

(2) Analysis of current condition

1) Raw materials -example of the efforts in the production of the mixed feed-

70% of soybean and wheat and 45% of corn, both mixed feed raw materials, are currently produced in the departments of Alto Paraná and Itapúa. The Cooperative Yguazú has built a flourmill with a processing capacity of 40 ton/day beginning the flour sale. This cooperative invited a Chilean expert in processing to increase quality and now faces a demand that exceeds supply to the local market. The bran or the wheat shells generated from the processing of flour, as a secondary product, are sold to cattle farms of the region as mixed feed. In the future, the Cooperative expects to produce mixed feed by building its own processing plant.

On the other hand, the Cooperative Colonias Unidas, besides the flour and its secondary product, is carrying out the extraction of soybean oil and the production and sale of pellets as a secondary product. One of the major factors that favor these efforts in the processing of agricultural products is that these areas form a producing base of abundant mixed feed raw materials.

2) Processing

Among plants related to mixed feed, there are not only mixed feed plants but also mills of soybean oil and cottonseed oil, milling plants, rice milling plants and tapioca plants. For this paper, we studied plants except for tapioca plants. Meat processing plants and dairy plants are among export goods producers. Chicken, pork and beef are generally processed separately due to differences in processing facilities and food sanitation. Slaughtering equipment is different from one another. Precooling before dissection is different between chicken on the one hand, and beef and pork on the other. Facilities for dissection and cutting are different. What they can share are packing plants, rapid freezer, freezing store and refrigerator. Although dairy plants have different equipment from one product to another, milk, dulce cheese and butter are usually produced in one plant since they are co-products.

The actual state of above-mentioned plants were put together in Table 4 based on Central Bank of Paraguay, industry census (surveyed in 1998 respectively) and corporate hearing. Oil mills centralize in Alto Parana. Flourmills and rice mills are mainly located in Asuncion. Most of mixed feed plants are in Itapua. Pork plants, chicken plants and dairy plants are concentrated in Asuncion and Central department. Since pork and chicken are consumer goods that have been demanded domestically so far, most of their plants are located in the national capital region with a large number of consumers.

Table 4 Actual State of Plants Related to Mixed Feed

Stage	Plant	Actual State
Primary Processing	Oil Mill	There are 15 oil mills in the country. The largest 2 companies have a 70% production share. Nearly 60% of the total production is in Alto Parana.
	Flourmill Rice Mill	Flourmills and rice mills are in 34 sites in the country. The largest 2 companies have a 65% share. Production is concentrated in Asuncion.
Secondary Processing	Mixed feed Plant	Besides plants for domestic consumption, there are 22 mixed feed plants in the country, however, only 5 or 6 companies are major ones. Itapua holds 65% of production share.
Tertiary Processing	Beef Plant Pork Plant Chicken Plant	There are 40 meat plants in the country. Plants that can export meat are concentrated in Asuncion. Since they basically cater to domestic demand, their production plants are mainly in the national capital region.
	Dairy Plant	There are 40 dairy plants in the country. Dairy products are mainly produced in the national capital region and Chaco district. They are also located in rural areas in order to meet local demand.

Chickens for broilers to produce chicken meat are not hatched in poultry farms but there are breeders who produce chickens like industrial output. Some companies specialize in chicken hatching. However, they have been small in scale and there were problems with the chickens' quality. In Paraguay's largest chicken producing company (Granja Avicola Blanca S.R.L.), about 50,000 chickens are hatched each day. About 60% of them are raised in their own poultry farms. The rest are delegated to contract farmers.

(3) Bottleneck and advantage

1) Raw materials -merit and bottleneck of the productive sector of raw materials-

Advantage of direct sowing

Direct sowing of soybean has a coverage rate of nearly 70% in the eastern and southern regions of the country. This practice is starting to be applied in the production of wheat and corn as well. One of the advantages of direct sowing is lower production cost. According to the data obtained by CAPECO and nine cooperatives in Alto Paraná and Itapúa, (which are the greatest grain producing departments), it is estimated that the unit production cost per direct sowing (in case the yield is of 2.5 ton) is an average of Gs.800,000/ha. The production cost of soybean through conventional methods, according to the estimates of the MAG, is Gs. 980,000/ha. This means that the production cost of direct sowing is approximately 18% less than the conventional method.

Increase of the cost of agro-chemicals and the reduction of machinery cost in direct sowing

In direct sowing, machinery costs (mainly for the preparation of the ground) and labor costs to remove

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Increase of the cost of agro-chemicals and the reduction of machinery cost in direct sowing

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weeds from the fields are 20% and 10% less, respectively, than the conventional method. This is the main difference in costs among the two farming methods. However, in direct sowing, agro-chemicals costs increase 12% since weed control is totally done through the use of chemicals. Since pulverization is done mechanically, the reduction of the volume in the application of chemicals constitutes another issue that must be studied in order to reduce machinery costs.

Seeds and fertilizers represent 25% of total production cost, and there isn't much variation between direct sowing and the conventional method. However, in the last three years, an annual increase of 15% in the density of soybean sowing per hectare through direct sowing has been observed in the main producing areas. This implies that there will be an increasing tendency in the demand of seeds for sowing. Soybean yields are relatively insensitive to the density of plantation; therefore, it is believed that the practice of dense plantation is done to control weeds. Wheat is commonly used to rotate with soybean in direct sowing, and its production cost is similar to soybean, with the difference that the cost of wheat seeds is substantially greater in the use of agro-chemicals. It's necessary to increase production of seeds adapted to the areas of production to decrease costs or self-supply with self-produced seeds.

The production cost of corn presents the same problem as wheat, even though its production cost, at Gs164,000/ton, is 30% and 50% less than the cost of soybean and wheat, respectively. Therefore, corn could become a raw material of the mixed feed cluster, more profitable than soybean and wheat, depending on the yield.

Harvest Loss

Even if it is true that the harvest decrease is not a factor that directly affects production cost, its improvement constitutes a task that must not be ignored if the soybean yield is to be increased. The harvest loss per hectare in the main productive areas of soybean (Caaguazú, Itapúa, Alto Paraná y Canindeyú, which as a whole represent approximately 90% of the total production) is an average of 8.2%, with a maximum of 10.2% from Canindeyú. One of the greatest causes of this decrease is the use of obsolete machinery, mainly combines. CAPECO pointed out that the optimum surface for the implementation of mechanized field with the use of a tractor and a combine is 200 ha and that these machines must be renewed every 5 or 7 years in order to reduce harvest loss. To that effect, the possibility to apply new tributary incentives (partial exemption of the different taxes) and the financing system to facilitate investment in agricultural machinery are to be analyzed.

Like soybean, wheat harvest losses average 7.6% per hectare. A decrease in the storage of 16% of the production per hectare is reported as well, due to the lack of capacity of the silos. Together these add up to a 24% loss. Corn, besides presenting a loss rate similar to wheat, could go through years in which it could not be harvested when being produced as a rotation crop with soybean, by not coordinating the season correctly. To solve this situation, a rotation system is required, appropriate to the local farming

characteristics.

2) Processing

There are bottlenecks in strengthening the cluster. We list them in a breakdown by location, plant management and quality standard as follows. In discussing the location, we assume that the mixed feed consists of 55 % of corn, 25 % of soybean lees, 17 % of sorghum and bran and 3 % of minor component such as vitamins.

(Location)

- More than half of existing oil mills are located near soybean producing districts. They have an advantage in location. However, since many of them belong to multinational enterprises, it is doubtful whether lees being exported now would be available for domestic sales.
- Milling plants, which concentrate in the national capital region, may have a slight disadvantage from the standpoint of the cluster's location.
- Since end products have been oriented to domestic demand, existing plants are around consumption centers, which are not originally suitable for the production of chicken, pork and raw milk.

(Plant Management)

- Major mixed feed plants existing have a location advantage. However, even the largest plant produces 150 tons a day, which is medium in scale.
- Only 1 plant produces 5,000 tons of feed in a day, which is considered high productivity in Paraguay. Other plants are small in scale and their productivity is low.
- Shipment method affects the cost of feed. Many plants use paper bag shipment, whose cost is the highest.
- From the standpoint of supply chain (raw material production - feed production - livestock farming - meat production - exports) the payment of IVA and its repayment are not linked. There are cases that some industries are forced to pay the total amount of IVA, which may weaken their cost competitiveness.

(Quality Standard)

- The quality standard of mixed feed is not set officially. The quality of mixed feed on the market is irregular.
- Meat products, except for beef and dairy products, have not been exported to date. There are concerns whether their products can meet a quality that is suitable for exports.
- In this cluster, chicken, pork and dairy products are assumed as products for exports. However, it would be difficult to export them to surrounding countries due to reasons related to animal quarantine and food quarantine

On the other hand, the following points can be considered as benefits:

- In Paraguay, raw materials for mixed feed are produced affluently. Those raw materials are supplied at a lower price than the international market price.
- The domestic demand for chicken meat and dairy products is growing extensively. They can expect not only the export market but also the domestic demand.
- There are potential markets in neighboring countries: Chile for pork and dairy products; Argentina for chicken meat.

2.2.2 Model of the cluster

In order to find tasks out of the actual state mentioned in 2.2.1, one model will be set up. It would be easier to extract tasks and projects clearly by comparing the model and the actual state. At first, we propose the best location for this cluster. Then, we present the size of a business for the cluster as a model. We intend to make a long-term goal, not an abstract model. Lastly, we discuss the prospect of the export market for meat products and dairy products, the end products of this cluster.

(1) Location

Since this cluster is based on the existing resources in the country, the analysis of the cluster is made from the standpoint of raw material production 1) and processing 2).

1) Location of the cluster: aspect by raw material

The production of mixing feed raw materials has concentrated in Itapúa and Alto Parana departments as mentioned above. Moreover, over 30% of the poultry farms are concentrated in the oriental region, including Itapúa and Alto Paraná. Both departments are breeding 35% of pigs raised.

Itapúa has more meat factories than Alto Paraná department. When raw material production is near the factory costs fall. Moreover, CRIA experimentation researched specializing in the grain production exists in Itapúa, and technological guidance is received easily. Therefore, Itapúa is suitable as the model region of cluster.

2) Processing

Table 5 shows the flow of the materials required for producing 1 ton of this cluster's end product.

Table 5 Materials Required for Producing 1 Ton of this Cluster's End Product

End Product	Raw Materials	mixed feed	raw (raw milk)	product
Chicken	Soybean 1.375 t, Corn 2.42t, Others 0.88t	4.4 t	2 t (800 head)	Chicken meat 1 ton
Pork	Soybean, Corn, others	14 .2 t	2 t (20 head)	Pork 1 ton
Dried Milk	Soybean, Corn, Others	2.6 t	7.7 t (raw milk)	Powdered milk 1 ton

As is shown in the table, the earlier the stage, the greater is the amount of material needed. In order to develop an efficient materials flow, we should consider not only the amount and the distance but also the shipped amount for one transport load, the frequency and the quality. The critical flow for chicken meat and pork is the flow between feed plants and poultry farms. Not only in the USA and Japan but also in Paraguay, it is said that cost competitiveness can be gained if there are poultry farms and hog farms within 50 to 60 km radius of the feed plant. As for dairy products, the distance between a milking farm and a plant should be short because they need to deliver raw milk while it is fresh. It is desirable that the distance for delivering living poultry and pigs to meat processing plants is short.

If both stock raising farms and crop farms existed in the same area, it would be easier to make use of excrements of stocks as fertilizers. If a crop farm and a mixed feed plant were close to each other, the cost for procuring raw materials would be lower. In this context, if the production of raw materials, feed plants, stock rising farms, meat plants and dairy plants were in the same area, the competitiveness of the cluster would increase significantly. From this standpoint, Itapua and Alto Parana are suitable for the location of the mixed feed cluster in terms of processing as in 1).

Producing districts of soybean and corn are suited for the mixed feed cluster, which is demonstrated by the growth of chicken production in Brazil. Between 1994 and 1999, chicken production in Brazil increased 62 % for the nation as a whole, but increased 303% in the Midwest. While corn production increased by 11% from 1993 to 1999 in Brazil as a whole, it increased by 51 % in the Midwest of Brazil. Similarly, soybean production increased by 34 % in the entire nation and by 58 % in the Midwest. These figures show that chicken production increased in the districts with more production of corn and soybean. Moreover, chicken production grew more in the Midwest, which is landlocked and adjacent to Paraguay, than other districts. It appears to show the potential of the mixed feed cluster in Paraguay.