Client-led Agro-industrial Action Development: The Case of Cassava Starch in Cauca Valley, Colombia

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A B S T R A C T

When complex organizational, institutional, technical (production, processing) and market constraints and needs are being faced by limited resources, innovative R&D methodologies are required for appropriate, efficient and effective solutions.

In 1996, more than 200 cassava starch processing households were being faced by a myriad of problems regarding their small agro-industries, resulting in poor social & economic conditions. This was further aggrevated by serious public order problems due to violent actions of "*guerilla*" groups throughout Cauca Valley, Colombia. Demands for intervention from farmer/processor groups and local institutions led to an innovative R&D action plan.

Several principal approaches were combined for this R&D action plan: *(i) integration of the principal actors and activities in the production to consumption chain; (ii) integration of client opinions with expert analyses; (iii) prioritization and consensus among stakeholders; and (iv) optimization of project resources efficiency.*

Rapid industry inventory, sampled technical surveys, focus group sessions, market analysis, concensus seeking partner workshops together with a frequent information feedback system generated a set of collaborative project proposals acceptable to and co-owned by all partners. Three out of four sub-proposals have already been financed and are currently being executed.

This paper, first, lays out the background conditions of Cauca Valley, followed by a discussion on the basic R&D approaches and participatory needs/opportunities assessment methodologies used. Then it summarizes the principal and most relevant findings, and concludes with summing up the advantages of the used combination of approaches and methodologies.

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Introduction

The Cauca department is a valley situated in the South-east of Colombia, near the Pacific Coast. Its population is multi-racial and pluri-cultural, where indigenous people, from the Paez and Guambiano tribes cohabit next to white, black and mestizo people. This department consists mainly of mid-altitude mountain ranges. The Pan-american highway connects the principal urban centres in this valley. Agriculture is the main economic activity, represented by extensive landholding for cattle raising and low input small hill-farms.

Cauca Valley hill-farmers have been suffering from a wide variety of problems, some of these for a long time, others more recent. Low crop yields, poor technical assistance and infrastructure, unstable markets and prices, and security problems due to *guerilla* activities are among the most serious constraints. Complex production systems have been both subsistence and market oriented. Besides beans, sisal, maize, potatoes, vegetables and fruit crops, cassava has traditionally played an important role for home consumption, as a market crop, or as raw material for small scale starch processing. Sour starch of irregular quality is traditionally used in the fabrication of typical bakery snacks like *pan de bono* and *bonuelos*. While cassava processing is a popular activity, the small scale industry suffers from a wide range of problems among which low product quality and processing technology, raw material availability, market access, credit and fluctuating prices, are most evident.

Past and on-going production and processing oriented technological interventions from national and international project activities have had impact, but the levels and details were unknown. A small processor cooperative was formed in the late 1980's, but has been operating at the margin for a small number of members only. Demands for technical assistance by local farmers and processors, directed to various local institutions, became more frequent and more vocal. By mid-1995, a first meeting was held between representatives of NGO's CETEC, Corpotunia, Fundacion Carvajal, and international agencies CIAT and CIRAD, to discuss options of possible strategies to act on the local farmer's demands.

This paper proposes an approach to better integrate the main stakeholders' activities in developing an action plan, following a set of basic principles. Then it discusses methodologies to efficiently and effectively combine secondary and primary data collection followed by a process of prioritization and consensus seeking; it discusses the key findings, which lead up to the main conclusions.

Hypothesis and Objectives

The adopted hypothesis was that a development action plan targeted at the cassava-processing industry with forward and backward linkages, needs to be based on past performance, current constraints and opportunities, and a client-driven prioritization and consensus seeking process.

While the project's longer term goal is the sustainable improvement of the socio-economic and environmental conditions of small farmers and processors in the Northern Cauca region of

Colombia, specific shorter term project objectives included (i) to assess the impact of past R&D interventions on the industry, (ii) to identify and prioritize principal needs and opportunities facing the sector, and (iii) to formulate and implement an action plan for sustainable development of the industry and its principal actors.

Principles, Methods and Activities

The literature evidences a large variety of approaches and methodologies that have been used for sector assessments. These range from extensive, resources-intensive, structured, formal household surveys representative of a whole region, to the more rapid and less resources-intensive, informal surveys or sondeo's (Fujisaka, 1991; Chambers, 1985; Henry and Howeler, 1996).

Given the complexity of issues, available project resources and existing socio-economic, financial, political and institutional conditions of the region and its co-inhabitants, and given the recent successful experiences by CIAT with adoption and impact studies coupled to integrated R&D projects, a combination of approaches was proposed (Gottret et al, 1998) that were translated into a set of leading principles: (i) integration of the principal actors and activities in the production to consumption chain; (ii) integration of client opinions with expert analyses; (iii) prioritization and consensus among stakeholders; and (iv) optimization of project resources efficiency. These principles, in turn, have been driven the *client-oriented R&D formulation* (rapid industry inventory and assessment, formal sampled surveys, focus groups, and consensus meetings) and *integration of sector level analysis*, regarding production, processing, market and organization aspects. The suggested principles and methods have resulted in a subsequent program of concrete activities, including:

(1) *Assessment of all pertinent secondary cassava sector information*

Departmental and village-level historical production and market statistics were complemented with a 1988 technological assessment of the sector (Chuzel and Muchnik, 1993; CETEC, 1994) and an industry analysis (Chacon y Mosquera, 1992), in order to identify key information gaps, forming the base for additional primary data collection needs.

(2) *Formal, structured industry inventory and rapid technical assessment*

- Inventory of the processing industry population based on a short formal questionnaire regarding socio-economic, administrative, management and technical aspects and principal constraints of cassava production and processing;
- Technical assessment by experts;
- Analysis and ex-post stratification of processors into main 5 technology levels.

(3) *Formal feedback of preliminary results to stakeholders*

Preliminary results from secondary and primary information of the sector were analyzed, organized and fed back to farmers/processors by way of distribution of a short and simple leaflet (readily understandable for most that could read).

(4) *Focal group sessions by 5 technology levels*

For each technology level, focus group discussions, consisting of 10-15 men and women producers/processors, were organized to (i) validate preliminary industry information (as mostly contained in the leaflet), (ii) prioritize principal industry constraints, (iii) to propose and discuss possible solutions to priority constraints, and (iv) qualitatively assess adoption and impact aspects from past technology introductions. Focus group discussions were also organized for starch consumers (bakery and snack-food industries) and technicians (from NGO's, R&D and extension agencies).

(5) *Formal impact survey applied to industry population sample*

Per technology level a sub sample of households were surveyed to quantitatively assess socio-economic impact aspects of past cassava production and processing technology introductions.

(6) *Inventory of available technologies*

Based on the integration of user perspectives and expert analysis results, government, finance, development and research institutes, local NGO's, and international R&D institutes, develop an inventory of readily available potential technologies, that can be offered to the region, as part of a sector and community action plan.

(7) *Consensus meeting with stakeholders*

"Demand side" principal constraints and opportunities, and "supply side" potential technologies are presented, analyzed, discussed and prioritized during a plenary meeting with participation of pertinent sector stakeholders or their representatives. Representatives of donor agencies take already part in this process. A consensus is reached on priority issues, future project topics, partners and participation.

(8) *Participatory formulation and negotiation of action plan proposals*

In a fully participatory fashion, chosen project topics are further developed into project proposal concept notes that are subsequently presented for technical, institutional and financial negotiation with potential national donor agencies, some of the latter having been part of the proposal development process.

Key Results

The majority of the results from the first 3 sets of activities, especially the sector inventory and characterization aspects, have been written up, published and/or fed back to the principal sector's stakeholders (Gottret et al., 1997; CIAT, 1995). Since both the methodology and the resulting information are rather straight-forward for the latter aspects, and for the sake of brevity, only the main results from the last 6 activities will be highlighted here.

Past adoption and impact:

Ex-post technology adoption and impact information can serve a number of uses and audiences (Gottret and Henry, 1994). In the context of the project's objectives, these activities aimed to generate information regarding (i) past technology adoption levels, technology sources, reasons for adoption and characterization of the type of adopters, and (ii) what population groups of the cassava sector have benefited from past technology adoption and by how much. Technologies that had been introduced in the past included improved cassava varieties and technical/organizational processing interventions (Gottret et al., 1997).

Table 1 summarizes the main results from an econometric model[1] measuring the effects of socio-economic variables (of producers/processors) on the level of technology adoption. These results show that adoption of variety "*Algodona*" and, improved washing and extraction equipment have relatively higher adoption levels than the other two technology intervention packages.

Also, the availability and make-up of family versus contracted labor has a strong influence on the adoption of improved (mechanized) processing equipment. In addition, the adoption of sedimentation channels (yes or no combined with unit organization by gravity) is highly influenced by direct sales to consumers, and by being a member of the cooperative. Other results (Gottret et al., 1998) show that, in this latter case, most adopters are related to larger and more capitalized processing units. It is surprising that only technical assistance has significantly affected the adoption of the recommendation of mixing varieties for processing. Furthermore, it is evident that processor's formal education levels do not really influence technology adoption in this case, as is mostly assumed in general adoption theories.

Results regarding the sources of technology (introduction) are somewhat inconclusive since the majority of adopters mentioned that "they had first seen the new technology in somebody else's processing unit", implying a processor-to-processor transfer process. Only to a minor extent did adopting processors name specific agencies or persons, as the source of technology introduction.

Ex-post technology impact was estimated using an economic surplus model as described by Alston et. al, (1995). The results show that technology adoption by the Cauca cassava farmers/processors, during the 1988-96 period, totalled 10.4 billion pesos (10.4 million US$). More relevant to this study is the further result, that 78% of this benefit stream accrued to cassava farmers and processors, while the remaining 22% benefited the consumer group, i.e. bakery and snack-food industries and their clients (Gottret et. al, 1998). Hence, firstly, past production and processing technologies have had a significant economic impact, and secondly, the majority of benefits reached the targeted population. These and aforementioned important adoption and impact findings serve to better focus the current action plan.

[1] For full specifications of the model that simulates the logistical adoption curve, and the resulting detailed results, see Gottret et al., 1998.

Consensus on priority constraints:

Key information regarding sector constraints has been generated from (i) user observations in formal surveys, (ii) discussions in focal group sessions, and (iii) expert analyses from primary and secondary data. The challenge has been to integrate these sets without losing degrees of representation of its specific origins.

Table 2 shows the results of the questionnaire's user observations, post-stratified by processing technology level. The major common problems are shown to be lack of working capital (and credit), raw material (roots) scarcity, product price fluctuations, and marketing issues. Of minor common importance are technical and/or equipment issues. It is important to note that contrary to other levels, the larger processing units (mostly of level 5) do not seem to have major capital or credit problems.

When comparing the latter results with the information generated during focus group sessions, (Table 3) relative priorities seem to be somewhat different for the whole industry and by technology level, especially regarding the relative importance of working capital, root supplies and marketing issues. Nonetheless these variables still remain of major importance to most.

These two sets of relative constraints are complemented by expert analysis of key technical and financial variables, as shown in Table 4. These results show, in a nutshell, the productivity and profitability differences between levels of technology. Both starch conversion rates and processing costs figures, for low and medium technology levels, have a significant potential for improvement. Also, while the benefit/cost indication for the medium and high technology levels seem reasonable, it needs to be noted that if the average rate of inflation (19-21%) is included, only high technology level units are profitable in real terms.

The different sets of constraints' information from producer/processors, consumer industry and experts (technicians) were combined into one table (Table 5) in order to facilitate discussions between stakeholders. From this table the relative priorities for each group are very typical to its specific interests. While no attempt was made to formulate a single set of priorities, a consensus was reached that the main obvious issues should be incorporated in the project proposals, to be formulated.

Action plan formulated, presented and negotiated:

Once agreement was reached on priority issues, the next step was to integrate producer and processor's suggestions for solving high priority problems with available state of the art technological and other interventions. This participatory process generated a set of possible packages that were presented to a meeting of principal stakeholders. Once the project overall goal and objectives were formulated, 4 separate sub-project project proposal concept notes were developed, focusing on production, processing, marketing and organizational aspects (including policy and credit issues). Different partners received coordination and collaboration roles, depending on relative comparative advantages. The full integrated project proposal titled "*Propuesta Regional para el Norte del Departamento del Cauca: Desarollo de la Agroindustria del Almidon de Yuca*" was co-signed by 8 development partners and presented to potential Colombian donors in July of 1997.

The importance of integrating potential donor agencies at an early stage in the project formulation process, bore fruit in that 3 out of 4 sub-projects received formal finance notification within 6 months after proposal submission.

Conclusions and Discussion

While it is still too early to make an overall *ex-post* evaluation of the project, since the majority of sub-projects only commenced execution during 1997-98, several positive aspects regarding project identification and formulation approaches have already become clear and can serve here as conclusions.

(1) The approach of integrating cassava production, processing, market and organization (production to consumption) aspects (and actors) during the identification and formulation phases of the project leads automatically to an integrated project that in turn leads to a sustainable and balanced whole sector development, optimizing the expected impact from different technologies. As such, raw material (cassava roots) from improved varieties will be processed using less and higher quality water, in processing units with a higher efficiency, whereby effluents are being recycled into value-added sub-products (with less environmental damage). Improved final products (at lesser per unit costs) will be sold through an efficient and effective marketing cooperative, reducing price fluctuations and marketing margins.

(2) A full client orientation or user-led R&D approach optimizes the appropriateness of user needs and subsequent technology selection, adaptation, and adoption. This participatory involvement of the project's major clients optimizes co-ownership and therefore contributes to clients' technology adaptation, adoption and diffusion.

(3) Frequent information feedback and consensus seeking among stake holders creates additional integration and co-ownership, and hence, improves project resources efficiency.

(4) The combination of user perspective/expert opinion and formal/informal data collection techniques combines an efficient collection and analysis of qualitative and quantitative data from technology suppliers ("experts") and technology demanders (users), covering both sector problems and opportunities.

(5) The integration of adoption and impact study results with problem identification and prioritization activities can directly help focus a project regarding technology transfer agents, methods and preselect specific project audiences for targeting expected benefits.

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Table 1 Estimated effects of socio-economic variables on technology adoption of the cassava starch industry in Cauca, Colombia

	Logistic function for the adoption of :			
	"Algodona" variety	Processing with mixture of "Algodona" and "Raya 7" var's	Improved washing and extraction equipment	Sedimentation channels +/- unit organization by gravity
% of adopters	36.6	19.3	42.1	17.9
Probability of adoption (%)	0.63	0.93	0.41	0.04
	Estimated parameters:			
Ease of Market Access				
Distance from unit to main highway	-0.97 *** [a]			
Direct sales to consumer				2.25 ***
Type of Manpower Used				
% of women or children labor	-2.24 ***		-2.02 ***	
% of contracted labor			1.35 ***	
Processor Characteristics				
Years of formal education				0.13 ***
Does also grow cassava		-1.82 ***		
Is member of the Cooperative				2.10 ***
Institutional Support				
Receives technical assistance		1.39 ***		

[a] *** significanse level $\alpha \leq 0.05$
** significance level $0.05 < \alpha \leq 0.10$
* significance level $0.10 < \alpha \leq 0.20$

Table 2. Questionnaire results on cassava industry constraint and their relative importance (as % of total respondants).

Constraint	Level 1	Level 1	Level 3	Level 4	Level 5
Working capital	23.7	25.8	19.3	17.0	3.7
Root availability	2.6	6.5	16.1	10.6	25.9
Product price fluctuations	7.9	16.0	11.3	4.2	3.7
Marketing problems	2.6	6.5	9.1	10.6	3.7
Water availability	5.3	3.2	3.6	8.5	7.4
Lack of drying floor space	7.9		4.4	4.3	3.7
Need to change installations			2.9	4.3	7.4
Lack of machinery	18.4		0.7		
Other	31.6	41.9	32.5	40.4	44.4

Table 3. Results of focus group sessions on cassava industry constraint identification and priorization.

	Priority by technology level			
Constraint	**Level 1 & 2**	**Level 3**	**Level 4**	**Level 5**
Lack of appropriate equipment	1	7	-	-
Starch marketing problems	2	3	1	1
Lack of working capital	3	2	2	-
Lack of clean water	4	5	6	7
Lack of farmer unification	5	4	-	5
Low root quality	6	6	4	6
Low root availability	9	6	7	4
Low starch quality	-	1	3	2
Residual water problem	-	8	5	8
Lack of training	-	-	8	3

Note: 1 = highest priority; 9 = lowest priority

Table 4. Processing, conversion rates and profitability indicators of the cassava starch industry in Cauca, Colombia, 1996

Parameter:	Tecnology level		
	Low (36 units)	Medium (140 units)	High (32 units)
Sample seize	10	23	14
Roots to starch conversion rate	5.3	5.0	4.6
Unit starch production (MT/yr)	24.5	82.6	205.6
Total processing costs ($Col/kg)	817	719	669
Gross profitability %	6.9	28.0	44.9
Net profitability %	-5.1	20.6	39.0

Table 5. Integration of different sets of information regarding the relative importance of cassava starch industry constraints.

Constraint \ Information source	Sources of constraints' information			
	Processors (questionnaire)	Processors (focus groups)	Consumer Industry	Technicians
Marketing	H	H		
Starch quality	L	H	H	H
Capital/credit availability	H	H		
Organization aspects	L	M		
Raw material availability	M	M	H	H
Equipment & installations	M	M		
Quantity and quality of water	L	M		
Residual water contamination	L	L		H
Product quality training		L	H	H
Product price stabilization		H	H	
Lack of policies				H

Note: H=high, M=medium and L=low importance