rootcrop RDE program. Driven by goals to diversify livelihoods and improve incomes of the poor, and contribute to agro-industry development, the national rootcrops program has been geared to: 1) increase productivity through improved varieties of desired traits, and improved crop and nutrient management practices; 2) increase value-added through post-harvest technologies and improved market linkages; 3) generate a knowledge base of the social arena in rootcrop agriculture; and 4) expand the reach of technologies through information, communication and extension services. High-yielding hybrids, novel products, processes and machines were produced. These same set of ways and ends mean differently the past twenty years than in the first decade of the program. The difference – the social and market perspectives, and the attention placed on people skills, even among the technical scientists.

Markets should have been the driving forces of invention and innovation, and users the actors who engineer their ends. Yet for a decade since the mid-seventies, rootcrop technology development was technical-heavy, top-down, fragmented, discipline-oriented, and lacked systems thinking. Not surprisingly, scores of the reported "mature technologies" (varieties, products, equipments) still lament in researchers' shelves.

The late 1980s marked some turning point. A skeletal social science unit was established, actively collaborating with the User's Perspective with Agricultural Research and Development (UPWARD) network. Its first socio-economist teamed up with a food technologist and a food

engineer to work on the Center's first consumer-oriented sweetpotato product development project pushing for vitamin A, funded by the International Potato Center (CIP). In 1989, the International Development Research Centre (IDRC) and the UPWARD network funded the country's first national socio-economic conference on rootcrops, which dealt with issues on methodology, information and database, and policy. These confluences gave birth to the integration of participatory research and development (PR&D) in the national rootcrop program. UPWARD has been instrumental in these paradigm shifts by engaging teams of technical and social science researchers in small grant projects in discovering local knowledge of sweetpotato pests and diseases, indigenous systems of nutrient management, in participatory diagnostics of sweetpotato livelihood systems, the people perspectives of technology development, and in participatory action projects.

The transformation was not easy. Internal organizational structure, workloads, personalities and mind-sets could not be changed overnight to permit flexibility and engagement of relevant disciplines to fit to the intensive time demands of PR&D. Both people skills and technical know-how are critical to the facilitators of the whole process. The local people and partners needed similar changes in mind-sets and people skills to be able to actively participate. Today, value chain, supply chain, and market-chain have become buzz words in proposal development in addition to participatory processes.

The case of rootcrop chips

The above-mentioned CIP-funded project yielded promising output. Market surveys and consumer tests in selected areas nationwide produced a prototype (i.e. sweetpotato chips) of desired flavours (sweet, garlic, onion) with a high vitamin A content, which would most likely have substantial consumer impact among the low and middle income groups. Fit to consumers' preference, the technology design was very specific. Product quality is assured only with a specific sweetpotato variety (high beta-carotene VSP 1), of a certain thickness, fried at no less than 160^0C, a certain cooking oil quality and cooking time, and packaging requirements. Two women and farmer cooperatives in two communities (in Dulag and Jaro, Northern Leyte, Fig. 2) pilot tested the technology and succeeded in their market tests. But its strength was its failure. VSP 1 got infested with scab, wiped out the crop all over the country. The technology slept for a long time (Truong et al, 1992).

Ten years later, three household-based food processors in Anilao, a village community in Liloan, Southern Leyte, were trained by the Department of Trade Industry (DTI) in banana chips processing, a small livelihood enterprise. Attacked by a disease, the supply of banana became irregular and pushed one innovative processor to try other materials like cassava *(Manihot esculenta*), sweetpotato *(Ipomoea batatas*) and yautia *(Xanthosoma sagittifolium* L. Schott). Of these, yautia or *gabi* chips became well-accepted and popular. The other processors followed till a handful of women, the first to popularize *gabi* chips, put Anilao in the native delicacy food map.

Gabi chips processing is a classic case of local innovation by rural women. *Gabi* chips, like the sweetpotato and cassava chips, are crispy snack foods enjoyed by adults and children, are good convenient gift packs, and some nutrient advantage. Other than energy source, yautia contains vitamin C (96 mg/100 g), riboflavin (0.2 mg/100 g), and niacin (1 mg/100 g) (Antoine, 2000). However, random sampling of produced *gabi* chips showed instability of the quality of the chips. What could possibly cause this instability? Conflicts between household processors and farmer-suppliers, and issues on input supply price and stability, product quality, and unfair competition began to surface as orders came. These were challenges and opportunities for researchers, local innovators, and their partner service providers. Without addressing these, losing their markets is simply a matter of time. Yet, the shelved sweetpotato chips technology later was used as basis to optimize the quality of *gabi* chips.

This paper presents the case of the development of *gabi* chips into a promising household-based micro-enterprise, especially by women in Liloan, Southern Leyte (Fig. 2). This is a collaborative project among different stakeholders, which consist of the women processors, supplier-farmers, and support service providers such as the local government unit, LGU - municipal agriculture office, the *Techno-gabay* (technology aid) based at the LGU, DTI and

Department of Science and Technology (DOST). The interdisciplinary research team at PhilRootcrops – Visayas State University (VSU) served as facilitator and coordinator. This collaboration was a learning platform that tested a particular approach (i.e. CI&I), as proof of concept, combined with participatory processes, the livelihood framework, user's perspective and market chain.

Figure 1. Location of PhilRootcrops, and project sites in the provinces of Leyte and Southern Leyte, Eastern Visayas Region, Philippines.

A collaborative project: integration of CPAR and CI&I

In mid-2000, a team of social science and engineering researchers at PhilRootcrops-VSU spearheaded the *gabi* chips collaborative project. They were guided by lessons of previous rootcrop integrated development projects and participatory action researches (e.g. dried cassava flour-grates, sweetpotato-base soy sauce, farmer field schools). The *gabi* chips project was meant to provide proof of concept to the Continuing Improvement and Innovation (CI&I) approach, following from VSU's completed ACIAR-funded livestock program that pioneered the same. CI&I consists of a set of tools that allows incremental improvements with specifically defined targets. Through a participatory

process, clientele and partners identify improvements or innovations; define the activities, measurable outputs and the timeframe to achieve them. The latter is defined in 30-day cycles with a built-in feedback system. The whole process is iterative in nature (Clark et al 2005; Timms et al, 2005) (Fig. 2).

The VSU experience showed that the CI&I approach provides a systematic management of PR&D because of its focused, stepwise implementation. It blends well with community-based participatory action research (CPAR) that is promoted by the Department of Agriculture (DA 2000) by: 1) engaging with various relevant partners in the different phases of implementation; from problem and opportunities diagnosis to monitoring and evaluation; and 2) being clientele-oriented and sensitive to their needs of opportunities and skills to address such; and 3) being open, flexible and iterative yet focused process. CPAR is geared towards greater participation, empowerment and sustainability through: 1) total farm approach; 2) total technology approach; 3) total family approach; 4) total community approach; and 5) market-driven approach.

Integrating CI&I with CPAR tested how the intensive and grounded knowledge generated from the latter could be more useful when mixed with the CI&I analytical and decision tools. This innovative blend was further enhanced with livelihood, users and market perspectives in assessing the relevant households in the context of their social arena. The livelihoods systems perspective views economic activity, such as food processing, in the context of multi-activities of rural households. Implications on resource use especially labour and time among rural women were quite critical in the design of interventions and their own innovations.

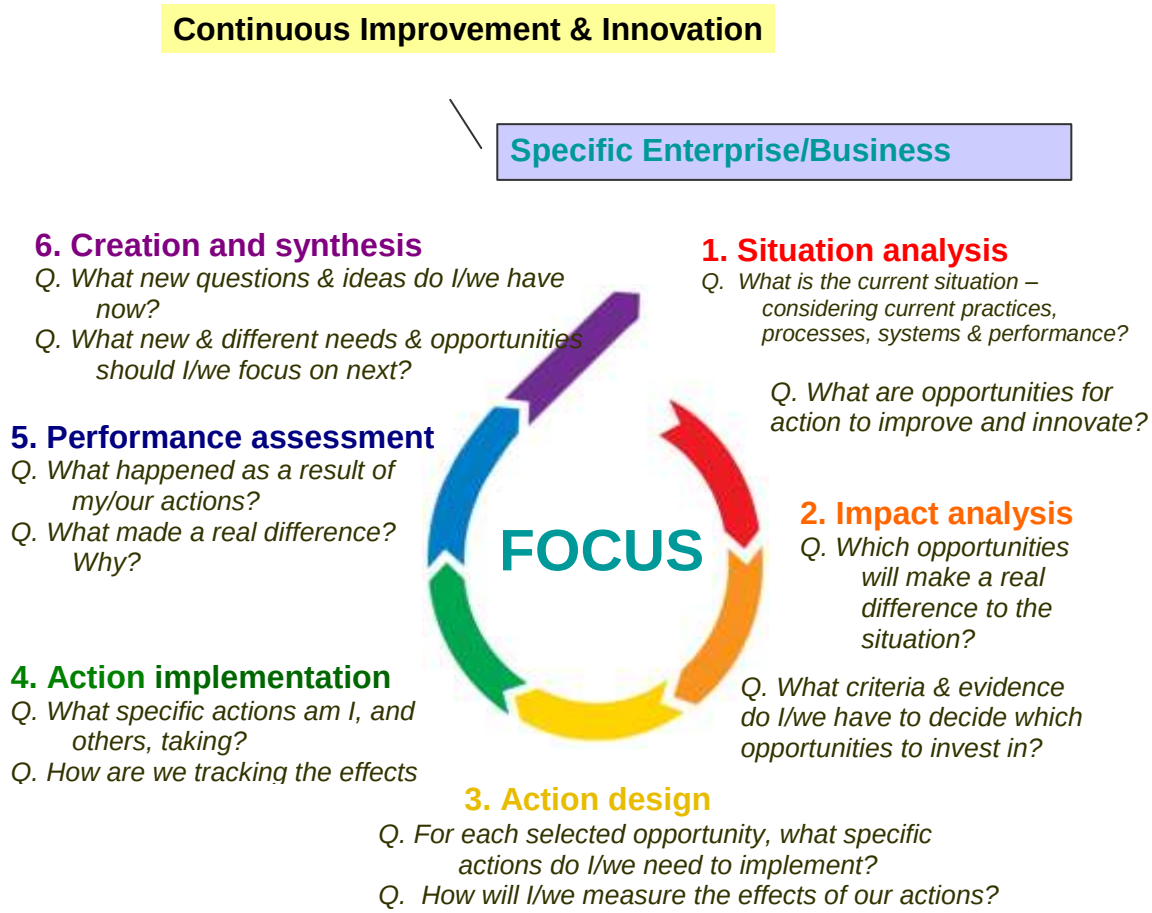
The market chain: an embedded concept in CI&I

The CI&I approach implies that improving the status of any actor (farmer, processor, consumer) along the chain (wherever the entry point in the development process) involves the improvement of each actor along the production-consumer continuum: the market chain. Thus, farmer benefits or processor profits involve value-adding strategies, improved distribution, or reduced costs, from the farm to the ultimate consumer. In CI&I, the different components such as production, processing and marketing constitute different levels of focus for each actor(s) involved, and all innovations are understood to contribute ultimately to improvements in a farm or processing enterprise. Each focus component is a part of the holistic assessment process, the action design; the fit and the timing of each stepwise improvement.

The main objective defined during the situation and impact analyses (Stages 1 and 2) by the processors and other stakeholders was to improve the profitability of the *gabi* chips micro-enterprise of the Anilao food processors by at least 10 percent by the end of the project. A focusing framework was used, which was a simplified step by step analysis of the factors that can improve profitability. In the process, the means to this profitability target was decomposed into product quality (raw material, processing), product presentation (packaging, labeling), and marketing strategies (promotions, market expansion). The CI&I stages summarized in Figure 2, together with the highlights of findings, elaborate the incremental target outputs in 30-day cycles, spread over one-and-a-half years.

In the case of *gabi* chips, the entry point of intervention was the household processor, by increasing the value-added through product quality improvement. Farmers participated in the process through raw material supply negotiation (price, required cultivar), and intervention in the supply chain such as the *gabi* production experimentation in a different agro-ecology by the farmer-scientist of *Techno-gabay*. This is to prepare for a stable and increased supply of *gabi* when markets for *gabi* chips increase. Though not in substantial volumes yet, g*abi* farmers benefit from the chips market and a guaranteed price of their produce. The consumers and the community benefit from a nutritious local delicacy and the prestige from the novelty, respectively.

Figure 2. The basic processes of the Continuing Improvement and Innovations (CI&I) approach



Highlights of findings

The CI & I process

1st 30 days: Orientation workshop, focusing, legitimization, situation and impact analyses

Roles and responsibilities of the different stakeholders were identified during the implementation workshop, and the partnership was legitimized with the Liloan local government by drawing up the terms of agreement. The focusing exercise defined the main target objective on increased profitability, while the situation and impact assessment analyses drew up the means of achieving the expected outputs for each actor: the processors (improved packaging and product quality), the farmers (assured supply of required raw materials at guaranteed price), and the support providers such as the LGU (credit, monitoring, assistance in business licensing), *Techno-gabay* (farmer and market contacts, farmer-scientist experimentation), DTI (packaging, trade fair assistance), DOST (good manufacturing practice (GMP) facility funding), and PhilRootcrops-VSU (product quality optimization, consumer tests and market promotion, nutrient analysis, bar-coding of product, capacity development trainings, over-all coordination and facilitation).

Label and packaging

A new label was designed and a plastic pack of desired thickness (0.02 mils) was used for the *gabi* chips. Since the product is still being monitored for quality and still in the process of optimization, the recommended improvement of packaging using plastic with design was deferred. The current plastic packing of 50-gm with the improved label is still being used until the nutrition facts and bar-coding shall have been completed. These are requirements for expansion to supermarkets.

Production and testing of the chips slicer

The developed chips slicer was tested with the main processor and was shown to have produced the chips of desired standard thickness for quality. However, the slicer was not adapted since it takes time to get used to the process. They have developed the proficiency in using their existing kitchen gadget that is available from the market. Also, the introduced slicer is expensive compared to what they are currently using. This will need further testing. A processor suggested modification for ease in use of the slicer as the present introduction is also more tedious.

Exhibit promotion and support

The exhibit sales in the 2006 Manila trade fair organized by the DTI tested the market effectiveness of the improved label and packaging, and the demand for chips in comparison to the previous year's exhibit. Support came such as the exhibit space rental was paid by the DTI, and the fare of the representative processor-exhibitor was shouldered by the LGU; the processor provided for own subsistence. The LGU also provided seed capital to the six processors who sent their products through the exhibitor.

2nd 30 days: Consumer testing (with shelf-life of chips); up to 60 days

Product quality had to be optimized. Consumer testing was done in the VSU campus with students (three groups: 2nd and 4th year high school and college), mothers and VSU staff. *Gabi* chips produced by six processors were tested for different shelf-life up to 64 days after delivery of chips.

Using a scale of 1-9, the chips were tested with the different groups at VSU (spot sales), and 2, 16, 37 and 64 days after delivery. These were tested for color, appearance, texture, flavor, and general acceptability. With no significant differences among the different group ratings, the averages of the groups were taken, as summarized below:

Table 1. Summary of consumer testing results for *gabi* chips of different shelf-life

Parameters	*Spot sales*	*2 days*	*16 days*	*37 days*	*64 days*
Color	7.1	7.2	7.2	6.9	6.7
Appearance	6.6	7.0	6.8	6.7	6.6
Texture	7.1	7.1	6.6	6.2	6.2
Flavor	7.4	6.9	6.9	6.3	6.1
Acceptability	7.4	7.0	6.9	6.3	6.1

Scale:

1 – dislike extremely	*4 – dislike slightly*	*7 – like moderately*
2 – dislike very much	*5 – neither like nor dislike*	*8 – like very much*
3. – dislike moderately	*6 – like slightly*	*9 – like extremely*

It is clear that the ratings decreased for all parameters tested up to the end of two months. In general, the ratings of 6 to 7 leave much to be desired and should signal the substantial amount of work in terms of product quality and product positioning in the market vis-à-vis the hundreds of available product in the same price range and product type. The selling points for *gabi* chips are its nutrient contribution and social benefits.

The tests were also analyzed as to processor. Two processors emerged as producers of good quality chips because of their higher acceptability ratings.

3rd 30 days: Screening variables for product quality

Using the optimized quality standard of the sweetpotato chips, selected variables were identified that could affect gabi chips. Laboratory test and sensory evaluation were done at the Department of Food Science and Technology.

Variables affecting product quality

Variables considered to influence the quality of fried *gabi* chips were screened using the Plackett-Burman screening experiments for 7 variables. Eight treatments were run to determine the main effects of the following variables:

- Freshness of the roots: about 1-2 weeks from harvest (+); about 8 weeks after harvest (-)
- Elevation of planting area:high in the mountain (+); lowland (-)
- Oil quality: Minola, oil brand (+); ordinary, (-); coconut oil-based
- Thickness of the slices: 3 mm (+); 1 mm (-)
- Temperature of frying: 180^{o}C (+); 160^{o}C (-)
- Frying time: 4.5 min (+), 3 min (-)
- Diameter of the slices: above 4 cm (+); below 4 cm (-)

Each of the 8 runs were prepared according to the procedure of processing the *gabi* chips, which include the following steps: washing of the roots and trimming of undesirable sections such as those with rots and damage, slicing using a lever-type slicer, frying at the set temperature using an electric fryer with frying basket, draining and cooling on paper, coating with 50% sugar solution, second frying and packaging. Table 2 shows the summary results.

The slice thickness and frying time were the only variables observed to have significant effect on the sensory attributes evaluated. Color acceptability was affected by these two variables. Crispiness acceptability and taste acceptability were affected by variables other than freshness of the roots and frying temperature. General acceptability was affected by all variables evaluated except frying temperature.

Out of the seven variables screened for effect on the sensory quality of the product, the slice thickness (1 and 3 mm) and frying time (3 and 4.5 min) affected the color, crispiness, taste and general acceptability of the product; indicating that within the chosen range, slice thickness and frying time had obvious effect on the product quality. Before the project, *gabi* chips processors in Liloan did not standardize product thickness and frying time. Frying temperature range between 180^{o}C and 160^{o}C have no effect on all sensory attributes evaluated, indicating this range produces the desired product quality. Except for frying temperature, all the variables screened were observed to have significant effect on the product quality.

It is important to further verify the validity of the results of this preliminary screening experiment. Also, establishing the variety used in the experiments is necessary in future optimization work which may need to be conducted to establish quality standards which apparently do not exist in the products currently produced by Liloan processors.

Table 2. Summary of effect estimates of selected variables on sensory attributes of sweetened *gabi* chips

Variables	Color	Crispiness	Taste	General
Mean/Intercept	6.31250	6.13333	6.05000	6.21667
Freshness	-0.00833	0.46667	-0.06667	0.01667
Elevation of area	-0.44167	-1.08333	-0.46667	-0.60000
Oil Quality	0.39167	0.51667	0.88333	0.58333
Slice Thickness	-1.09167	-1.21667	-1.61667	-1.36667
Frying Temperature	-0.24167	-0.03333	-0.01667	0.00000
Frying Time	-0.65833	-0.95000	-0.66667	-0.71667
Slice Diameter	-0.39167	-1.10000	-0.61667	-0.71667

Refer to Appendix tables 1-4 for detailed statistical analysis results.

Next 30-120 days: Supply chain and conflict resolution between processors and farmers

Cultivar, raw material sources and price

Four cultivars are grown in the locality, but only the two white cultivars, “nilawaan” and “sawud”, are reported by both processors and farmers as good for chips. Others are good for home use and pig feed.

At the start, farmers in three yautia producing villages had marketing arrangement with the processors. Later, this was reduced to only the village of Magaupas in order to control for the required cultivar, maturity of cormels, seasonal rotation of supply, as well as the elevation of production areas. Magaupas is a major producing area, while Pres. Roxas is a test or experiment area of the Techno-gabay MS. The project team, and the municipal DA through the Techno-gabay monitors supply concerns. The *Techno-gabay* center also facilitates *gabi* raw material and *gabi* chips orders.

Some conflicts relating with the business licensing requirement, personality differences, and raw material purchases from Libagon farmers had to be dealt with. This was resolved by meeting both the processors group and the core farmers from Liloan. Resolving price differences and stressing the importance of raw material quality requirement led to the agreement between the processors and the farmers, as well as the addition of technical assistance and monitoring of farms to the project activities.

Farm technical assistance

Researches on yautia production systems and crop management at PhilRootcrops are insignificant, and much of the knowledge still lay in farmers hands. Soil sampling was taken in the three barangays that were observed to have different agro-ecologies and soil quality. The samples gathered will still be analyzed at the Central laboratory.

Fourth 30-60-day cycle: business planning and implementation

Packaging the business plan

Business plan preparation training was conducted among project stakeholders. The business plan for enterprise development was prepared for the *Techno-gabay* Enhancement Fund for Rural Development. This provides the possibility of improving the processing facility, together with GMP interventions, of the main processing household. This will enable them to establish a facility that can be approved by the Bureau of Food and Drug standards, and the needed S & T interventions in terms of improving quality through improved packaging, nutrient analysis and shelf-life tests. Implementation of the *gabi* chips business plan.

The business plan includes for funding the establishment of a GMP facility, nutrient analysis, bar-coding, and marketing strategies. The establishment of the micro-model Current Good Manufacturing Practice (CGMP) facility for *gabi c*hips will soon be constructed with the approval of the business plan funding. Further DTI has approved the funding of 100 kgs of plastic packs with 3-clour design and provides for a 9 kg- batch of electric fryer, a common service facility (CSF) for other processors as well.. The latter will be evaluated for product optimization.

DOST supports the funding deficiencies in the construction of the CGMP facility through its TECHNICOM (or technology commercialization) funding window.

Some reflections and lessons learned: CI&I, CPAR and the market chain

Farmers first and last? In actual development efforts, it does not really matter, first and last. In the rural and agricultural arenas, what really matters is focusing on the problem or opportunity at hand. The farmer is an important part of the whole systems chain. His benefit is not contributed by his farming or agriculture alone. This phrase is more a “perspective” just as the concept of “poverty”. They are reflective of targets, the ultimate goals of a development endeavour. It is, however, a useful mindset; especially one that conditions development efforts to prioritize “marginalized” farmers. Marginalized producers are those with no or limited access to information and contacts, resource-poor and powerless in dealing with market rules, and do not possess competitive edge.

In the context of the market chain, understanding and improving the response to market opportunities, improving access to information and contacts, appropriate and sustainable raw materials supply and arrangements, and improving markets are critical to ensure the benefits to farmers and other actors. The market chain is a generic framework. It can be embedded in various modes of participatory approaches, capacity development framework, or enterprise building methodologies.

The *gabi* chips case showed that the development pathways promoted by the CI&I approach through a participatory process can result in value-adding at various points in the production-utilization chain: farmers, processors, consumers, service providers. This case presents a development pathway of collaboration among partners to address utilization, market and supply opportunities. Wherever is the development entry point (farm, processing enterprise, marketing) depending on the problem or opportunity, effective partnership can deliver the goods.

The CI&I approach is a way of doing and learning; of skills-building, and has the advantage of defined activities being focused, specific, measurable, and time-bound. The focused incremental improvement(s) designed to lead on to the final goal (defined by stakeholders) improve the likelihood of achieving results by each actor because the progression at each step and the targets are clear and doable.

As proof of concept, all the identified value-adding activities from farm to market in support of the *gabi* enterprise were achieved in just about one-and-a-half years. The business plan is now on-going implementation, which mainly benefits the household processors and the supplier-farmers. The facilitators and support service providers have greatly learned from the process, with inter-agency collaboration strengthened and spillover technical assistance to micro-enterprises in other communities already planned (e.g., bar-coding, nutrient analysis, CGMP, packaging, common service facilities).

"Knowing the goal is one thing. Knowing how to get there is another."

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