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Title: Comparison of logistics strategies of two cooperatives in the poultry sector using Stated

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THE COMPARISON OF LOGISTIC STRATEGIES OF TWO COOPERATIVES IN THE POULTRY SECTOR THROUGH THE STATED PREFERENCE.

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ABSTRACT

This article is a comparative study of logistic strategies of two Agribusiness Cooperatives in the poultry sector, with the inclusion area that is located in the geographical region bordering the Itaipu Lake made by Itaipu hydroelectric dam on the border of Brazil and Paraguay. This work aims to identify how these cooperatives agents order their preferences in the supply of maize as feed to the poultry industry. The four attributes considered important in the determination of the main logistical costs in the bond of the chain are Segregation, Quality, Storage and Drying. For this was used the Stated Preference Techniques, which identified the need of increase corn production in the summer harvest and its separation with the product harvested in winter, the research also suggests investing in silos to increase the storage capacity of production, only in the Drying attribute, both cooperatives have expressed contrary opinions, between investing in dryers and opt for natural drying.

Keywords: Agribusiness, regional development, logistics, stated preference.

Introduction

The Brazilian economy has a strong dependence on agribusiness, which generates 25% of Gross Domestic Product (GDP) and accounts for approximately one third of the jobs that exist in Brazil. According to the Ministry of Agriculture, Livestock and Food Supply of Brazil (MAPA, 2011), in 2009 the sector was responsible for the largest source of foreign exchange, accounting for 42% of total of exports, with US$ 64.7 billion of the 152.2 billion exported by the country.

In Brazil, the southern region presents itself as a major food producer, taking in the poultry an important activity of productive diversification with emphasis on significant growth. Situated in the South, the State of Paraná is the largest Brazilian producer of chickens, with high concentrations in the western region, in which says the Staduto et al (2008) the activity had its performance enhanced by abundant supply of raw materials for feed.

This region showed strong transformation since its colonization intensified in 1950. With the modernization of agriculture in the country, began to create opportunities in the beginning of the industrial complexes development (Dalmas et al. 2007). According with the data of the Brazilian Institute of Geography and Statistics (IBGE, 2010) in 2006 had 33.9% of the herd in the state. Between the years 2000 to 2008 showed an increase in the production by 112%, higher than Brazil and the Paraná, which were 50.82% and 73.71% respectively, being more dynamic in the activity.

Within the west region of the state, is located in the frontier region of the countries Brazil and Paraguay, which borders the lake of the Itaipu dam. This region has an important participation in the regional economy and where are inserted both agro-industrial cooperatives that are going to be analyzed in this study, whose predominance is poultry.

According with Tombolo and Dalla Costa (2010) the entry of cooperatives in poultry production was due to the adoption and incorporation into the production system of vertical integration developed by traditional poultry industry.

Williamson (1989) as analyzing the determinants of organizational form identifies that the choice of vertical integration by a company is given by the need to achieve savings in transaction costs.

One of the differences can be observed in the action of cooperatives in poultry production is the largest control in the chain on the bond responsible for the production of raw materials for feed. Thus, the Cooperatives adopted vertical integration in the challenge of maintaining the frequency in the functioning of plants, specifically in this chain bond, as strategies that seek to reduce risks in the regular supply of raw materials, because this affects the competitiveness of the sector.

As the logistical challenges is presented and the importance of the poultry sector for the region, it is appropriate to research, on which seeks to identify and measure how agents linked to two cooperatives in the region ordered in practice their preferences in terms of investment strategies focused on the supply corn used in the manufacture of feed for the poultry industry.

 Area covered by the research: Region bordering the Itaipu Lake

Located in the Far East of Paraná, the region bordering the Itaipu Lake, analyzed by Colodel (1988), from the economic and historical context, was the starting point of the occupation and exploitation of the western state of Parana, Brazil. This region has as main geographical reference, the Parana River which, in this part, defines the border between the countries of Brazil and Paraguay.

The introduction of agriculture in the region was in an environment marked by the process of agricultural modernization in the seventies, which favored the consolidation of soybean and

wheat as prior in sequence the culture of corn, in the mechanized system from planting to the harvest.

According to Oliveira (2008) these products prompted the formation of *export base* of the Western Region bringing strong economic growth for agribusiness and consequently to the regional economy.

The construction of the Hydroelectric Plant of Itaipu Dam was an event that caused major changes in the landscape, both geographically as well in the social and economic aspects, these changes were perceived with greater intensity in the towns that border the entire length of the flooded area.

The new configuration made by the formation of Itaipu lake that formed the bordering region of the Itaipu Lake labeled by the group of towns formed by 15 cities in the state of Parana and a city in the state of Mato Grosso do Sul who suffered expropriation of land by the Itaipu hydroelectric plant, a total of 16 municipalities in the Brazilian side.

Picture 1 below shows the location of the counties bordering the lake of Itaipu, located in the Far West of Paraná.

The studied area was defined as criterion with the counties that have intersection between the area of operation of the two cooperatives and the region bordering the Itaipu Lake, add to this set the neighboring counties in which the cooperatives have performance and exclusion of two cities which do not have coverage.

Picture 1 - Location of Paraná counties bordering the Itaipu Lake

Source: Base mapping of IBGE (Reolon, 2007).

The Cooperatives

Simultaneously with the implementation of agriculture in the region, a combination of the initiative of government incentives to farmers, were established cooperatives. This work will focus on two Agroindustry Cooperatives of the study area which, at first, acted an important role in the deployment of storage infrastructure of the production and dissemination of innovations available to the consolidation of corn and soybeans, and currently has in poultry industry represents one of the main activities.

In the segment of inputs, national companies, foreign and cooperatives operate on one side and feed manufacturers and on the other side as plaintiffs of rural production SANTINI and Souza Filho (2009).

The exchange of information along the chain is an important part in the strategies of vertical coordination. The flow of this information has an impact on transaction costs. According Bijman (2009) the cooperatives through the relationship of trust with its shareholders will occupy relative advantage in the exchange process which puts a certain advantage in supply chain integration.

This arrangement is perfectly identified in the areas of activity of the two cooperatives to be studied, and with greater intensity, since they have a strong bond with their members, which facilitates this relationship.

With regard to the logistics structure oriented to storage of grain production in the study region, there is a shortage of storehouses. According to information production for the year 2010, collected with the Cooperatives, and data Esalq - Log (2011) the capacity storage of the two cooperatives was sufficient to store only 57% of the amount of grain acquired in the catchment area of storehouses. Although, so far from ideal as recommended by FAO in the storage capacity is higher than 20% of the production in a harvest as appropriate to improve safety levels.

While in the United States the static storage capacity is 2.5 times the production of a harvest period, data from the National Supply Company (CONAB, 2005a) the storage capacity compared to Brazilian production is equivalent to a harvest is only 70%. Since the United States 80% of this capacity is located on farms, while in Brazil the proportion is only 11%.

Cooperative A

The Cooperative (A) was founded in the mid-sixties by a group of farmers, who had in common the necessity to improve conditions in the acquisition of inputs and marketing of their produce. Since that period was the beginning of the settlement of the region where there was no structured way of commercial production.

From this initiative has established itself one of the largest cooperatives of Brazil. His current area act covering 12 counties, it has 14 units of agricultural products, with the industrialization of corn, soybean, cassava, frozen vegetables and poultry.

According to Ziebert and Shiki (2004) the production of broilers showed strong momentum in the counties bordering the Itaipu Lake, from 1999, when it opened a poultry slaughterhouse Agroindustry Cooperative. The strong performance of the Cooperative as an integrator, promoted the establishment of poultry with their partners.

With 8,300 partners and approximately 4,400 employees have great cooperative participation in the generation of foreign exchange and taxes in the region, especially in counties where industrial units are installed.

Cooperative B

The Cooperative B had its inception in the early seventies, as a result of the movement organization in the region, also with the aim of reducing the difficulties faced by the farmers to acquire inputs and sell their production.

This cooperative has as a remarkable feature the land composition of its social board, where more than 80% of members have less than 50 hectares of land. Condition that allowed the collection of the *Declaration of Capability* of Pronaf (DAP legal) of the National Program for Strengthening Family Farming (PRONAF), with the Ministry of Agrarian Development (MDA) of Brazil. Passing thus obtaining the seal of social marketing products mainly soybeans for biodiesel, this in practice is configured as a differential price.

Along the last eleven years, in other words 2000 to 2010, the social board of the Cooperative B of which showed an increase in the period 2005 to 2010 grew by 18% and the number of employees grew by 315 % in the period from 2004 to 2010. This change of context affected the gross sales of the cooperative and the responsible for this change was the introduction of

poultry activities in 2005 with the aim of adding greater value to raw materials produced by the members.

Methodology

In order to achieve the purpose of this study, the methodology used was based on the realization of a literature review on the subject with survey data of the reality on the production and storage, with the official parts competent and public sector and academics research institutes. As well, it was carried out a field survey *using Stated Preference Techniques*, through which we sought to uncover the preferences based on the choices of agents of the Cooperatives, how much the variables weigh on investment decisions in the corn supply logistics for feed.

The economic problem of choice and *Stated Preference Techniques*

The classical literature defines economics as the science that studies the production, The circulation and consumption of goods and services produced by a society, used by this same society to meet your needs. According to Viceconte Neves (1999), when faced with the paradox that the resources are finite and the human needs are infinite, the agents have to choose the best combination of assets that maximize the utility.

Faced with this dilemma, the science has improved econometric models, which allow to reveal what is the behavior of individuals facing the need to make choices. The *Stated Preference Techniques* have been used in several studies in order to capture information on how people order their preferences, and from these data make suggestions.

Using Stated Preference, there are studies in the area of agribusiness as the study of the sugar cane industry of Paraná, Schmidtke *et al* (2009), using the technique to identify how these agents perceive the main restrictions of products derived from sugar cane in the international

market as well as to Miloca (2005) who identified the most important logistics attributes in the relationship between the industry with suppliers of the mate leaf.

Many others authors use this method, which according to Louviere I (2000), The *Stated Preference Techniques* is widespread in the industrial and commercial. According to him, among its applications is to identify and evaluate elements which are often not explicit, however exert influence on decision making.

Thus, the *Stated Preference Techniques* is shown a method that adapts to this study, allowing identifying the preferences of the managers of storage units and the managers of the two feed factory of the two Cooperatives, facing the challenges of dealing with problems that affect the logistics supply of corn to the feed in the poultry industry.

According to Lobo (2003) the research starts from the preparation in which it seeks to define the attributes, the cards are prepared and is determined the presentation form, and next run it. In this phase, the cards are clearly presented so that interviewed may order their preferences. In the analysis phase are made interpretations of the results generated mathematically.

3. Application and Results

As already stated, were interviewed managers linked to units of receipt and storage of grain and feed mills managers of the two cooperatives, which seeks to measure the usefulness of the attributes selected as important variables in the logistics of corn for chicken feed. To determine the attributes were conducted initial interviews to determine them with the managers of the cooperatives.

Considering the challenges that agents encountered in daily life, which are related to the processes of receiving, drying and storing corn for chicken feed, the attributes used to refer to these topics, since it directly influence the levels of service efficiency storage of grain production in the study region.
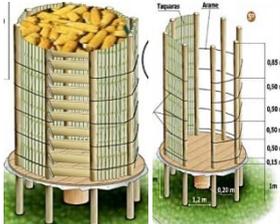
The exposition of agricultural production to climatic factors and seasonality of production requires planning and establishment of strategies that implicate the importance of stock in the regular supply of raw materials. In this sense the storage of the crop production to provide continuous demand industrial process in the off season is one of the most important logistics operations in this stage of the chain.

Thus, four attributes were elected *Segregation, Quality, Storage and Drying,* which are directly related to production and storage of corn for the supply of feed mills for broiler chickens in the region. Each attribute was presented with two levels of choice.

In the *Segregation* attribute the agents interviewed face a context of having to choose between storing so separate or mix the production of summer harvest and winter harvest. In the *Quality* attribute were presented the alternatives to increase or maintain equal the production of the summer harvest. Being a consensus on the technical means that summer is the period with the best conditions to produce corn of superior quality, unlike the winter season, during which the culture is more exposed to climatic factors that affect production and quality of corn. In an environment of shortage of storehouses the attribute *Storage* was presented to the interviewed with two possibilities, invest in storehouses or maintain the same static storage capacity. And last, In the *Drying* attribute, were presented situations in which the Cooperatives would choose to invest in dryers to accelerate the drying process on reception of production (thus avoiding parking lines of trucks), or as a strategy to establish reception of the production on lower humidity levels (reducing the drying time and consequently increasing the rate of reception of the production).

As an example of the card presented to the interviewed is presented the Picture 2 below.

Picture 2: Example of card

Segregation	Quality	Storage	Drying
Store in a separated way the summer and the winter harvest	Increase the production in the Summer harvest	Build more silos	Receives the corn with a lower moisture content

Elaborated by the Authors

Table 01, below shows the data the coefficients of each attribute indicating the contribution in terms of utility declared by the interviewed of the Cooperative A. These data will be discussed below.

Table 1 - Results obtained for the Cooperative A

*** LOGIT MULTINOMIAL COM PPROBABILIDADE CONDICIONAL ***
*** Method of Newton-Raphson – Max score with (5) Iteration ***
Efficiency = 0,8000 *** QMR = 0,8213

Attribute	Coefficient	Error	Test t	IC.(t=2,5%)
Segregation	1,5979	0,5460	2,9262	[0,506 ; 2,690]
Quality	0,1491	0,4545	0,3280	[-0,760 ; 1,058]
Storage	0,6164	0,4616	1,3353	[-0,307 ; 1,540]
Drying	-1,3137	0,5182	-2,5350	[-2,350 ; -0,277]

Obs.: The efficiency is already included in the variance.
Transformation: NOT TRANSFORMED DATAS
Number of Interviews = 12   Number of Cases = 36
F(Betas_0) = -38,1366   F(Betas_1) = -27,4200
Rho = 0,2810   Rho (Ajt) = 0,1761

Source: Research Data

As can be seen in the Table 01, the results of the survey done with the interviewers the Cooperative A, show that in order of importance of the attributes appears first the *Segregation*, followed by *Drying*, *Storage* and last *Quality*. This indicates that there is recognition of the need to increase the storage of the summer harvest, because this is the better quality. The drying attribute presents a negative coefficient, it indicates that to interviewers, this cooperative receiving of the product with lower moisture content, it was not considered the situation that would generate the best option to use, so they would choose to invest in dryers to speed up the receipt, instead of opting for natural drying of corn in the fields. In the storage attribute, to the interviewed, there is also a gain in the construction of silos to store the new production, instead to keep equal the static capacity. At last, the quality attribute indicates that for the interviewed there is the necessity to increase the offer of corn in the summer harvest, which would improve the quality of maize in the region.

Table 02, below shows the results of the coefficients calculated for the Cooperative B.

Table 2 - Results obtained for the Cooperative B

*** LOGIT MULTINOMIAL COM PPROBABILIDADE CONDICIONAL ***
*** Method of Newton-Raphson - Max score with (5) Iteration ***
Efficiency = 0,8000 *** QMR = 1,7985

Attribute	Coefficient	Error	Test t	IC.(t=2,5%)
Segregation	1,5281	0,5662	2,6990	[0,396 ; 2,660]
Quality	0,3252	0,4606	0,7060	[-0,596 ; 1,246]
Storage	0,9930	0,5256	1,8891	[-0,058 ; 2,044]
Drying	2,0945	0,5902	3,5488	[0,914 ; 3,275]

Obs.: The efficiency is already included in the variance.
Transformation: NOT TRANSFORMED DATAS
Number of Interviews = 12   Number of Cases = 36
F(Betas_0) = -38,1366   F(Betas_1) = -22,5955
LR (-2[F(0)-F(B)])= 31,0822
Rho = 0,4075   Rho (Ajt) = 0,3026

Source: Research Data

For the Cooperative B the results differ in the Cooperative A just order of importance of the drying attributes and segregation, and for this, there is a gain in the natural drying rather the use of dryers, since its coefficient is positive.

For both cooperatives it is possible visualize the results of the test of statistical $\rho2$ (Pseudo Coefficient of Determination - *Rho*). To Ortuzar and Willumsen (1990), as found in Souza (1999), the statistical ρ^2 has its theoretical value limited from 0 to 1, but its value above 0.2 and close to 0.4 indicates an adjust considered excellent for the multinomial logit model. In the case of the results found in this study, Rho has values 0.2810 and 0.4075. To the test of likelihood ratio LR = -2 {L (0) - L (β *)}, which intended to test the null hypothesis of all parameters simultaneously. According to Ben-Akiva and Lerman (1989 apud Souza, 1999), LR if the value is greater than the tabulated value $\chi2$ (α, r), so, it rejects the null hypothesis of all parameters simultaneously, however, the parameters have utility and are therefore relevant to the interviewed persons.

An analysis, related to each other, of the results of the preferences expressed by the interviewed persons from Cooperative A and Cooperative B of a comparison of their perceptions is presented in the Picture 3 below and discussed later.

Picture 3: Results related together among cooperatives A and B
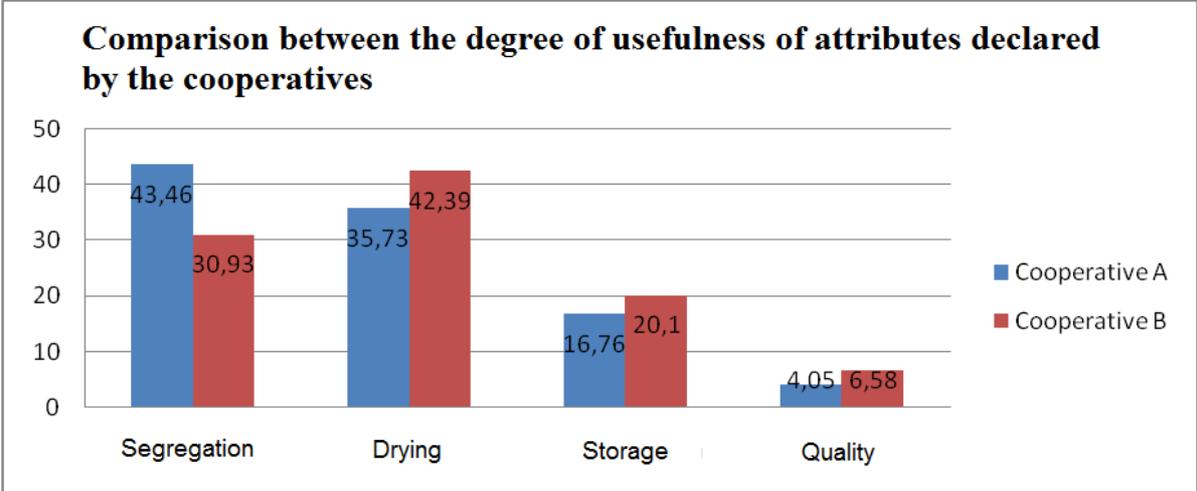
Source: Research Data

The results obtained showed a similar trend between the degree of agent preferences of both cooperatives, for each attribute. However the survey revealed a difference in the order of the preference of the two first attributes, while the Cooperative A orders as the most important the attribute *Segregation* and the second *Drying*, in the Cooperative B is observes the contrary where first appears the *Drying* and after comes *Segregation* in terms of the order of relative importance. The other attributes showed the same order in the opinion of the two cooperatives. Staying in the third the attribute *Storage,* and *Quality* in *fourth*.

The Segregation, highlighted as most important attribute in the opinion of those interviewed by the Cooperative A, represents 43.46% in terms of importance in relation to the other three attributes, in other words, almost half of the preference has turned to this item. This highlights the concern about the need to separate the corn production of summer harvest with corn produced in the winter harvest. As expect this choice reveals how this action may affect the quality of corn, therefore, serves as an instrument that makes possible to manage the levels of each lot of corn that can be combined to obtain certain feed with tolerable levels of quality for each phase of production of chickens. Once the production is mixed, yonder the contamination of the corn with best quality for the worst, it eliminates any possibility of interfering levels of feed quality. Also, the importance given to *Segregation* highlights the difficulties encountered by the Cooperative for the separation of the corn, since it competes with other commodities in storage space mainly soybeans, and wheat to a lesser extent. This situation is aggravated by the deficit of static storage capacity of the cooperative itself, which is directly linked to the availability of space for *Segregation*.

Although, *Segregation* with 30.35% of the weight of the preference appears in second place for the Cooperative B, the indices confirm the importance of this attribute. The fact of this attribute to have less weight, compared to the Cooperative A, is attributed to the condition

that the area of the Cooperative B is located further north, and therefore less exposed to severe frosts in winter. In practice it is observed that the occurrence of frost has significantly compromised the quality of the corn produced in areas exposed by this climatic event. For the Cooperative A, this is a real problem that was reflected in the levels of sensitivity of *Segregation* attribute shown it as more relevant for this group of interviewed persons of this Cooperative.

As mentioned before, *Drying* was elected as the most important attribute for the Cooperative B with 42.39%, and the second most important for the Cooperative A with 35.73%. Humidity levels can influence corn in many ways a set of factors which are related to the storage and supply strategies for ration. So, the higher the moisture of the corn delivered by the partners to the cooperative, the greater the time required for drying, which directly affects the rhyme of receipt of corn and therefore the cost of drying. Besides of representing a discount on the total production delivered. This discount is nothing more than the cost of drying converted to product.

The product with excess moisture also reduces the speed of receipt in practice causing huge queues of trucks during peak season. This situation is aggravated because the investment in dryers did not follow the trend of increased production nor even the increments observed in the technological harvest that modern harvesters machine are introduced annually with increasing capacity which shortens the interval of the harvest period increasing the demand for dryers.

Nevertheless the proximity between the percentages found for the two cooperatives in the *Drying* attribute and the importance that it represents for them, this ratio presented a negative sign for the Cooperative A, contrary to the sign of the same coefficient for the Cooperative B. The opposite sign shows a different choice considered first as earn. The agents of the Cooperative B assumed the condition that the best chance would be to reduce the moisture

levels of corn naturally, slowing the harvest which would involve the receipt of corn with lower moisture, positively impacting the drying time and consequently increasing the capacity to receive. For the Cooperative A, the strategy is to invest to increase the drying efficiency of the receipt of the product. The choice to invest in dryers instead of awareness the partners of the cooperative so that they deliver the corn with lower moisture content by the Cooperative A, this means that these agents are not willing to take the risk inherent to the exposure in the corn field for longer.

As already mentioned, the agricultural explorations are activities that are exposed to climatic factors. As the increases the cycle is extended, also increase the risk of losses from the weather exposure. The decision of harvesting the corn with lower moisture or increase the cost of drying is directly influenced by the sensitivity that agents have in relation to assume the climate risk. The region covered by the Cooperative A is more susceptible to weather risks that reflected in the answers presented.

The *Storage* attribute even with relative weight lower than the other, also appears as important. The result of the coefficient generated by the research was positive, it means that the interviewed persons from both cooperatives consider necessary to add value by investing in the construction of storehouses to increase the storage capacity of the production.

As well *Quality* attribute however with a lower percentage of importance among the four attributes, it expressed the concern of the agents over the need to increase maize production in the summer harvest to reduce the dependency on corn of winter harvest to the feed supply thus decreasing the risk for the lack of quality. However, it is noteworthy that this feature is directly linked to the previous attributes and overcoming this problem depends on the new settings to the cooperatives.

4. Conclusion

The aim of this study was to identify the strategies of agents in the management of the main factors that affect the logistics of the supply of corn for feed of broilers in the region between the neighboring countries of Brazil and Paraguay, on the lake of the Itaipu hydroelectric dam, area of coverage of the Agribusiness Cooperatives studied in stages between harvesting to the feed industry.

The survey aimed to measure the importance degree that each Cooperative put to different stages of logistics system connected to the supply of feed for the broiler. Through the *Stated Preference Techniques* identified that in order of importance *Segregation* and *Drying* appear to be the most important compared with the other opinions expressed by the interviewed persons from both cooperatives.

In practice both cooperatives would adopt different strategies to improve the system for receiving and drying corn for feed, due to opposite signs obtained in the answer, the Cooperative A would choose to invest in dryers, while the Cooperative B chose the strategy to receive the product with lower moisture, investing in awareness campaigns among the partners, but both recognize the need to reduce the moisture of the corn.

The poultry industry has evolved based on a system of production integration, standing out as one of the most important activities in the Brazilian agribusiness. Despite technological advances seen in the industry, there are many challenges to maintaining and increasing competitiveness. Among these challenges highlight the corn supply to feed the chickens related to the logistics system, which is also a concerning source to the Cooperatives.

The research identified the preferences of Cooperatives agents in terms of importance degree putting strategies to improve the system of corn supply for feed that is destined to the poultry industry. The need to increase maize production became evident in the summer harvest and its

segregation with the product harvested in the winter, as well as improves the drying process in order to ensure the final quality of the feed.

Research suggests the expansion of the storage service, showing the need for investment in silos to increase the storage capacity of production, mainly because it has a strong interdependence related with the other attributes.

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