Participatory approach in improving agro-enterprises in Duong Lieu Commune, Vietnam

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Duong Lieu village, located 20 km west of Hanoi,began cassava and canna starch processing in the 1960s, and rapidly expanded since the 1980s due to its proximity and access to Hanoi's growing markets. A comparative study of the two starch production systems showed that the processing technology of each rootcrop was appropriately developed in accordance with root quality, starch properties, and profitability. The major constraint to the production system was not related to technology, but the confined space as a result of being located in a peri-urban area where land is limited. While the peri-urban location provided the opportunity of markets, the limited available space was a constraint in expanding operations. This constraint was further exacerbated by several associated enterprises that developed around, or in support of, the starch processing enterprises. The confined space has caused wasted labor as processors spend hours daily queuing up to procure roots. It has also caused low starch quality as there was limited space for adequate filtering systems or for starch drying. Another major problem caused by the confined space was the environmental pollution that has plagued all residents. The constraints and problems were clearly recognized by the commune during a stakeholders' meeting, but solutions were elusive. A visit to some processing villages in the south was organized for some commune officials, machine manufacturers, and processors to brainstorm for solutions. They came back with the idea of setting up an organized processing zone outside the village. A follow-up visit to a sweetpotato starch processing zone in China was planned so that the commune may learn how to implement the idea.Through this process, the stakeholders were empowered to solve their own problems with the production system.

Dong Lieu commune in Hay Tay province lies some 20km from Hanoi. The area is traditionally agricultural but has, since the late 1960's, specialized in household-level rootcrop - cassava and canna - processing due to its proximity to Hanoi and access to its growing markets. Since then, processing capacity has increased 3-10 times, an average of 600 percent increase over 15-25 years. Average cassava processing has increased from 0.05 t/hh/day in 1978 to 3 t/hh/day in 2001, while average canna processing has increased from 0.04 t/hh/day in the 1960's to 9 t/hh/day. Thus, the volume of roots handled by each trader has increased by 200-300 percent in recent times. Of the 2,193 households in the commune, 1,410 households (64 percent) are directly involved in rootcrop processing, while others supply raw materials, trade end products, use processing by-products, or provide a wide range of support services. On average, pig raising using the residue from cassava processing as a major feed ingredient is a common supplemental livelihood activity in rootcrop processing households (1,409 or 64 percent of households raise pigs). Only 4 percent of the households obtain a livelihood mainly from crop production (Table 1). In the 2000/1 processing season (around September to April) the commune processed 680 tons of cassava roots and 314 tons of canna roots daily.

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Table 1. Household types in Dong Lieu, defined by their main economic activity.

Household type	Number	Percent of households in commune
Agricultural production (only)	98	4
Cassava processing	656	30
Canna processing	143	6
Starch filtering	300	12
Maltose production	146	6
Noodle production	150	6
Other	786	36

Why and how the technologies were developed

The cassava and canna processors developed two different sets of processing technologies due to differences in the nature of these two types of roots, the differences in the properties of the two types of starch, and the different levels of profitability of the two types of starch. Cassava starch contains cyanide. Thus, for food safety, the skin must be peeled, and peeled roots must be washed well (Table 2).

Cassava starch has small particles, which makes it easy to extract; therefore, until 2001, most processors separated starch by hand, and only one separation was enough (Table 3). This particle size also has implications for the length of time the starch settles, the drain hole size, and thus, the length of time it takes to drain. On the other hand, canna starch is more difficult to extract due to the large size of its particles. It is usually separated by feet action, which applies one's body weight to extract the starch. It requires less time to settle and less time to drain. An interesting technology employed by the cassava starch processors is the use of a layer of ash on a piece of cloth laid over the starch in order to draw out the moisture. Once the starch is sufficiently dry, the ash is taken outside, along with the cloth, to dry.

Profitability has also affected the development of technologies used for cassava and canna starch processing. Processors were more willing to invest in canna starch because it provided higher profits, at least until 2001 (Table 4) when larger buyers from the south came to Duong Lieu in search of cassava starch for industrial purposes. Once cassava starch began to yield higher profit, separators for cassava starch emerged. Until then, the separating machines were generally purchased for canna processing. In addition to investing in separating machines, some processors were observed to employ the "sour-liquid method" (a method of applying a certain amount of the used processing liquid to balance the pH level of the settling water), and a starch stirring machine, both of which were designed to improve extraction rates (Table 5). Such elaborate processing procedures have not been applied to cassava starch processing.

Table 2. The nature of cassava and canna roots and the implications for processing methods.

	Nature of roots	Implications for processing
Cassava	Contain cyanide Roots uniform in shape	• Must be peeled to get rid of cyanide • The shape makes peeling easy • After peeling, roots need to be washed well, so a simple washer was developed
Canna	Do not contain cyanide Root are sinuous	• Roots do not need to be peeled; also, they are not easy to peel • Simple wash is sufficient and no machine is used to wash

Table 3. The different properties of cassava and canna starch and the implications for processing methods.

	Starch properties	Implications for processing
Cassava	Small particles Compact starch	• Due to small particles, easy to extract; until 2001, most processors separated starch only once by hand. • Needs 8-12 hours to settle. • Due to small particles, the drain hole must be small and takes 12 hours for water to drain. • The starch is compact and thus, difficult to draw out the moisture. A layer of ash over cloth used to draw out moisture after draining.
Canna	Large particles Not very compact starch	• Due to large particles, difficult to extract; when extracting manually, often separated by feet action, applying body weight. • Need to extract twice to extract most of the starch. • Takes only 3 hours to settle. • Since particles are large, the drain holes can be bigger and takes 4 hours to drain. • No need to draw out moisture after draining.

Table 4. The prices of cassava and canna roots and starch, and profits in 2000 and 2001.

	Roots (VnD/kg)		Starch (VnD/kg)		Profit (VnD/kg)	
	2000	2001	2000	2001	2000	2001
Cassava	450	390	900	1,100	(-)100 - 0	233 – 300
Canna	700	565	3,000	2,400	200 - 500	(-)140 - 382

Based on 45-50% wet starch conversion rate for cassava and 25%-28% for canna.

In summary, the processing procedures for cassava and canna are quite different from one another as the processors in Duong Lieu developed technologies appropriate for the distinct nature of the roots and starch of each rootcrop, and for the different levels of profitability (Table 6).

The constraints—how they emerged

As starch processing developed, a starch-based cluster of enterprises emerged in support of, or in association with, starch processing (Table 7). The ever-increasing enterprises are packed in the small village area with little space to operate and no space to expand (Figure 1). The major constraints facing the starch processors are not the technologies, as they are developed appropriately, but the limited space and the constraints to production associated with it.

Table 5. The difference in profitability of cassava and canna starch and how it has affected the development of processing methods.

	Profitability	Implications for processing
Cassava	Starch prices were generally low until 2001	• Processors did not invest in separating machines and most separated starch by hand until prices became higher in 2001.
Canna	Due to the popularity of canna noodles, canna starch prices are generally higher	• Most processors invested in separating machines; those who did not, separated 2-3 times to increase extraction. • Some were willing to invest in "sour liquid" (i.e., to balance the pH level) and stirring machines to increase extraction.

Table 6. Differences in cassava and canna starch processing procedures.

	Cassava	Canna	Reason for difference
Peeling	Peeled	Not peeled	Nature of roots
Washing	Washed well by machine	Roughly washed by hand	Nature of roots
Separating (starch extraction)	Separate once either by hand or by machine	Separate 2-3 times either by feet or by machine; may use “sour liquid method” and a stirring machine	Starch properties Profitability
Settling	8-12 hours	4 hours	Starch properties
Draining	12 hours	3 hours	Starch properties
Withdrawing moisture	With ash	None	Starch properties

Table 7. Number of households engaged in different enterprises in Dong Lieu.

Household Activity	No. HH
Cassava starch processing	630
Canna starch processing	141
Cassava starch filtering	311
Cassava root grating (service)	59
Canna waste drying for sale	209
Canna waste filtering	32
Maltose production	146
Canna noodle production	65
Sugar processing	2
Rice noodle production	86
Candy production	32
Tofu production	8
Processing solid waste trade	11
Cassava/canna root trade	33
Rice production for maltose	3
Agricultural labor for hire	201
Industrial labor for hire	91
Green bean processing	15
Mushroom production	12
Pig raising	1409
Alcohol production	21
Tile cutting	2
Drying cassava waste (fuel)	432
Others (including services)	847
Total no. of activities	4798
Total no. of households	2193

As starch processing activities increased over the years, the procurement of the raw material (i.e., the roots) became increasingly problematic as the village was not set up to accommodate root trading in an organized manner. Since the village is packed and the interior roads are too small to be passable by truck, all root trading must be handled in one market location. During the processing season, the women queue for hours (some say for 3-4 hours) to obtain roots, then push/pull the heavy cart load back home, which can be a fairly long journey. Thus, much time and labor is wasted in root procurement. Moreover, there is also limited space for drying starch or starch sheets for noodles, so many processors push cartloads of products to the fields and spread them out to dry in the morning and return in the afternoon to collect them. Again, depending on the location of the house in relation to the field, this can also be

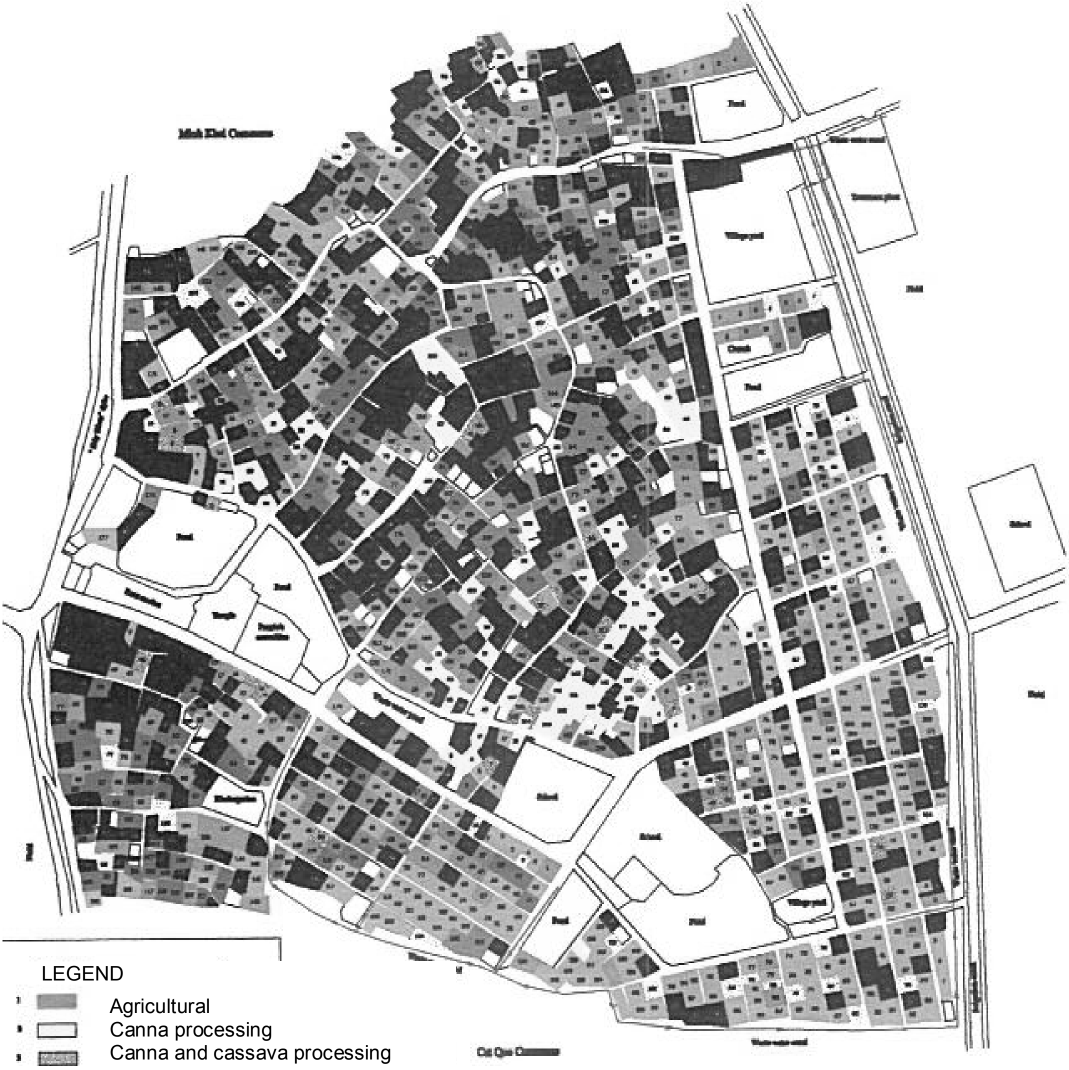

Figure 1. Starch processing areas in Dong Lieu.

a time-consuming activity. The limited space also contributes to low starch quality as there is not enough room to set up settling tanks. Starch quality is further adversely affected by drying on the very dusty or muddy roadside, as there is limited space available for drying. Thus, the limited space has resulted in serious labor wastage and low starch quality.

In addition to the adverse effects it has on production, the confined space has caused another serious problem—environmental pollution—as starch processing generates a large amount of wastewater and solid waste. On average, processing one ton of cassava roots generates 10.7 m^3 of wastewater, while processing the same amount of canna generates 12.9 m^3. Duong Lieu processed 75,000 tons of cassava roots and

50,000 tons of canna roots during the 1999—2000 processing season, generating almost 1.45 million m^3 of wastewater. At the same time, an average of 47 percent of cassava roots and 33 percent of canna roots become solid waste material. Thus, in the 1999 – 2000 season, an estimated 51,750 tons of solid waste were generated.

Nearly all of the inhabitants in the processing villages said that the solid waste smelled and looked bad. Almost all of the non-processors thought that the decomposing waste was harmful to their health and 84 percent of the processors even admitted so. Most of the people in the processing village have had solid waste dumped in front of their houses, which has been a source of conflict among the residents. The most notable impact in the non-processing village was wastewater in canals flowing by the non-processing village. The residents in the non-processing village complained about the pollution and bad smell in their village associated with activities in the processing villages, and pleaded for solutions.

Policies, training, and support for enterprise development

After an extensive study of the situation and a stakeholders' meeting with the commune leaders and processors, limited space, wasted labor, and environmental pollution were clearly recognized by the participants as the major constraints to the development of their enterprise. During the meeting, no viable proposals emerged. The constraints were evident, but solutions were elusive.

A trip to Dong Nai Province in southern Vietnam to visit some medium-sized processing enterprises was organized and funded by the project for Duong Lieu in the hope that it would generate some ideas for overcoming the constraints facing the processors. A five-member team from Duong Lieu – two small processors, one large processor, one processing machine manufacturer, and one commune official in charge of local enterprises – was organized to travel to Dong Nai. The team visited two processing communes in Tra Co and Bui Chu where they observed production systems in which processors were fewer than in Duong Lieu, but with larger scales of production, processing 20-30 tons of roots per day. More modern and advanced technologies were used by these medium-sized processing enterprises to produce higher-quality starch. In addition to starch, they also produce a wide range of starch products for export. However, the two aspects of the production systems that impressed the Duong Lieu delegation the most were the continuous filtering tank system which accounted for the high quality of the starch and the way the wastes were processed or disposed.

Upon returning from the visit, the commune brainstormed on the idea of creating a processing zone in Duong Lieu. This idea was derived from the need to create a space to accommodate the continuous filtering tank system and a better-organized processing setup. In the discussion with the Duong Lieu delegation it became clear that the processing zone they envisioned was very similar to the processing setup in Pingying County in Shandong Province in China. The processors in Pingying County rent space during the processing season in a processing zone that is set up on both sides of a major road. This allows the root trucks to drive up to each processing site and deliver the roots right to the processor. Each processing site has enough space to set up sufficient quantities of processing machines such as washers, separators of sequential extraction density, numerous settling tanks, and areas for starch draining and drying. Each processor has access to wells and clean sources of water in order to ensure starch quality. Furthermore, the starch collectors can drive down the road and purchase starch from the processors on both sides of the road to further save the starch processors from taking their products to the market.

Since the visit to Dong Nai led to a major breakthrough in enterprise development, a follow-up visit to Pingying would likely provide the necessary support in implementing the idea generated from Dong Nai. A study trip to Pingying would provide training for special processing zone development and management so that Duong Lieu may draw on the lessons learned from the Pingying experience. This may begin with a study tour by the commune official from the Department of Land Use Planning which is to take charge of designing the zone. Duong Lieu can further benefit from the experience in Pingying in organizing the processors for setting up the processing zone. The machinery and processing technologies in general may also need to be modified or upgraded to match the new production system in order to increase efficiency. This is another area in which the Duong Lieu machinery manufacturer may learn from the Pingying processing system. Finally, Duong Lieu can take lessons from Pingying about how its processing zone manages the voluminous waste generated during the short processing season.

Conclusions

The improvement of an agroenterprise – whether urban, peri-urban, or rural – requires the precise identification of problems and constraints. In the case of Duong Lieu processing, the processing technology was developed appropriately and effectively. The improvement lies in the peri-urban nature of this village, which, owing to its confined space, has limited space for production and little potential for expansion. The solution was generated by the commune itself after observing a similar production system and comparing it with the constraints they face. Concrete steps toward a solution may take form in another visit to a similar processing zone. This is a case of an innovative and participatory approach to empower the local population to solve problems and overcome constraints.