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Implementation of a Traceability and Certification System for Non-genetically Modified Soybeans: The Experience of Imcopa Co. in Brazil

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Abstract

This paper analyses a productive opportunity taken by a family-owned Brazilian soybean crusher (Imcopa) as it adapted its production system to sell certified non-GM soybeans products. Imcopa was Brazil's first soybean crusher to implement a non-GM soybean traceability and certification system, in 1998. It is now held to be the world's largest non-GM lecithin exporter. The analysis adopted here is based on a microeconomic perspective of productive opportunities identified by the firm, which goes beyond a simple balance-sheet approach. Four fundamental elements were used to guide the analysis: benefit-cost ratio; information asymmetry; bounded rationality; and company's growth. The possibility of selling non-GM soy and soybean products on the international market has provided Imcopa with access to an even broader commercial network of feed and food products. This has given the company a better outlook on why it should diversify its activities and intensify its pace of growth.

Keywords: non-GM soy, cost, benefit, traceability, certification

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Introduction

Imcopa – Importação, Exportação e Indústria de Óleos Ltda. was Brazil's first soybean crusher to implement a soybean traceability and certification system for non genetically-modified (non-GM) soybeans and products in 1998. As a pioneer, the company has expanded rapidly over the past decade, with invoicing up from $70 million USD in 1998 to nearly $1.3 billion in 2008. Growth came not only from the emergence of a profitable non-GM food market niche, but also from the identification and exploitation of new production opportunities related to that niche.

This article analyses Imcopa's experience in implementing a traceability and certification system for non-GM soybeans and products. Our analysis goes beyond a neoclassical approach based on an economic-financial diagnosis for a company seeking to optimize its resources in a substantive rational manner. We set out to shed light on a medium-size, family-owned company's decision-making process in a market dominated by major transnational's and how investments could create a novel market niche for both domestic and export markets. While this market niche was being created there was a lot of incertitude concerning non-GM labeled products and the viability of investments, despite the fact the social resistance against genetically modified organisms in Europe became a central issue in the international trade between the United States and the European Union. In such context, this study follows the company's decision making logic in the context of uncertainty by which the agents looked for new productive opportunities.

We use an analytical framework that examines the costs and benefits of a given investment in which the parameters for decision making evolve with short-term and structural changes in supply and demand. These changes are caused mainly by the dynamic nature of technology; a company's learning process, the discovery of new opportunities for production and institutional changes regarding the regulation of technology. Our analysis discusses four major aspects, by following an historical approach of the company: the bounded rationality of players in decision making; the asymmetry of information related to an uncertain environment; the business benefit-cost ratio; and the production opportunities identified by the firm based on the entrepreneur's own image of the environment in which he operates.

The data collected for this study came from interviews with Imcopa's Director of Operations in three different periods: first in 2006, as part of a survey done by the Co-Extra Consortium[1]; and then in 2008 and 2009, in order to update and expand the company's experience in a new situation as the non-GM soybean market has consolidated both domestically and internationally.

Section 1 presents a brief theoretical review relating to a firm's investment decisions under conditions of uncertainty and asymmetry of information, in the specific context of the food market. Section 2 describes Imcopa's profile as a producer before and after the implementation of its system for tracing and certifying non-GM soybeans and soybean products. Section 3 briefly characterizes the tracing and certification system and then identifies major cost and benefit factors associated with its implementation. Section 4 presents some closing considerations.

[1] Co-Extra (GM and non-GM supply chains: their Co-Existence and Traceability). European FP6 Research Program.

Information Uncertainty and Asymmetry in the Food Market

The commercial release of GM soybeans in the US and the EU in the late 1990s gave rise to a period of intense controversy on risks inherent to the production and consumption of genetically modified organisms (GMOs). That controversy was enhanced by the spread of Bovine Spongiform Encephalopathy (BSE) in several European countries, which revealed the questionable and unaccountable criteria used by expert committees responsible for analyzing, managing and communicating food-related risks (Miller 1999; Millstone and van Zwanenberg 2001).

The rejection of regulatory agencies' risk analyses by consumer and environmental organizations in several European countries led governments to withhold the approval of GMOs. EU-wide harmonization policies adopted from 1992 to 1995 were destabilized by de facto moratoria declared by certain governments against the adoption of GMOs in their countries (Morris and Adley 2000) [2]. Likewise, in Brazil, an attempt by the National Technical Biosafety Commission (CTNBio) to rush through the release of Monsanto's GM soybeans in 1998 was held back by court injunctions obtained by the Brazilian Consumer Defense Institute (IDEC) and Greenpeace Brazil. During the next seven years, as ensuing litigation proceeded through courts, Brazil experienced large-scale debates over the risks and benefits to farmers and consumers of adopting GM soybeans[3].

Resistance against the release of GMOs in several European countries and the 2000 approval of labeling rules for food containing GMOs in the EU were decisive factors in the decision by major supermarket chains and food-industry groups to keep GMOs out of their product lines. Actually, uncertainties arising from controversy over the risks and benefits of producing and consuming GM food reflect a contemporary quandary, most prevalent in developed countries, that goes beyond quantitative food security, to qualitative safety aspects of the food supply. Meanwhile, with the expansion of global trade, particularly within new economic blocs, the harmonization of plant-health controls has become an enduring and complex problem.

In the context of expanding international trade it is important to note that food products are no longer produced and consumed in the same country, thus compromising the enforceability of national food safety regulations, which have no cross-border efficacy. Responsibility for enforcement has actually been shifting from the public to the private sphere. The World Trade Organization (WTO), supermarket chains and some food corporations have begun to set and implement food quality standards nationally and internationally[4]. Increasingly, concentrated retail markets entail supermarket chains covering multi-country regions in which the same products are provided by a single supplier. On the other hand, this geographic reach can also increase the diversity of products offered by chain stores. Consequently the impact of any food

[2] In 2000, the EU required labels for food with over 1% of its content consisting of GMOs (Regulation 49/2000). That limit was lowered to 0.9% by the Regulation 1829/2003.
[3] The legal deadlock was removed with the new 2005 Biosafety Law in, which permanently legalized illegal GM soybean crops, which were widespread mainly in Rio Grande do Sul. The illegal spread of GM soybeans in that State was facilitated by its common border with Argentina, where they were widely used and from where many growers smuggled seeds into Brazil. On this process, see Pelaez and Silva (2009) and Pelaez (2009).
[4] On this matter see also Braithwaite and Drahos (2001).

safety problem is no longer a concern just for the small geographic area served by a supermarket, but for the entire area covered by the company's chain stores. This fact increases the exposure of retail chains to liability for harm and also the risk of harm to its own reputation. Major retail chains thus tend to be leading players in the implementation of traceability systems, in order to identify failures in quality control throughout their supply chain as well as identifying responsibilities for any harm caused by shortcomings in their food quality-control systems (Hatanaka, Bain and Bush, 2005).

Consequently, "third-party certification" (TPC) has emerged as an important institution to certify the quality of products offered for sale. According to Deaton (2004), third-party certifiers provide market signals concerning food quality claims. The strategic role of such signals is to reduce information asymmetry, the importance of which is growing in the perception of societies whose political agenda includes debating the inherent risks of adopting new technologies.

According to Loader and Hobbs (1999), the asymmetric distribution of information in the food market gives more information on product quality to sellers than to buyers. This is because food is no longer a commodity whose features can be observed simply by visual inspection. Food products have become a specialty commodity whose quality-related features often can only be perceived when they are consumed. For these authors, impacts of information asymmetry in the food market can be handled in three, non-mutually-exclusive ways. The first solution is to introduce certification and labeling systems to assure product quality and safety firm-by-firm. The second solution is to implement a legal framework to assure labeling and an adequate level of quality control for food. The third solution is to have laws that hold companies accountable for food-safety failures, allowing them to be targeted by civil suits to establish liability and redress. Such measures tend to make companies more concerned about assuring the safety of the food products they market.

Similarly, Tanner (2000) observes that companies with certified food products can enjoy several advantages: less risk of food-safety liability suits; a stronger defense through detailed assessments and inspections of the company (due diligence); a greater ability to comply with legislation; achievement of competitive advantages; ease of access to markets; national and international acceptance; lower costs and higher profits; lower insurance costs and more effective management.

These advantages go beyond the distribution and manufacture links in the production chain to include farmers, final consumers and society at large. Advantages here include: lower production costs and prices for final consumers; higher-quality products and more value added; less chance for fraud by buyers who often make misleading claims about low-quality products; access to new markets; good labor practices including safer working conditions and better wages; enforcement of environmental recovery and preservation standards.

Another important advantage of traceability and certification systems is that it gives agents a chance to identify new production opportunities. The recombination of productive resources required to implement these systems involves the creation of new services, which can allow new market segments or niches to emerge. Consequently, new opportunities identified by agents will provoke a reworking of their own productive resources. Quality decisions made by entrepreneurs thus depends upon identifying production opportunities a firm can seize, based on their ability to reorganize existing resources. A firm's behavior regarding productive opportunities is guided not only by objective facts, but ultimately by expectations created by entrepreneurs regarding possibilities for growth (Penrose 2006). Diversification or differentiation of products through traceability and certification system expanded this firm's potential for growth, while opening up new social and economic networks. In this new relational environment, agents' decisions tend to vary depending on new elements that influence their own image of the environment and the decision-making process itself (Boulding 1961; Loasby 1976; Callon 1998). To the extent that rationality, or the agents' decision-making process, depends on the environment in which they operate, their positioning along the chain (or multiple chains) of production also tends, in turn, to generate information asymmetries.

Overview of Imcopa's Production

Founded in 1967, Imcopa is a medium-sized, family-owned company with approximately 450 employees, located in the State of Paraná, in southern Brazil. The company's soybean crushing capacity is around 2 million tons/year, or 5.5 tons/day, and 98% of its output is exported. It owns three soybean processing facilities, two of them located in soybean production areas and the third about 70 km from the country's main soybean export port (Paranaguá).

The crushing of 2 million tons/year yields approximately 1.5 million tons of soybean meal, with 44-53% protein content. Twenty-four percent of that output (360,000 tons) is high-protein meal (60-70%). It also produces around 240,000 tons of refined oil, 20,000 tons of lecithin[5] (emulsifier), 230 tons of tocopherol (a precursor to vitamin E), 28,000 tons of molasses extracted from soybean meal and 7,000 tons of ethanol, obtained through fermentation of the molasses (Table 1).

Table 1. Soybean Products, Imcopa, 2008

Products	**Total Annual Production**
Processed soybeans	2.0 million tons
Meal	1.5 million tons
High-protein meal	360,000 tons
Refined oil	240,000 tons
Lecithin	20,000 tons
Fatty acid (tocopherol)	230 tons
Molasses	28,000 tons
Alcohol	7,000 tons

Source: Traver (2008)

Imcopa estimates the total world demand for lecithin is at around 50,000 tons/year, meaning its 20,000 tons produced in 2008 accounted for 40% of global consumption. Only 20-22% of the lecithin is sold on the domestic market. Imcopa meets a major share of Nestlé's demand for lecithin, and 100% of Kraft's demand, in addition to sales to other major food companies. The decision to initiate the non-GM certification program by Imcopa was mainly motivated by

[5] Obtained from oil seeds, lecithin has an emulsifier property valuable as a food ingredient by providing stable and smooth mixtures of oil and water in processed foods such as chocolate bars, candy bars, biscuits, snacks and baby food.

Nestle's demand for non-GM lecithin which is an important ingredient added to several industrialized food products. This demand is a preventive strategy adopted by several big food companies in Europe who consider this kind of food content a commercial risk because of the consumer's resistance to accepting GM food products. Imcopa was the first company in Brazil to launch non-GM certified soybean oil. Approximately 99% of the oil and 97% of the meal is exported. Thus, Imcopa exports non-GM soybean and products to more than 250 clients[6] in over 30 countries[7] (Traver 2006).

Imcopa works with about eleven co-operatives who supply 80% of the soybeans bought by the company. Six co-operatives provide about 70% of the volume used by the company. Imcopa partners with individual farmers and wholesalers who do the segregation of non-GM soybeans. The company is located in Paraná, Brazil which is the largest soybean producing State with around 20 million tons/year. Imcopa has several logistical advantages which include proximity to production, the presence of adequate infrastructure to move raw material to the processing facilities and easy access to the main export outlet, at the Port of Paranaguá.

In addition, during the period of most heated debate on advantages and disadvantages of adopting GMOs in Brazil (1998-2005), the State of Paraná strongly resisted the approval of GM crops. This involved the State government's control and enforcement activities to prevent the illegal planting of GM varieties, as well as commercial strategies by several co-operatives seeking to create a market differential by implementing their own systems for non-GM soybean identity preservation and certification[8]. When the decision was make to implement the traceability system in 1998, Imcopa was well positioned geographically near large supplies of non-GM soybeans, available for virtually no premium to local farmers. This gave Imcopa large profits during the initial phase of implementation of the non-GM soybean certification system.

The Traceability and Certification System

Imcopa's traceability and certification system was set up in 1999 by Genetic ID, an American company specializing in GM analysis and detection. That same year, Genetic ID and Law Laboratories, a company specializing in quality control and the legal compliance of food products, formed a partnership which created, Cert ID Ltd. Company. They began certifying Imcopa's non-GM products.

Imcopa's traceability and certification system is made up of four stages related to the successive activities of soybean production and marketing:

i) production and multiplication of seeds
ii) production of grain
iii) industrial processing
iv) delivery for export

[6] The main client companies are Nestlé, Kraft, Unilever, Porters, Grampian, Amadori, Martini, Danone, Carrefour, Tesco, Asda, Agravis, Ewos, Mitsubishi, Nutreco, Solae, Cargill, Bunge, Barry Callebaut, Fenaco and Degussa.
[7] The main countries are France, Germany, Belgium, Holland, Denmark, Norway, Finland, Sweden, Switzerland, Austria, UK, Scotland, Ireland, Italy, Greece, Japan, Korea, New Zealand, Australia, Argentina, Chile, Uruguay, USA and Canada.
[8] On this process see Pelaez and Albergoni (2004), Brehm and Pelaez (2008) and Nascimento and Pelaez (2008).

Production and Multiplication of Seeds

In this stage, Imcopa inspects and validates the entire process of seed production and multiplication for its suppliers, through the following activities:

- Seed production: The original seeds are produced by companies accredited by the Ministry of Agriculture. The purchase, testing and distribution of these seeds to co-operatives are monitored by Imcopa. All original seeds are tested by the co-operatives or purchased with non-GM certificates.

- Seed distribution for multiplication: Imcopa monitors the distribution of original seeds that are multiplied by co-operatives for later distribution to farmers.

- Seed planting: Seed planting is supervised by the co-operatives' own agronomists and is validated by Imcopa.

- Seed harvest: The harvesting process and seed-storage in silos are monitored by the co-operative and validated by Imcopa.

- Distribution of seeds for soybean production: After storage, the seeds are classified and packed for distribution. The documentation is validated by Imcopa and delivered to the farmers for planting.

Grain Production

During grain production, in addition to inspection and validation of the process, Imcopa carries out tests to assure the soybeans' non-GM identity, as follows:

- Planting: Seeds are delivered to the farmers by their cooperatives, to be planted. The process is monitored by the cooperatives and validated by Imcopa.

- Harvest: The harvest is monitored through strip tests[9] done by Imcopa.

- Transportation to silos at the cooperatives: Chronologically-numbered samples are collected from each truckload. One composite sample for each five trucks is homogenized and strip-tested. If the test is negative for GMOs, the trucks are unloaded. If the test is positive, all the samples are tested individually to identify the specific truck with GM material, which is rejected. Another composite sample, for an entire day of grain deliveries, is tested by the co-operative.

- Transportation from the silos to Imcopa facilities: During this stage, chronologically-numbered samples are also collected from each truckload. To avoid contamination, all

[9] "Strip tests" or immunochemical tests are used, among other purposes, to identify GMOs. The method uses antibodies to find a GMO molecule. If found, it reacts with the antibody and changes the color of the strip thus indicating the presence of GM material. It is a quantitative method that provides a quick result (in about 5 minutes) at low cost (around US$ 6 per strip) (Grainnet, 1999).

trucks are cleaned with air spray guns before they are loaded. A composite sample from five truckloads is homogenized and strip-tested. If the test is negative for GMOs, the trucks are unloaded. If the test is positive, all the samples are tested individually to identify the specific truck with GM material, which is rejected. The samples are kept for 360 days. Another composite sample, for each seven days of grain deliveries, is sent to be PCR-tested[10] at an accredited laboratory.

Industrial Processing

During this stage, samples are collected every two hours, as soybeans are unloaded into the processing plant. Twice weekly, composite samples are PCR-tested at an accredited laboratory. Samples are also collected every two hours from the meal, oil (crude and refined) and lecithin units of production. For meal and refined oil, the composite sample of the day is tested for GMOs, in addition to physical-chemical tests. For crude oil and lecithin, the composite sample of the day only undergoes physical-chemical tests. These composite samples are stored for one year.

For meal and crude oil, the composite sample is PCR-tested fortnightly at an accredited laboratory. This procedure is applied to refined oil and lecithin every seven days, and the lecithin also undergoes microbiological tests. This stage thus requires only that the company have the trained personnel and the kits needed to carry out the tests for GM material.

Dispatch for Export

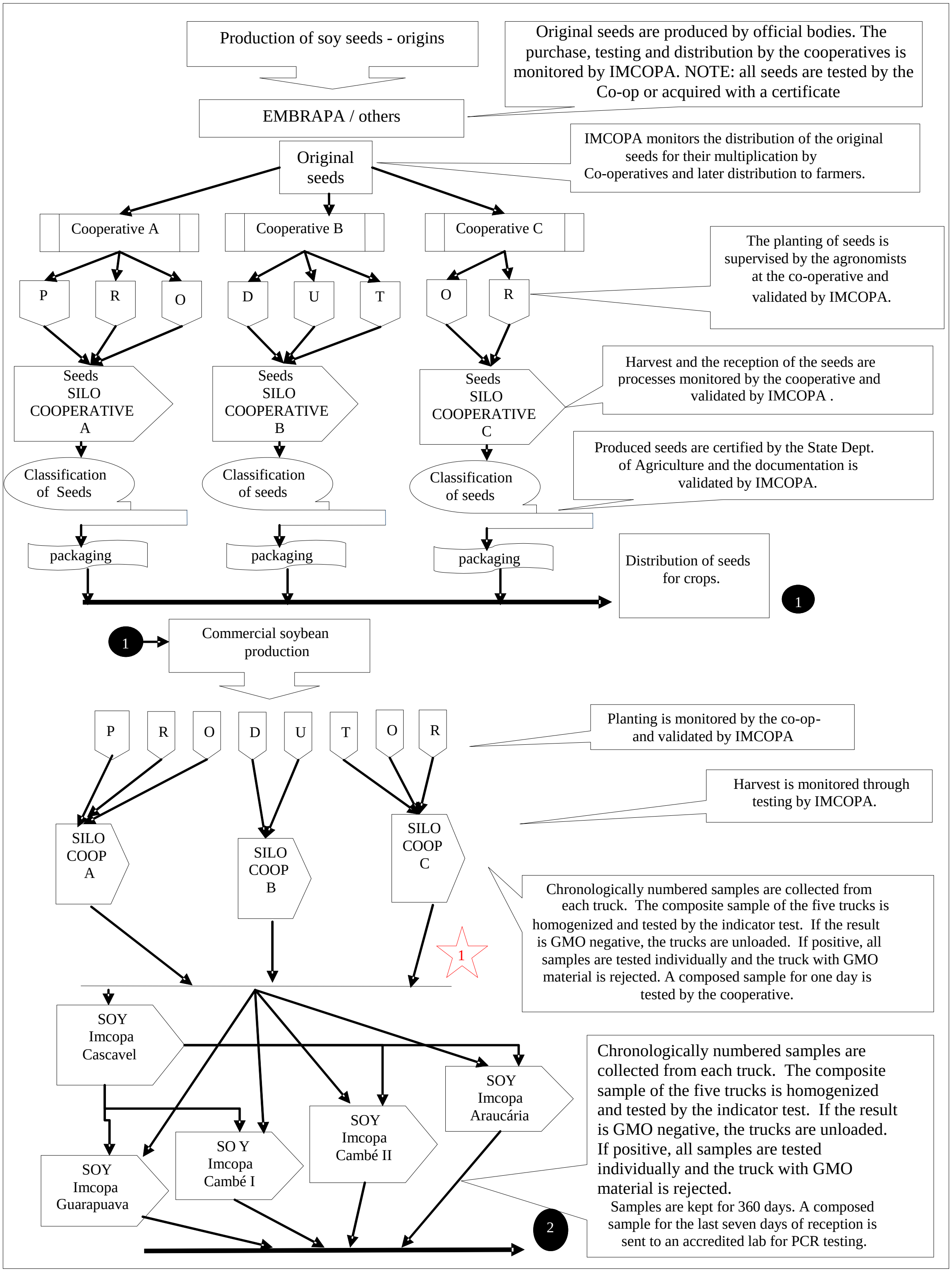
Company care is intensified, because products risk being contaminated by other companies' loads, mainly at port terminals. Procedures include:

- Dispatch of degummed oil: Samples are collected as oil is loaded into trucks and wagons, and undergo physio-chemical and microbiological tests. For each shipload a Transaction Certificate of Compliance (TCC) is issued, identifying the company traceability and assuring the product is non-GM. If required by the client, a PCR test for the lot can be provided.

- Dispatch of meal: Samples are collected as the meal is loaded into trucks and wagons. Before Imcopa delivers each load to the ships, all conveyor belts and empty ship loaders are activated for at least 15 minutes, to assure that no trace of previous loads can come into contact with the merchandise. Physicochemical tests are done on daily composite samples, which are stored for one year. A TCC is also issued for each shipload. Another sample is collected from every hold in the ship, for PCR testing.

Below is a flowchart of Imcopa's traceability and certification system for non-GM soybeans and products.

[10] PCR (Polymerase Chain Reaction) is a method to analyze DNA (deoxyribonucleic acid) directly in order, among other uses, to detect the presence of specific GMO molecules in grain or food products. This method is more sensitive than immunochemical methods but also takes longer (two or three days) and costs more (about US$ 200 to US$300 per sample) (Grainnet 1999).


Production of soy seeds - origins
Original seeds are produced by official bodies. The purchase, testing and distribution by the cooperatives is monitored by IMCOPA. NOTE: all seeds are tested by the Co-op or acquired with a certificate
EMBRAPA / others
Original seeds
IMCOPA monitors the distribution of the original seeds for their multiplication by Co-operatives and later distribution to farmers.
Cooperative A
Cooperative B
Cooperative C
The planting of seeds is supervised by the agronomists at the co-operative and validated by IMCOPA.
P
R
O
D
U
T
O
R
Seeds SILO COOPERATIVE A
Seeds SILO COOPERATIVE B
Seeds SILO COOPERATIVE C
Harvest and the reception of the seeds are processes monitored by the cooperative and validated by IMCOPA .
Classification of Seeds
Classification of seeds
Classification of seeds
Produced seeds are certified by the State Dept. of Agriculture and the documentation is validated by IMCOPA.
packaging
packaging
packaging
Distribution of seeds for crops.
1
1
Commercial soybean production
P
R
O
D
U
T
O
R
Planting is monitored by the co-op- and validated by IMCOPA
Harvest is monitored through testing by IMCOPA.
SILO COOP A
SILO COOP B
SILO COOP C
Chronologically numbered samples are collected from each truck. The composite sample of the five trucks is homogenized and tested by the indicator test. If the result is GMO negative, the trucks are unloaded. If positive, all samples are tested individually and the truck with GMO material is rejected. A composed sample for one day is tested by the cooperative.
1
SOY Imcopa Cascavel
SOY Imcopa Araucária
SOY Imcopa Cambé II
SO Y Imcopa Cambé I
SOY Imcopa Guarapuava
Chronologically numbered samples are collected from each truck. The composite sample of the five trucks is homogenized and tested by the indicator test. If the result is GMO negative, the trucks are unloaded. If positive, all samples are tested individually and the truck with GMO material is rejected.
Samples are kept for 360 days. A composed sample for the last seven days of reception is sent to an accredited lab for PCR testing.
2

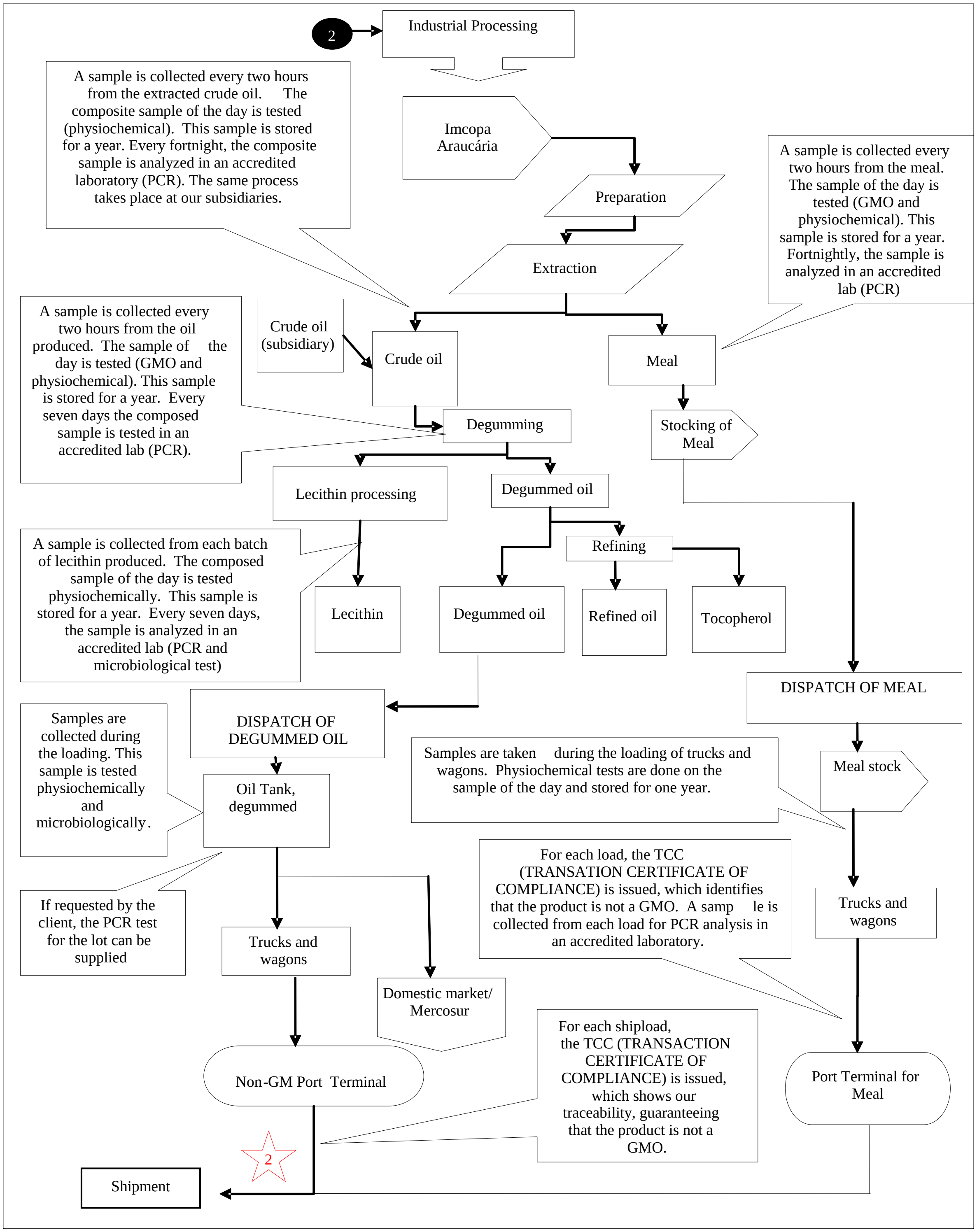


Figure 1. Flowchart of Imcopa's Traceability and Certification System for Non-Gm Soybeans and Products
Source: Traver (2005)

Note: ☆ = Critical point in the system.

Critical Points in the Control System

There are two critical control points to assure the identity preservation of conventional soybeans and products from the purchase of grain to loading at port. The first, and most critical is the reception of grain at the collection and storage facilities in the State's interior region. Significant risks exist because farmers began planting part of their land with GM soybeans after they were legalized in 2005, thus increasing the probability of blending with non-GM grain. Farmers who grow non-GM soybeans, face widespread risk from neighboring farmers who often share columbines, which become a vector for contamination of non-GM grain.

Once the grain has been purchased from farmers, the port terminal is the second critical point. Despite policy control over GM soybean shipments adopted by the Paraná State government in the Paranaguá Port, Imcopa does not assume that the port authorities' procedures are reliable enough, due to the huge flows of raw material from various regions of the country. To minimize risks of contamination, Imcopa has an officer of its own at each of the two terminals (Center-South and Cotriguaçu) it uses to store shipments before loading. Company employees are hired exclusively to monitor the movement of conveyor belts and the appropriate cleaning of the silos.

Traceability and Certification Costs

Implementing and maintaining traceability costs break down into four categories: infrastructure investment; personnel training expenses; spending on analyses (GMO tests); and the payment of premiums to farmers for growing non-GM soybeans.

Infrastructure investments were minor for Imcopa due to the company's choice to work exclusively with non-GM products. They did not need to invest in new silos or manufacturing facilities. Investments were limited to a laboratory equipped with a grain processor to carry out GM identity tests, which cost little and are accounted for as part of the company's general expenses. The second category, for training of personnel, was done by the certifying company. The third category involves operating costs and the purchase of test kits to control identity preservation through the stages of cultivation, transportation, processing and storage. The fourth category has to do with the expansion of the area planted to GMOs in Brazil, particularly in the State of Paraná, following December 2005, when the federal government finally managed to push through a law to impose the commercial release of GM soybeans. Moreover, the Paraná State government's policy of banning the dispatch of GM soybeans through the Port of Paranaguá was overturned by a September 2006 court order, signifying that all the port's berths could now load GM soybeans.

Imcopa occasionally paid premium prices to rural co-operatives for non-GM soybeans for several years, due to an abundance of raw material available in the State of Paraná[11]. Not until 2006 did premiums paid to farmers become standard clauses in supply contracts. This also has to do with the fact that soybean crushers constitute an oligopsony.

[11] From 2004 to 2006, the three rural co-operatives in Paraná that had implemented their own non-GM soybean traceability and certification systems reported paying an average of US$ 4 to US$ 5/ton (Pelaez et al., 2006).

In 2005, ten major crushers purchased 70% of Brazil's soybean harvest. Specifically in Paraná, where 23% of the country's soybean crushing facilities are concentrated, Imcopa is the leader in crushing capacity, with 35% of the State's installed capacity (Abiove 2005). Processing companies – which are more than just crushers are often global soybean traders[12] and gain significant bargaining power over co-operatives and individual farmers. This oligopsonic power had allowed those companies to retain the bulk or even the entirety of premiums paid by importers for non-GM products, until the mid-2000s.

In 1999, the total cost of implementing the Imcopa system was around $ 900,000USD. Of that, some $650,000 (72% of the total) went to traceability activities. Imcopa paid the equivalent of $250,000 for certification. In that year, Imcopa processed about 250,000 tons of soybeans, which means a cost of $3.60/ton (Traver 2006).

In 2006, the company crushed about 2.8 million tons of soybeans, and paid $2 million in traceability and certification costs, an average of $0.70/ton of soybeans. Of that, 75% ($1.5 million) went to running the traceability system, while the other 25% covered certification costs. Thus from 1999 to 2006, there was a significant 80% reduction in the unit cost of the company's traceability and certification system. According to Imcopa's director, this cost reduction was mainly due to gains in scale and with the company's learning curve in running the system. Inclusion of $7/ton in premiums paid to farmers in 2006, however, raised the total unit costs for the system to around $7.70/ton of processed soybeans (Traver 2008).

In 2008, total costs for maintaining the system rose to $22/ton, due to two factors: higher costs with traceability and certification (from $ 0.70/ton to US$ 2/ton) caused by the expansion of GM soybean plantations in the proximities of non-GM areas and by the need for more quality control to dispatch shipments through Paranaguá Port; and, most particularly, the tripling of premiums paid to farmers, from $7/ton to $20/ton as shown in Table 2.

Table 2. Imcopa's Traceability and Certification Costs: 1999, 2006 and 2008

Cost item	**Implementation (1999)**		**Maintenance (2006)**		**Maintenance (2008)**	
	TOTAL in $USD					
	$	$/ton	$	$/ton	$	$/ton
Traceability	650,000	2.60	1,500,000	0.50	NA	1.70
Certification	250,000	1.00	500,000	0.20	NA	0.30
TOTAL	900,000	3.60	2,000,000	0.70	4,000,000	2.00
Premium[1]	NA	5.00	20,000,00	7.00	40,000,000	20.00
TOTAL + PREMIUM	NA	8.60	22,000,00	7.70	44,000,000	22.00

Source: Traver (2006, 2008).

Note: [1] The value of premiums paid to farmers by Imcopa in 1999 varied depending on the contract negotiated with each co-operative; therefore not everyone received US$ 5/ton. NA = Not Available.

Benefits of the System

Three benefits from the traceability and certification system are examined: (i) higher turnover for

[12] Most notably the multinational traders: Cargill, Dreyfuss and Bunge.

the company, (ii) the benefit-cost ratio accrued from premiums paid by international buyers for the sale of non-GM soybean products and (iii) the diversification of the company's activities as a result of newly identified production opportunities.

Financial Benefits

Premiums paid for non-GM soybean products depend on each year's market conditions. Non-GM lecithin brings in the highest premium, at $1,000/ton in 2006. After falling more than 50% in 2007 and 2008, this premium returned to its 2006 values in 2009. Fatty acid is the product with the most unstable demand. In 2006, it sold with premiums up to $4,500/ton, about 10 times more than the market value of the non-certified product. At other times, this market nearly dries up with almost no consumers, as was the case in 2008 (Traver 2009). The production of crude and refined soybean oil, meanwhile, provides no benefits from the non-GM traceability and certification system, since it is sold at no additional premium (Table 3).

Table 3. Average premiums paid and received by Imcopa on the sale of non-GM soybean products, 2006/2009.

Products	**Premiums $/Ton**			
	2006	2007	2008	2009**
Raw soybeans*	7	12	20	NA
Meal	8	14	25	35 - 40
Crude and refined oil	0	0	0	0
Lecithin	1,000	400 - 500	500 - 600	1,000
Fatty acid (tocopherol)	0 – 4,500	NA	NA	NA

Source: Traver (2006 and 2008), Oliveira (2006) and Campos (2006)
* Premiums paid by Imcopa to farmers.
** Forecast.

The company's benefit-cost ratio can be estimated specifically related to its traceability and certification system in 2006 and 2008 in terms of the premiums paid on the sale of meal and lecithin. In 2006, Imcopa sold around 2 million tons of meal, with an average premium of $14 per ton. It sold 25,000 tons of lecithin, with a premium of $1,000 per ton. This brought in a total annual added value of $67 million for the company, while total costs for certification and traceability were around $2.5 million. In this sense, the company's benefit-cost ratio concerning the adoption of non-GM controls was around 26.8. Even so, additional costs to pay farmers' premiums hiked the system's total operating expenses to $27.8 million, reducing the ratio to the order of 2.4. In 2008, increased premiums paid to farmers substantially reduced the company's benefit-cost ratio from 2.4 to 1.1 (Table 4).

The largest benefit obtained by Imcopa with its certification program came in its growth, with the company's productive capacity expanding eight times, from 250,000 tons per year in 1998 to 2 million tons per year in 2008. Meanwhile, turnover grew by a factor of 18, from $70 million in 1998 to approximately $1.3 billion in 2008. The most intense period of growth was from 1998 to 2003, when turnover grew 328%. In the following years, turnover continued to grow but at lower rates. From 2003-2005, the company grew 116%, from 2005-2006 another 53% and from 2006-2008 by 30% (Table 4). That rapid rate of growth led Imcopa to become the fifth largest soybean processer in the country, and number one in Paraná.

Table 4. Imcopa's yearly turnover and benefit-cost ratio: 1998/2008

Year	Turnover	Total Value of Premium Received (Meal + Lecithin)	Total System Cost (Traceability + Certification)		Benefit-Cost Ratio	
			Without Premium	*With Premium*	*Without Premium*	*With Premium*
1998	$70 million	NA	NA	NA	NA	NA
2003	$300 million	NA	NA	NA	NA	NA
2005	$650 million	NA	NA	NA	NA	NA
2006	$1 billion	$67.0 million∗	$2.5 million∗	$27.8 million∗	26.8	2.4
2008	$1.3 billion	$47.5 million	$4 million	$44 million	11.9	1.1

∗Present value estimated to 2008 at a 12.45 annual interest rate.
Source: Gazeta Mercantil (2005), Gazeta do Povo (2006) and Traver (2006 and 2008).

Additionally, sales of non-GM certified products allowed Imcopa to expand in an economic climate in which many soybean processers had to shut down due to hard competition from multinationals, especially those with plants located in Argentina. Several factors make the cost of producing soybean products in Argentina up to 25% lower than in Brazil:

- The concentration of plants in a single region (80% located in Santa Fé Province)[13] facilitates logistics, particularly for exports.

- The valuation of the Brazilian currency since January 2002 lowered the price competitiveness of soybeans and products compared to Argentine output. From January 2002 to May 2009, the average rate of exchange between the two countries was 0.476 Real = 1.0 Peso (Banco Central 2009).

- In Brazil, many processing plants are not in soybean-producing regions. This implies the payment of a 12% tax (the Tax on Circulation of Merchandise and Services/ICMS) for the interstate purchase of raw soybeans. Since the accounting entry of credits to be compensated by the processing of meal and oil does not entirely pay the costs of crushers, it is advantageous to export soybeans *in natura* and crush them in Argentina. There the taxes are the other way around: grain is more heavily taxed (3.5%), thus favoring the export of oil and meal (Valor Econômico 2006).

- Fuel oil and natural gas cost three times more in Brazil than in Argentina, due to Argentine government subsidies. Since fuel consumption is 80% of the cost of crushing soybeans, soybeans processed in Argentina are much more competitive than those crushed in Brazil (Traver 2006).

The competitive advantages of Argentina's micro- and macro-economic environment has led many transnationals to shift part of their soybean crushing units from Brazil to Argentina. Companies like Bunge and Cargill decided to forego investments in Brazilian plants, in order to prioritize the construction and expansion of plants in Argentina[14].

[13] On this point, see Ghezan, G. et al. (2006).
[14] In 2006, Bunge began crushing in a plant expansion in Buenos Aires, able to produce 19,000 tons/day, while Cargill also invested in Argentina, in a plant whose crushing capacity is 12,000 tons/day (Valor Econômico, 2006).

Productive Opportunities

Imcopa's main motivation for implementing the identity preservation system for non-GM soybean products was demand from major food corporations such as Nestlé and Kraft Foods, eager to avoid having their products labeled "GM" in Europe. This situation allowed Imcopa to negotiate a premium price for certified lecithin from non-GM soybeans that was five times the going market price. Imcopa was thus assured not only a rapid return on its investments, but also a high rate of profit as it operated the system we have just described.

Since lecithin is a byproduct of oil production, all stages in the process had to be traced in order to certify each of the products. The company therefore started seeking clients abroad for its non-GM meal and oil. Although there was significant demand for non-GM products by the late 1990's, particularly in Europe, it was hard for Imcopa to find consumers willing to pay premiums for certified non-GM products. This market segment grew slowly. Imcopa earned virtually no premiums on its soybean meal sales from certifying this product during the first year the traceability system was in operation. In the second year, the company managed to differentiate prices on the export of 60% of the meal it processed. It was only in the third year of operations that Imcopa earned premiums on 100% of its meal production, ranging from $3 to $4 per ton.

As it sought market segments for higher value-added products, however, the company began to identify new production opportunities based on differentiating the protein content of its meal for more specific markets, such as fish food. Soybean meal with 40-50% protein has such a high sugar content that, in water, it tends to ferment and create a toxic environment for fish. Extracting the sugar reduces this effect, in addition to raising the meal's protein content, thus adding value to the product. At the same time, the molasses byproduct obtained by extracting the sugar is a good substrate for producing ethanol. Soybean ethanol obtained from this molasses can be used in pharmaceuticals, beverages and to produce biofuel. The company also uses its soybean molasses as an energy source for its own production lines, thus reducing costs significantly, since energy is the most important cost item in soybean processing (Traver 2006).

Imcopa's strategy to add value to it's product line through non-GM certification gave rise to new opportunities to differentiate production by increasing the protein content of its soybean meal. As a result, these more high-quality market segments moved the company to implement complementary quality-control programs that in turn demanded new certifications and new adaptations of its production structure. Imcopa has now earned another ten quality certificates[15], which complement a product-quality differentiation strategy in a market traditionally known for the sale of bulk agricultural and industrial commodities.

Conclusion

Imcopa adopted quality-control in order to implement its non-GM soybean traceability system, based on a recombination of existing productive resources, and in so doing lowered the costs of

[15] ISO 9000; ISO 14000; Hazard Analysis and Critical Control Points (HACCP); Good Manufacturing Practices (GMP); GMP-Animal Feed; Kosher Certificate; Halal Certificate; Salmonella-free Program; Special Granulometric Control Program; Agricultural Sustainable Production Certificate (Pro-Terra).

both implementing and operating the system. Together with the high premiums it initially earned on non-GM lecithin sales and later on its non-GM soybean meal, with no need to pass part of the profits on to farmers, in the system's early years Imcopa maintained quite a high level benefit-cost ratio.

That benefit-cost ratio began to decline when the sale of GM soybeans was legalized in Brazil in December 2005 and the dissemination of GM plantations increased the risks for preserving the identity of the company's product, along with the costs of its traceability system. Also as a result of this, Imcopa was obliged to adopt a more effective strategy to promote the planting of non-GM soybeans, through the payment of higher premiums to farmers. That strategy was the key to reducing information asymmetries between the opportunities the company had identified on overseas markets for non-GM soybean products and the opportunities perceived by farmers, who live in a farm-supply market controlled by seed and pesticide companies.

Considering this drive for short-term returns on investment, the economic feasibility of maintaining non-GM soybean traceability and certification systems capable of sustaining the coexistence of GM and non-GM crops depends above all on the presence of markets willing to offer a price differential attractive to all players involved in the production chain. Though, the logic of this market niche depends on a set of factors involving the balance between social acceptance and resistance of GM food in which the premium paid by the existence of a segregation system seems to be the less important one.

In addition to the extraordinary earnings from its certification of non-GM products, the product differentiation based on a recombination of the company's own resources revealed new productive opportunities and created previously non-existent market niches for soybean meal. Actually, productive opportunities arising from the sale of non-GM soybeans are mainly concentrated in the grain processing stage, as a function of the company's own operational environment. In Imcopa's case, the expansion of its involvement in global food and feed markets allowed it to become part of a more complex network of commercial and production relations. In this new environment, market niches that emerge for products with higher value added allow a medium-sized, family-owned company like Imcopa to expand its share in a market traditionally known for the sale of commodities and controlled by major transnational corporations.

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