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Management Model for Small-Scale Dairies in the State of Bahia

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Abstract *— Dairy farming plays a crucial role in Brazilian agribusiness and contributes to the country's employment and income generation. Moreover, the state of Bahia is the largest consumer market for dairy products in the northeastern region of Brazil. On the other hand, it has been observed that rural producers have low productivity and competitiveness. In addition, there is a need to implement mechanisms to support the competitiveness of agribusinesses and the production sector from the perspective of food chains, based on the evaluation of factors related to intangible resources, given their importance to the economy. In this scenario, this article aims to present a Management Model for Small-Scale Dairies in the context of the Milk Agro-industrial System of Bahia (SAG Leite). To this end, we visited companies and rural producers and applied the Intellectual Capital Statement – Made in Europe model (InCaS) to evaluate the maturity level of the actors involved. To conclude, we present the Management Model for Small-Scale Dairies, which involves (i) stakeholders; (ii) information and knowledge; (iii) methods, tools, and technology; (iv) indicators and results; and (v) processes.*

I. INTRODUCTION

Agribusiness accounts for 21% of Brazil's Gross Domestic Product (GDP). It is one of the cornerstones of the country's economy and constitutes the so-called "Green Belt." Dairy farming stands out as the fourth most important economic sector in the national ranking, with US$ 10 billion in total annual revenues, according to the Census of Agriculture by IBGE (2017) [1], which makes the country a key player in the global commodities market.

In 2017, Brazil had the largest cattle herd globally, with 232 million head. Indeed, agricultural production (60% of which comes from dairy farming) is the basis of the economy of 90% of the country's municipalities (IBGE, 2017) [1]. However, production costs and inferior quality hinder the global competitiveness of Brazilian milk (Monteiro, 2020) [2].

According to Zacarchenco, Van Dender, and Rego (2020) [3] and the Union of Dairy Industries and Products Derived from Milk (Sindileite) (2018) [4], there is a trend toward the consumption of dairy products with high nutritional density, probiotics, prebiotics, fiber, and low fat and lactose.

The opening of the Chinese market for Brazilian milk powder and cheese has led to a need to improve the relationship between producers and plants, as reported by G1 (2019) [5] and the Brazilian Dairy Producers Association (Abraleite) (AGROemDIA, 2019) [6].

Also based on the 2017 Census of Agriculture by IBGE and the Federation of Industries of the State of Bahia (FIEB), the state produces about 40% of the milk in northeast Brazil and is the largest consumer market for regional dairy products. This scenario reflects the economic imbalance caused by the low productivity and competitiveness of the state's dairies, which needs to be analyzed and corrected.

The first problem concerns the imbalance between demand and supply in the commodities market, which, in turn, requires increased productivity.Another issue is the lack of mechanisms to support agro-industry competitiveness and parameters to measure the level of development of the relations between the production chain and the market.

In this context, this article aims to analyze the context of Bahia's Milk Agro-industrial System (from now on,"SAG Leite") and propose a Management Model for Small-Scale Dairies operating in the state. Primary data were collected through interviews conducted with dairy producers and plants. In addition, a questionnaire based on the InCaS instrument (Intellectual Capital Statement) was adapted to the reality of SAG Leite in order to diagnose it and measure its level of development.

Then, a proposal for the Management Model was prepared, based on the generation of knowledge and under the monitoring of indicators and/or parameters determined from the European concept of Initiative for Sustainable Productive Agriculture (INSPIA).

II. THE COMPETITIVENESS OF BRAZIL'S MILK AGRO-INDUSTRIAL SYSTEM

According to the concept of Davis & Goldberg (1957) [7], agribusiness is "the sum total of all operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them." The rural complex is a corpus of specialized, independent entities linked to rural production. Agro-industrial systems also refer to "agribusiness," systems, chains, complexes, clusters, supply chains, and productive arrangements.

Among the agro-industrial systems, SAG Leite stands out for its long tradition of livestock farming, its importance for human nutrition, and the socio-economic impact of its economic activity. It features a standard design that shows the input suppliers (feed, for example), the *dentro da porteira* ("farm inputs") modality of production, the transportation, the dairy plant (processing and packaging), the distribution, and the consumers, as shown in Figure 1.

Fig.1 – Milk Agro-industrial System (SAG Leite)
Source: Rodrigues-Enriquez, Alor-Hernández & Sanchez-Ramires in ResearchGate(2015) [8]

Agro-industrial systems must be addressed in terms of their relationships and knowledge sharing to construct a management model that leads to competitiveness.

According to Zylbersztajn (1995), in an agro-industrial system, it is paramount to adopt a coordination structure responsible for minimizing costs, including the transaction costs necessary to drive the economic system and the prices to be charged. This coordination structure is based on market conditions, public policies, cooperative actions, joint ventures, and industry-producers integration and can facilitate or hinder the promotion of mechanisms to meet consumer demands based on the transmission of information and the reduction of transaction costs through quality control and production incentives.

High transaction costs indicate that the governance structure is carried out by the market with no contracts. Economic inefficiency occurs because the actors are independent and there are no economies of scale and scope; that is, prices alone fail to help coordination. If all the actors have the same perception of competitiveness, income will increase for all (ZYLBERSZTAJN, 1995) [10].

The industry is the driving force of value addition and has expanded its role and performance as a dynamic factor of the agro-industrial system. Therefore, it emerges as a natural actor to coordinate the chain and be in charge of the transaction costs of the economy, as proposed by Zylbersztajn (1995) [10], when answering a question by Coase (1988) [11]: "Why is not all production carried on by one big firm?".

The dairy industry is one of the most regulated sectors in the economy, which increases production costs. Therefore, it is crucial to reduce transaction costs so that the agro-industrial system can be competitive by considering the three competitive strategies pointed out by Porter (1986), namely cost leadership, differentiation and focus).

Distribution is the closest link to the consumer and points to information and trends, such as replacing products with low aggregation for those with higher added value (yogurts and dairy drinks, for example). In addition, one must consider cultural, economic, and socio-demographic characteristics. When projecting the results of the SAG Leite (which has oligopsony characteristics) from the viewpoint of market competition (which is an indispensable factor for the success of any enterprise), it is paramount to share information (feedback) with all agro-industrial components in the opposite direction of economic transactions.

As for competitiveness in agribusiness, the ongoing transformations have resulted in profound implications for organizations and production agents, among which we highlight the international trade intensity, the decreased protection for regional and national economies, and the pace of scientific and technological development, which, in turn, enables the dissemination of knowledge.

Iafelice (2021) [14] analyzed the concept of Davis & Goldberg (1957) [7] by comparing it with the current reality (referred to as the "New Form"). The author noted that after World War II, the expansion of global agricultural trade and the increase in productivity implied the use of agrochemicals, non-renewable fuels, technology, and specialization of supply chain actors on a larger scale. In addition, that study pointed to the increased interference of the financial system in the commodity market and the opening of the Chinese and European markets (we must consider that China First has been around for 5,000 years). The author also addressed the consequences of the COVID-19 pandemic, highlighting the need to employ competence, intelligence, diligence, and resilience to reorganize the world's agricultural production (especially the Brazilian one) amid an emerging scenario of rules, trends, possibilities, and resulting limitations.

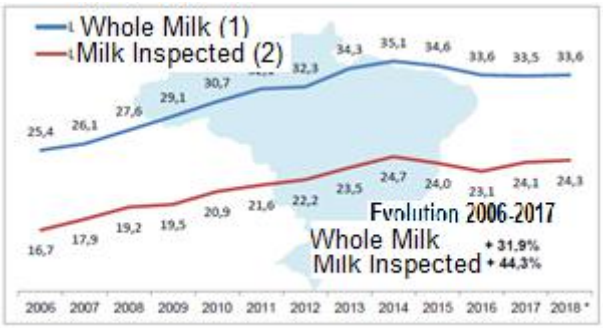
The effect of innovation in SAG Leite must be analyzed. Gunday et al. (2009) [13] dealt with the innovation and the performance of companies (or Agro-industrial Systems) and considered that "innovation is broadly seen as an essential component of competitiveness, embedded in the organizational structures, processes, products and services within a firm" (GUNDAY et al., 2009) [13]. In the scope of SAG Leite, innovation has been imposed by competition (from the introduction of differentiated products), putting pressure on profit margins and leading, in turn, to the need to increase sales volume through efficient distribution.

In this scenario, the competitive advantage for SAG Leite will derive from an adequate definition of the Management Model, which focuses on results and/or processes (PUCRS Online, 2020) [15].

According to the IBGE Census (2017) [1], since the 2000s, Brazilian milk production has reached 34 million liters/year. This resulted from the increase of investments in genetics, feeding, and logistic infrastructure for product conservation and the implementation of stricter legislation, all of which forced the improvement of quality and leveraged the amount of processed milk, according to Chart 1.

An important parameter is the lack of uniformity in productivity per cow/year reached in the largest producing states in Brazil, which reveals the lack of management homogeneity. Interestingly, the productivity, especially in the southern states of Brazil, is similar to that obtained by Uruguay and New Zealand, which are major players in the world market. However, there is a potential for growth in the other states, highlighting the importance of structuring and articulating the various actors.

Chart 1 – Brazil: evolution of national milk production (in billion liters)



(1) Municipal Livestock Survey; (2) Quarterly Milk Survey

Source: IBGE, 2017 [1]

We must emphasize the semi-extensive management system, typical of Brazil, which resorts to little feed supplementation during dry seasons and periods. The few producers assisted by rural extension adopt more modern exploitation techniques such as the storage of concentrated volume or green fodder (such as silage), irrigation, and pasture rotation. The use of feed supplementation (or the adoption of the confinement system) contributes to increasing costs and investments, consequently reducing the competitiveness of the farm.

Farm technology impacts the qualified supply of products. The difference between the volume produced and the volume processed is an aspect that deserves highlighting and is a direct consequence of the lack of quality of raw milk.

In 2017, the Brazilian dairy industry had a production capacity of around 24 billion liters per year, far above the volume effectively milked and processed, according to IBGE's Census of Agriculture; in other words, the sector operates at idle capacity.

III. PRIMARY RESEARCH ON THE MILK AGRO-INDUSTRIAL SYSTEM IN BAHIA

To diagnose the reality of dairy farming in Bahia from the perspective of the Milk Agro-industrial System (SAG Leite), a questionnaire was elaborated to be answered by producers and agribusiness representatives as follows:

a) Indústria Campanella Alimentos Ltda (Palmas de Monte Alto, in the microregion of Guanambi, in the Center-South of Bahia):

Campanella Alimentos Ltda started its activities in 1996, with the distribution of cold cuts, through a commercial representation established in Salvador, Bahia. In 2001, the company inaugurated the dairy plant to produce derived products such as cheeses, yogurts, drinks, sweets, and pasteurized milk.

Aiming at the sustainable development of the communities, the Campanella group provides technical support to the producers of associations and dairy basins in the region of Palmas de Monte Alto and neighboring municipalities under no integration regime.

Raw milk (90%) comes from family agriculture and is collected in trucks equipped with isothermal tanks. The raw material goes through a mapping process and quality control in the company's laboratory, which has reducedmilk acidity (before, only 20% of the milk received was used, but now only 10% is discarded).

To expand commercialization, a showroom was set up to sell products, mainly cheese. In addition, the planting of grapes to produce wine and add value to cheeses has been encouraged, and investments have been made in the technical improvement of workers and suppliers.

As for competitiveness, the owner of this company pointed out the lack of collaboration among dairy plants, considering the need to improve productivity in the field and the quality of the milk, given the region's potential.

b) Fazenda e Granja CarinhoLtda – Laticínios Bahia (Carinho Farm, BR 122 Highway, km 7, Pindaí, in the microregion of Guanambi, in the Center-South of Bahia):

Fazenda e Granja CarinhoLtda (Laticínios Bahia) was established in 1993 and has 35 employees. It works with milk produced by small producers in the region.

The agro-industry plant can receive 11,000 liters of milk per day on average but processes 7,000 liters in the dry season and operates at full capacity during the rainy season. At the time of this study, it paid producers US$0.40 per liter of milk. The farm has its personnel to regulate plant production.

Even though there are no formal integration contracts with small producers, the company provides technical assistance through an agronomic engineer who visits the properties and teaches producers how to plant grass and forage crops more suitable to the region, such as *andu* beans, in order to improve the animals' nutrition.

Due to the high costsin SAG Leite, particularly the inputs, the company installed a photovoltaic energy generation system.

Bahia dairy products are considered of decent quality and very competitive. However, the businessman in charge understands that a state policy for technical assistance and genetic improvement must be implemented, such as the one adopted by the Municipality of Pindaí, which provides high standard matrices and technical guidance on the farms.

c) Cooplar – Cooperativa de Lagoa Real Ltda (Lagoa Real, in the Center-South of Bahia):

Cooplar is a successful case in a very dry region, characterized by poor soils and inappropriate natural vegetation, requiring milk to be produced on a supplementary feeding basis.

The cooperative has 160 active members and participates in the Federal Government's *Fome Zero* program. This means that it must process the milk collected for consumption in the municipality after processing by the dairy plant.

The agro-industry canprocess 15,000 liters of milk per day, but its current output is 3,000 liters, reinforcing the need to expand production at the field level and the milk quality. Thus, as the genetic consistency of the herds is low, an improvement program must be put in place. Thus, Cooplar has selected breeds that best adapt to the dry characteristics of the region and disseminated the practice of artificial insemination (although at low intensity).

As for supplies, a 60-kilo sack of corn costs U$ 22.00, and a sack of cottonseed costs U$ 0.54. On the other hand, producers are paid $0.35 per liter of milk, which hampers production, even when they count on the subsidy offered by the *Fome Zero* program. Collecting milk on farms raises costs even higher. A few producers get the milk from the farm to the plant in inadequate storage and transport conditions. It is worth mentioning that some middlemen work collecting the milk in the region.

Cooplar makes the farm viable due to its lean administrative structure and efficient management that contributes to cost reduction, allowing the company to manufacture products well accepted in the market. We should also point out that through the *Fome Zero* program, the dairy plant receives around U$ 0.19 per liter of milk processed and delivered to the municipalities.

Expansions have been made in the plant, such as the acquisition of machinery and trucks, with resources totaling U$ 400,000, allocated from the *Bahia Produtiva* program organized by the World Bank to improve milk production. In addition, funding has been requested to hire a veterinarian to provide technical assistance services.

d) Coopag-Cooperativa de Produção Agropecuária de Jiló e Região Ltda (Várzea Nova, Piemonte da Chapada Diamantina):

Coopag is the largest agro-industry in the region of Várzea Nova and Miguel Calmon, between the municipalities of Jacobina and Morro do Chapéu. It has a daily reception capacity of 16,000 liters and contributes to closing the productive chain in such a poor and arid region.

Coopag's products are made with selected raw materials, go through rigorous control, and their quality is recognized in the market.

The fact that small cheese dairies are not certified by the *Sistema de InspeçãoEstadual* ("State Inspection Service," SIE) prevents them from being more aggressive in the market. As small producers are forced to sell their products to large dairy plants that buy milk in the region at very low prices, such as Betânia and Canastra, production becomes unviable due to high costs.

In this scenario, a strong feature of Coopag is the approximation with the region's small producers, which allows providing technical assistance and supporting the production and the collection of the product.

The dairy has a project to expand the structure for cheese production using funds granted by the *Bahia Produtiva* program. A strategy that has been successfully implemented is the purchase of fruit from regional suppliers to produce yogurts and pulps.

e) Indústria Leitíssimo S/A (Jaborandi, West Region):

The result of a meticulous work of almost 20 years, carried out by New Zealand entrepreneurs with expertise in dairy farming, Leitíssimo is based on the border between Goiás and Bahia and has stood out in the market for the quality of its product (Leitíssimo, 2020, and Globo Rural, 2020) [16] and [17].

At first, the breeding cows were genetically adapted to the tropical climate and selected from crossbreeding (artificial insemination) with the "KiwiCross" breed. This allowed a high average daily productivity without supplementary feeding, thusreducing production costs. The farm has an infrastructure focusing exclusively on field exploration, with irrigated pickets from a center pivot.

According to the farm manager, the highlights at the field level are:

- Low labor turnover, which increases involvement with the production and fosters continuous learning.
- A unique herd (selected and trained on the farm), free of tuberculosis, brucellosis, and other zoonoses, which increases productivity (milk is not collected off the property) and a competitive edge as to its lineage.
- The strategic location of the farm, at an altitude of 800 meters and surrounded by a natural reserve (75% of the total area), which provides isolation from other farming activities, reducing contagion and ensuring the control of the production process by adhering to health surveillance standards.

The production model is similar to that in New Zealand, where the high incorporation rate of technological improvements differentiates dairy farming from that practiced in other countries. In New Zealand, milk is produced on fertile land, with abundant water, in the field, and an adapted cattle herd based on the KiwiCross breed, resulting from the crossing and genetic adaptation of small Dutch cattle and Jersey breed. The production is carried out entirely in the field and results in a large volume of high-quality milk (with high solids content) and a reduced unit cost, which, in turn, increases the country's competitiveness worldwide.

f) Rural Producer "A," from Candiba:

The farm structure is adequate, has a reasonable level of mechanization and automation, and is equipped with a mechanical milking machine.

The producer uses complementary feed based on seed (bought in Barreiras, at U$ 0.40 per kilo), mixed with silage stored in large volume (seven silos ensure the feed during the dry season).

The animals have achieved an adequate level of genetic consistencydue to continuous selection. The farm adopts artificial insemination and natural mating using high standard bulls born from mothers and grandmothers selected for their high-yielding capacity.

The business operates as a family farm. The producer has a satisfactory level of knowledge but no controls. The management is performed instinctively and must be improved to contribute to the farm's efficiency.

The commercialization is assured by a partnership with Da Vaca dairy in Guanambi, which collects the milk stored in the expansion tank (including the region's production).

g) Rural Producer "B," from Barreiras (West Bahia):

The operations are based in a small property with less than 100 hectares, with five (5) employees and 50 breeding cows producing about 350 liters. The facilities, machinery, vehicles, and equipment are adequate, and the producer adopts adequate controls and computerized processes.

The producer acquires knowledge through the internet, is not a cooperative member, is not integrated with agribusinesses, and is paid according to the volume produced (no formal contract). The milk produced on this farm has 4.18% of solid content and is stored in expansion tanks.

According to the producer's view, the productive chain has relative competitiveness, and a positive change in the profile of dairy production in the region has been detected. However, he stresses the need for government intervention to improve productivity, as he considers technical assistance insufficient.

IV. ANALYSIS OF INFORMATION REGARDING THE BAHIA MILK SUPPLY CHAIN

Bahia's SAG Leite accounts for 4% of Brazil's gross agricultural production and is the largest milk producer in the Northeast (accounting for approximately 40% of the entire region), mainly due to the exploitation of the Cerrado biome in the Western Region. In 2017, agribusiness accounted for 24% of the state's GDP and 37% of exports, still according to the Census.

Bahia is one of the largest consumer markets in the country's Northeast region, and its demand is concentrated in the Metropolitan Region of Salvador. The state consumes more milk than it produces since the internal demand totals 1.2 billion liters/year; however, the supply reaches only 858 million liters/year (77.3 million of which are produced in the state's western region). In the state, 77.8% of the agricultural establishments are run by family farmers (the largest contingent in the country), who occupy 32.2% of the cultivated lands and typically have limited skills and education; moreover, their productivity is hampered by the lack or complete absence of technical assistance. That is, the farms are dispersed and misaligned and do not maintain loyal relationships with agribusinesses or processing cooperatives (IBGE, 2017).

Regarding the edaphoclimatic conditions, the state presents a diversity of biomes (*Cerrado*, Atlantic Forest, and *Caatinga*). However, agriculture and cattle-raising in Bahia operate largely in the semi-arid region and are, therefore, subject to the effects of drought.

According to IBGE (2017), producers in Bahia have low productivity because they use outdated technology and adopt inadequate prophylactic and sanitary practices. As a result, their production is very low compared to world averages, given the difficulty of enhancing farming techniques and the challenges posed by edaphoclimatic occurrences (such as the drought), which interfere by reducing profitability margins. For Lacki (1996) [9], producers make mistakes regarding factors and apply inadequate technologies. This, in turn, means that their unit costs are unnecessarily high and hurt their competitiveness.

In the processing stage, even having the power to determine the prices to be paid to producers, the agro-industries (dairy farms and plants) resort to imports due to the low productivity at the field level, thus implying a decrease in competitiveness caused by the inherent costs. Most agro-industries are small, family-based, and informal, such as the cheese dairies. Many are not particularly concerned about hygiene standards or raw materials control, nor are they inspected or comply with the sanitary legislation in force. Therefore, their competitiveness is low and requires incorporating technology to differentiate their product portfolio, add value, segmentcustomers, and reach other markets.

As for the know-how required to create conditions that can impact agro-industrial competitiveness, all research, bibliography, and experience come from and are targeted at the reality of the South/Southeast of Brazil, which is completely different from that of the Northeast.

For example, the west of Bahia receives much more sunlight than other regions, increasing green fodder production. For this reason, differently from the South and Southeast regions, where 30 pickets are used in rotational grazing, in Barreiras, it is possible to operate with 24 pickets (20% less).

Most cattle ranchers have low schooling and limited access to information and technical assistance. According to the IBGE (2017), 78% of Bahia's rural lands are used for agriculture and cattle ranching, 70% of the small

producers completed elementary school, and 80% do not receive regular visits from extension agents.

To mitigate this situation, the Brazilian Agricultural Research Corporation (Embrapa) created the *BaldeCheio* ("Full Bucket") program in 1998, based on rural extension and a strong emphasis on training. The technicians linked to *BaldeCheio* mentor producers, thus creating cooperation and commitment between producers and technicians while considering the profile of each actor involved. In Bahia, the Bahia Produtiva program has been changing the reality of small farms and milk producers. The program inverts the priority, taking the focus off dairy plants and redirecting it to the expansion of the production that will supply them.

The beneficiaries of *BaldeCheio* can take the production to the next level. For example, it has been found that 80% of participant farms have come to produce 100 liters/day in an extensive regime, increasing the production by 30% in the first months and 100% in the first year. This technical supervision must go on. When technical assistance is interrupted, the producer returns to the starting point on almost all occasions.

Another very important change in the west region is the introduction of associativism culture, which results in the organization of small producers into community associations and cooperatives, under the tutelage of the *Bahia Produtiva/AliançaProdutiva* programs, managed by the state government and funded with resources granted by the World Bank.

The program has allowed hiring a manager for the central cooperative in Barreiras and extension agents and technicians to work with the associations. The professional management combined the actions of the cooperative and associations, allowing the collective commercialization of milk with small dairies and increasing the small producers' bargaining power. In addition, the growth in production volume due to technical assistance allows the installation of concentrators that remove the excess water from milk; this, in turn, allows producers to sell the surplus to large dairy plants operating in other places and therefore reduces production costs. The association also facilitates collective purchases, thus reducing costs.

Furthermore, overseas enterprises have installed operations in the *Cerrado* biome and introduced innovative technology locally. An example of this is the Leitíssimo company, which is run by New Zealand entrepreneurs who settled in the town of Jaborandi about 15 years ago and adapted the production techniques used in the New Zealand dairy industry to the conditions of the *Cerrado*. However, their focus was different, and they set out to achieve a low cost per head instead of a high yield per animal.

Leitíssimo is the major enterprise in the region (which is characterized by the presence of small dairy plants). However, it will probably attract other entrepreneurs in the future since the conditions that the west offers to make it **Brazil's final dairy frontier.**First, however, small agribusinesses and producers must improve their efficiency by focusing on technology and management.

While Brazilian producers strive to increase their yields per hectare, Leitíssimo works with low average production, around 15 to 20 liters/head/day, in a pasture regime, using Tifton grass and corn and mineralization, and focuses on reducing product unit costs.

As for industrialization, differently from the traditional UHT technology employed by Brazilian dairies to process milk in carton packs, Leitíssimo produces long-life milk bottled in black film packs to prevent photooxidation and uses no preservatives. This method increases the quality of the product and adds more value to it. Furthermore, since their focus is to reduce the product unit cost, when the market is not very receptive, the surplus is sold to Piracanjuba, a large plantin the state of Goiás.

As for pricing, there is a concern in organizing the agro-industrial system in the region, and this has been achieved through professional meetings, seminars, and knowledge dissemination.Indeed, an initiative developed and managed for more than 20 years by the University of Maringá called ConseLeite was created from one of these meetings.ConseLeite is a software program that suggests a fair price to milk producers based on algorithms and confidential information provided by agro-industry companies (i.e., the industrialization cost) and producers' associations (i.e., the milk production cost). The companies do not have to pay the suggested price but have typically adopted it as a baseline. The gradual implementation of this methodology in Bahia represents an approximation between the industry and producers, which has boosted the search for efficiency.

Since they are closer to consumers, retailers have the highest profitability in the SAG Leite chain. Besides working at minimal risk, the large chains price the products and manage to obtain a profit margin of around 40%, compared to 20% by agro-industry companies and 10% by producers. This indicates that producers must join forces with plants, especially small and medium-sized ones. Therefore, the expansion of the use of ConseLeite may contribute to making the whole chain more efficient and shows the need to intervene in the medium and long terms through government policy. Indeed, pro-active producers and dairy plants have tried to achieve this, particularly through the Federation of Agriculture and Livestock of Bahia, which has spearheaded the efforts.

The timing is favorable to forward this regulation request to the Legislative Assembly and the State Government, considering that the milk production chain is one of the most important in Bahia and has great social appeal. Furthermore, the deficit between consumption (1.2 billion/liter/year) and production (less than 1 billion/liter/year) urges such initiatives.

As for the primary information collected, we can highlight the following key points:

- Both producers and plants must reconsider their view on the participation in associativism, as they lack a greater understanding of its challenges and benefits;
- There is an opportunity to integrate producers and agribusinesses to exchange experiences and know-how;
- There is a difference in perception regarding the competitiveness of SAG Leite, according to the producers' and plants' views;
- Regardless of productivity, the price paid per liter of milk is determined exclusively by the industry and solely considers the volume collected;
- There is practically no integration between producers and agro-industries, and only a lateral buying and selling relationship is maintained;
- In terms of technology, producers store their products in expansion tanks or cooling systems;
- Most of the know-how acquired by producers comes from internet research and training courses;
- In turn, the agro-industries typically rely on the internet andcourses and extension activities.
- It is worth noting the difficulty in providing rural extension services to producers in Bahia. The geographic extension, the lack of technicians, and the low schooling of the producers are barriers to achieving these goals.
- The family farmers are dispersed and misaligned in the process and do not have loyal relationships with the agro-industries or processing cooperatives.
- Dairies must make greater efforts to conquer the market and maintain their competitiveness. The adoption of innovative practices by agro-industries is incipient.
- The processing segment is characterized as an oligopoly and consists of medium and small enterprises. It relies on raw materials delivered by small producers in the state and imported powdered milk and pays low prices to raw milk producers.

In summary, the engagement in innovative practices in the dairy agro-industrial scenario in Bahia is limited or non-existent. This attests to the enormous potential for improvement in the scope of the issues addressed herein. The circumstances point to the need to propose a management model that contributes to leveraging the competitiveness of the dairy agro-industrial system in Bahia.

The need for the agribusiness to continue to provide ongoing support to the production link is evident, allowing the dissemination of knowledge and incorporating good practices throughout the Agro-industrial System.

V. USING THE INTELLECTUAL CAPITAL STATEMENT INSTRUMENT (INCAS) TO BUILD THE MANAGEMENT MODEL

To help to design a management model targeted at small dairies in Bahia, considering the need for knowledge incorporation, we resorted to the InCaS methodology, developed by the German pilot project Wissensbilanz – Made in Germany (led by Fraunhofer IPK, based in Berlin) and by the European pilot project "InCaS: Intellectual Capital Statement – Made in Europe." The methodology can be understood as an Intellectual Capital Statement (InCaS), an instrument to assess, develop, and report on an organization's intellectual capital and systematically monitor critical success factors.

Mertins and Will (2009)[18]analyzed the degree of importance of the critical factors for intellectual capital (IC) perceived by companies and what the structure of IC in an organization would be, supported by human (HC), structural (SC), and relational (RC) capital.

The starting point of the IC verification process is the vision of a given organization and its strategy, considering the possibilities and risks found in the business environment, according to Figure 2 (Mertins& Will, 2009) [18].

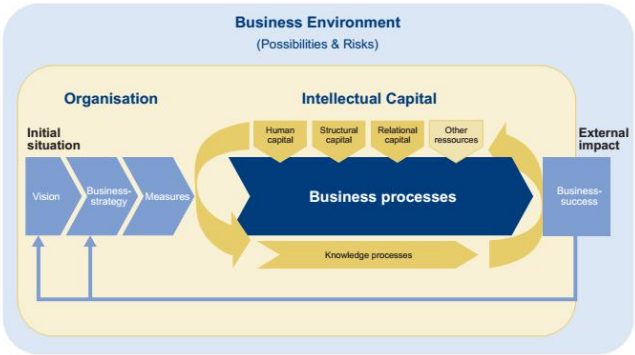


Fig.2. Representation of the business environment proposed by the European Commission's Directorate-General for Research, 2010.

Source: Mertins& Will (2009) [18]

To develop a catalog of requirements for ICS certification, the consortium reviewed various ICS guidelines for companies in Europe and their correlated auditing activities, based on a comparative analysis of non-financial reporting frameworks by OECD.

Intellectual capital (IC) refers to the collective knowledge acquired from the organizational and personal routines and the relationships of a given organization (Stewart, 1997) [19]; (Bontis, 2002) [20]. Moreover, intellectual capital is a valuable resource that organizations need to develop to achieve sustainable competitive advantages (Chen, 2008) [21].

The term intellectual capital (IC) was coined by Stewart (1991)[22], who defined it as "the sum of an organization's resources encompassing collective tacit knowledge, human skills, experience and any intellectual resource that can contribute to value creation for the organization" (Brooking, 1997) [23].

Along these lines, several authors have proposed other definitions for IC. According to Brooking (1997) [23], IC consists of intangible assets that allow a given organization to operate by introducing the combination element. According toEdvinsson (1997) [24], IC consists of the improvement capabilities of human beings, the structural capital, the expertise, the relationships, know-how, and other intangible assets. For Stewart (1997) [25], IC is "the sum of knowledge, intellectual property and experience held by everyone in a company, and which is used to create a competitive edge." It refers to the intellectual assets (knowledge, information, intellectual property, and experience) that can be harnessed to create wealth.

Bontis (1998) [26] categorizes intellectual capital into three interrelated primary components: Human, structural and relational capital, which are described as follows:

- **Human capital**: refers to the human factor in organizations, such as knowledge, skills, competencies, experience, and attitude. Furthermore, Roos and Jacobsen (1999) [27] added innovation and people's talents to the list. Human capital cannot be owned, it can only be rented (Edvinsson& Malone, 1997) [28]. Thus, the loss of human capital can threaten organizations because their talents, skills, and tacit knowledge will be lost (Roos et al., 1997) [29].
- **Structural capital**: refers to the learning and knowledge acquired in everyday activities, which is employed as the support infrastructure for human capital (Kong & Thompson, 2009) [30]. The list of items that make up structural capital is long and includes empowerment, organizational capacity, physical systems, quality, the scope of computerized systems, corporate image, database, organizational concepts, intellectual property, patents, trademarks, and copyrights (Silveira & Selig, 2001) [31]that may create value for organizations (Bontiset al., 2000) [32].
- **Relational capital** refers to organizations' formal and informal relationships with external stakeholders. In addition, it unveils the perceptions they have about these organizations and the knowledge exchange between both (Bontis, 1998) [26]. Relational capital is important for an organization because it multiplies value creation by connecting human and structural capital with external stakeholders (Ordonez de Pablos, 2004) [33].

An important aspect pointed out by Roos et al. (1999) [34] is that the way the IC is constituted for a given organization may not be the same for another. Thus, considering the context of this article, the IC of the milk agro-industrial system is different from the IC of a company in the metal-mechanic sector, for example. What matters is that IC provides the best possible value to organizations by combining, using, interacting, aligning, and balancing the three previous components and managing the flow of knowledge between them.

In this sense, considering the scope of this article, an InCaS model was developed for the various actors involved in the system and is characterized as follows:

- **Agro-industries**: the companies operating in the segment by producing the dairy products;
- **Producers**: the farmers who produce milk;
- **Other players**: associations, public and private agents that are part, whether active or not, of the milk production chain;

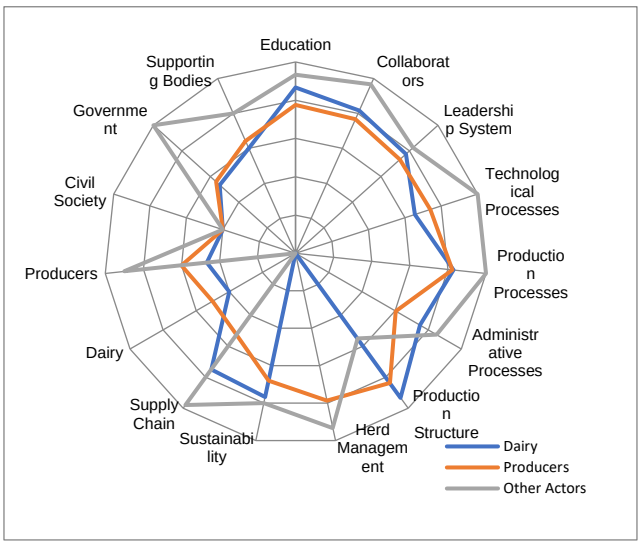
For each of these actors, the human, relational, and structural capitals were considered, organized as follows:

- **Human capital (HC)** – the education, employees, and leadership system dimensions were considered;
- **Structural capital (SC)** – technological, production, and administrative processes were considered, along with production structure, herd management, and;
- **Relational capital (RC)** – the production chain, the agro-industries, producers, civil society, the government, and support agencies were considered.

Thus, a questionnaire was structured and subsequently applied with the participation of various actors. Answers were obtained from a total of five (5) players from the

agro-industrial sector, six (6(from the production sector, and 2 (two) from other sectors. Chart 2 shows the results for the three segments.

Chart 2. Result of the capital assessment for the various actors.



Source: Prepared by the authors.

The charts reveal a few crucial points, as follows:

- **Education (HC)** – There is an opportunity to improve the educational level of producers. This involves the development of technical knowledge, training, and qualification of these employees and their level of education.
- **Collaborators (HC)** – The relationship with the collaborators working in the industry and the field is well developed.
- **Leadership system (HC)** – Although it was reported that these systems have a good overall level, the interviews and the practices identified in the scope of this study show that there is potential for them to advance. This item comprises the valuing and recognition of professionals, the critical analysis of overall performance, leadership, and knowledge dissemination.
- **Technological processes (SC)** – The use of technology in the agro-industrial system is deficient, both among producers and agro-industries. These involve the development of new technologies, products, and raw materials.
- **Production processes (SC)** – Although it was reported that they have a good overall level, the interviews and the practices identified show potential to improve the production process in terms of quality control, storage policy, processing, and transportation.
- **Administrative processes (SC)** – There is an opportunity to improve strategic planning, as well as selling and buying, marketing, financial, and control processes.
- **Production structure (CS)** – Both farmers and the agro-industries reported that the structure is adequate (machinery, equipment, facilities, and milk delivery location).
- **Herd management (CS)** – Farmers claimed to have a good command of and adopt adequate herd management practices.
- **Sustainability (SC)** – There is an opportunity for improvement in this aspect for bother producers and the agro-industrial sector in terms of waste, energy, and water management.
- **Supply chain (SC)** – There is potential for improvement in the relationship between the actors in the supply chain (producers, agro-industries, and the wholesale and/or retail distribution sector) to exchange information and improve distribution channels.
- **Agro-industries (RC)** – These are highly likely to integrate with the other actors, particularly regarding technology transfer and fostering a better financial buyer-supplier relationship.
- **Producers (RC)** – The producers need to adopt loyalty practices in the delivery and relations with associations and cooperatives associated with the milk production activity.
- **Civil society (RC)** – There is a possibility of expanding the relationship with civil society.
- **Government (RC)** – In the view of both producers and agro-industries, the government should grant more subsidies for the production chain.
- **Supporting Bodies (RC)** – There is potential to increase the relationship with institutions, class associations, and entities, as well as financial, research, and development institutions.

In summary, considering the description of the milk agro-industrial system scenario, the interviews conducted with the different actors of the production chain in the state of Bahia, while considering the results of the InCaS model analysis, allowed the structuring of a management model targeted at small dairy plants based in the state of Bahia.

VI. MANAGEMENT TARGETED AT COMPETITIVENESS BASED ON THE ACCUMULATION OF KNOWLEDGE

Considering that the low level of technical knowledge and the conducting of business pose challenges to the competitiveness of the dairy agribusiness in the state of Bahia, it becomes evident that the guidelines developed for the implementation of a management model must be grounded in this perspective.

Since the 1990s, the perspective of the Knowledge and the Learning Economies has contributed to advancing the idea that the competitiveness of companies and countries depends heavily on creative and innovative technological capabilities. The accumulation of technological capabilities must overcome the contradictions imposed by the market (the so-called trade-offs) in the search for the aforementioned paradigm shifts and innovations. Studies have been conducted to develop models (whether they are supported or not by metrics) that aim to register how and to what extent the production of knowledge in organizations occurs. Indeed, according to Nonaka & Takeuchi and Leonard-Barton, the accumulation of knowledge increases competitiveness in organizations. The SECI model of knowledge dimensions (or the Nonaka-Takeuchi model) focuses on analyzing endogenous learning. Moreover, the competencies model for developing organizations focuses on the basic competencies or set of technical and managerial systems and skills,given the need to tackle the internal rigidity that inhibits innovation.

Figueiredo (2009) [35] proposed investigating the technological learning processes and mechanisms used by companies to build and accumulate their capabilities. The author examined three learning mechanisms in light of specific metrics: “(i) intra-firm; (ii) inter-firm; and (iii) intra-organizational.” The author also defined **technological capability** (or knowledge base) as “a set of resources of a cognitive nature. It is an intangible asset that defines its performance in the market and what is possible to accomplish through production (of goods and services) and innovation activities” (ROOS et al., 1999) [34].

Nonaka and Takeuchi (2008) [36] conceived the Knowledge Spiral Model (of the SECI Model) to show the process of interaction between explicit knowledge and tacit knowledge by representing the process of knowledge creation in organizations from the observation of the dynamics of innovation in Japanese companies.

The elements presented in Figure 3 are the cornerstones of knowledge creation:

- **Socialization** (from tacit knowledge to tacit knowledge): sharing experiences (mental models and technical skills) to create tacit knowledge.
- **Externalization** (from tacit knowledge to explicit knowledge): articulation of tacit knowledge into explicit knowledge (metaphors, analogies, hypotheses, or models).
- **Combination** (from explicit knowledge to explicit knowledge): the systematization of concepts into an explicit knowledge system (involving exchanges through documents, meetings, phone calls, social media).
- **Internalization** (from explicit knowledge to tacit knowledge): incorporation of explicit knowledge into tacit knowledge (or “learning by doing”).

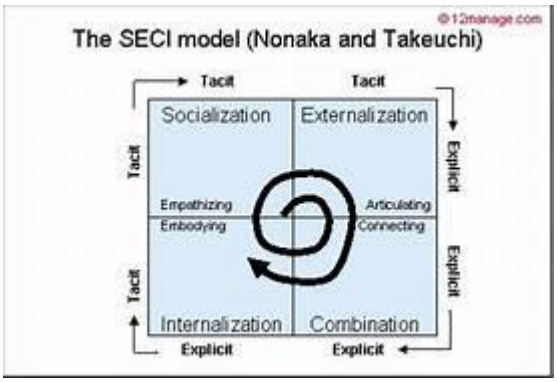


Fig.3: SECI Model

Source: Adapted from Nonaka and Takeuchi (2008) [36].

Leonard-Barton (1998) [37] advocates that organizations, besides being “financial institutions,” are “knowledge institutions.” The creation process is characterized by a dynamic that comprises search and selection rhythms, exploration and synthesis stages, cycles of divergent thoughts, and convergence steps.

Tacit knowledge is paramount to the process of generating innovation in terms of the **divergence** (the social component, influenced by dialogue) and **convergence** of the knowledge creation process (the coordination of tacit knowledge), according to Leonard-Barton and Sensiper (1998) [38].

In generating and diffusing activities, new knowledge is incorporated into the firm’s assets and categorized into four groups, as follows (Leonard-Barton, 1998) [39]:

- **Integrated, shared problem-solving** (present): The integration of employees aimed at problem-solving leads to new knowledge, which must be managed and disseminated throughout the organization.

- **Implementation and integration of new technologies and technical processes** (internal): Team spirit prevails over individual ownership of ideas.
- **Testing and prototyping** (future): Experimentation is an opportunity for knowledge development and acquisition.
- **Importing knowledge from outside the firm** (external): The search for innovative technologies is to be carried out systematically and carefully.

Leonard-Barton and Sensiper (1998) [40] illustrated the dynamics of the process based on the development funnel proposed by Clark and Wheelwright, according to Figure 4.

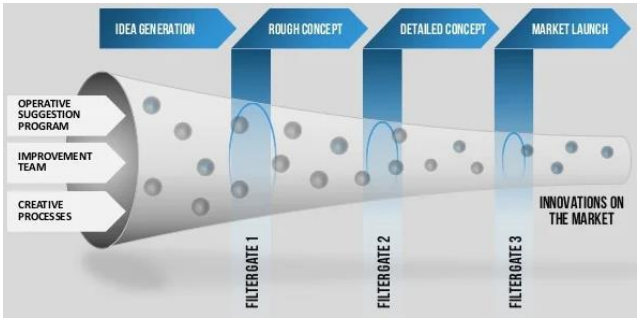


Fig.4: Incremental cycles of the innovation funnel model

Source: Adapted from Leonard-Barton and Sensiper (1998) [40].

Core capabilities are built up over time and cannot be easily copied or imitated. They include technological knowledge and activities that positively differentiate the firm from its competitors (Leonard-Barton, 1998) [39].

The enabling elements of the knowledge creation process in this model are divided into four major groups, namely

- **Physical systems**: software, hardware, and machinery;
- **Management systems**: educational, incentive, and rewards plans should guide the strategic use of resources and foster the accumulation of knowledge in the physical systems and the group;
- **Knowledge and skills:** The retention of diversified staff, rich in "personalized qualifications."
- **Corporate Values**: outline the general standards of behavior and concepts.

The managerial level of the organization, responsible for fostering knowledge diffusion and intra-organizational relationships, is treated as a source of external knowledge in their model (Leonard-Barton, 1998) [39].

Nonaka and Takeuchi's conceptual framework focuses on a dynamic model anchored in the social interaction between tacit and explicit knowledge and is responsible for expanding knowledge quantity and quality.

For Leonard-Barton (1998) [39], activities (and not financial goals or rewards, individual or group qualifications) are what create the skills of a firm. The activities incorporated in the individual create the context necessary for the firm's competitive advantage to be superior and are required in order to retain strategic technological skills. The ability to manage knowledge creation processes so that the company differentiates itself from its competitors is characteristic of managers who manage to make companies develop and sustain competitive advantages.

Nonaka and Takeuchi and Dorothy Leonard-Barton's knowledge creation and diffusion models are complementary and differ from economic and organizational theories. The authors present a view of how organizations can understand their processes better, manage them, and act as facilitators and organizers of the continuous flow of knowledge among collaborators. The development of favorable environments in the search for competitive edges provides a more efficient way to direct the efforts for innovation and competitiveness, according to Zack (1999) [41].

VII. ASSUMPTIONS FOR THE CONSTRUCTION OF THE MANAGEMENT MODEL FOR SMALL-SCALE DAIRIES IN THE STATE OF BAHIA

Given the above, the proposition of the Management Model for Small-Scale Dairies in the State of Bahia must consider a series of observations identified based on interviews with the different players in the dairy chain and the literature review. The key points are listed below:

- **Distribution** – Information and consumption trends for dairy products.
- **Industry** – Dynamic link or the driving force for adding value. Low value-added products have lost market share in all social classes, to the detriment of increased consumption of premium products (yogurts and dairy beverages). The industry determines the prices to be paid to producers.
- **Small Agro-industries** – In this case, the concern with hygiene and raw materials control stands out given the legislation in force. There are many small-scale businesses, such as family and informal enterprises (such as cheese dairies).

- **Producers** – They have low productivity, rely on outdated technology, and adopt unsatisfactory prophylactic and sanitary practices. They must tackle edaphoclimatic occurrences and present low profitability margins in their production, much due to the high product unit costs, which, in turn, reduces competitiveness.
- **Coordination Structure** – The determining factors of coordination are market conditions, public policies, cooperative actions, joint ventures, and the difficulty in integrating industry and producers. These factors pose challenges for promoting mechanisms to meet consumer demands. Adequate dissemination of information would contribute to reducing transaction costs through quality control and production incentives. All actors must have the same perception of how to maintain the competitiveness of SAG-Leite in the market.
- **Transaction costs** – If these are too high, they indicate that the governance structure is exclusively market-based, with no formalization of contracts. Since the actors are independent and there are no economies of scale and scope, this leads to economic inefficiency. Prices alone do not help coordination.
- **Applicable laws** – They must be strictly observed; they provide for the production and commercialization of products for human consumption.
- **Capacity building** – The degree of capacity building of the players involved in the process is low.

We suggest the adoption of a Management Model to outline the overall strategy and allow value generation prior to tailoring them to meet the needs of the chain players and leverage the sector. Thus, some assumptions were outlined and detailed as follows:

- **Assumption 1 – The elements of the management model:** The model consists of players, processes, information, knowledge, methods, tools, technology, indicators, and results.
- **Assumption 2 – The model's view**: The core element of the model is the milk producers, who are also responsible for cooling the raw milk and transporting it from the farm to the plants or for the occasional sale to the final consumer.
- **Assumption 3 – Chain players:** In the proposed model, the following actors will be considered: (i) the agro-industry, i.e., the companies operating in the segment by processing and producing dairy products; (ii) producers, or the farmers that produce raw milk; (iii) associations and class entities; (iv) public and private agents that are part, whether active or not, of the milk production chain, such as financial, research and development institutions (EMBRAPA, SENAI, SENAR, SEBRAE, Banks, among others); (v) Municipal, State and Federal Governments.
- **Assumption 4 – Chain processes:** The model will consider management (strategic planning, human resources, purchasing, sales, marketing, finance, and controls), production (products, by-products, quality control, storage policy, processing, and transportation), and technology processes (innovation and development of products, service, and processes). These processes have been established based on the InCaS approach.
- **Assumption 5 – Information and knowledge:** Primary research has shown that player must expand their access to information and knowledge. The basis of this assumption is the approach advocated by Nonaka and Takeuchi's (1995) SECI Model [42].
- **Assumption 6 – Methods, tools, and technologies:** The development and implementation of methods, tools, and technologies to support the competitiveness of agribusinesses will assist the advancement of the competitive relationships between production chains and the market in light of the concepts laid down by the InCaS Model;
- **Assumption 7 – Indicators and results:** The best arrangement of the elements of the management model aims to balance the supply and demand for dairy products to increase the productivity of the agro-industries, especially as they are the players in charge of coordinating the production chain;
- **Assumption 8 – Management principles:** The management model incorporates the fundamental principles of administration (planning, organization, direction, and control), mobilizing the stakeholders to search for excellence.

Figure 5 illustrates the relationship between the constituent elements of the Management Model for Small-Scale Dairies in the State of Bahia, which was developed based on the assumptions above.

Given this scenario, taking the constituent elements as a basis and reinforcing that the model should be developed in the view of the producers, we understand that according to the management model proposed herein, producers relate to the actors, carry out the management, administration, and technology processes, and rely on methods, tools, and technologies to support the processes. The players measure and manage indicators and results. Furthermore, regarding knowledge, producers socialize, externalize, internalize, and combine information and knowledge, according to Figure 6.

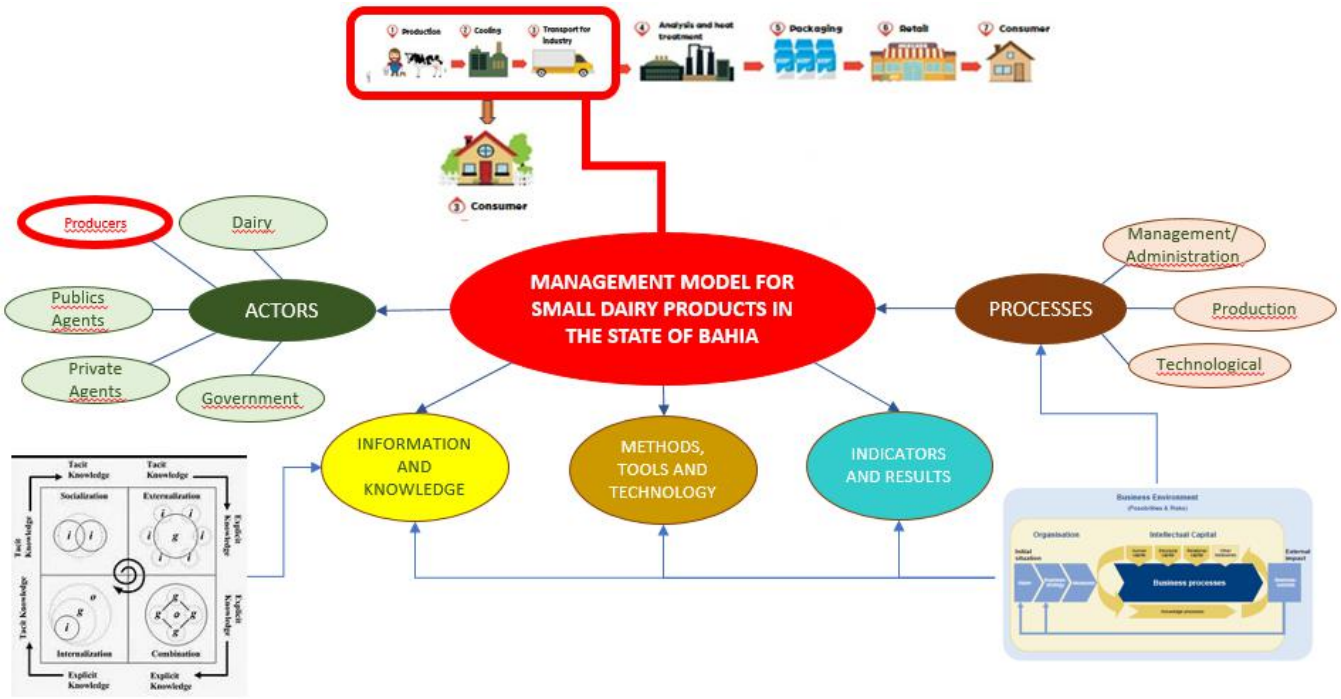


Fig.5 – Relationship between the elements of the Management Model for Small-scale Dairies in the State of Bahia, based on the assumptions.

Source: Authors

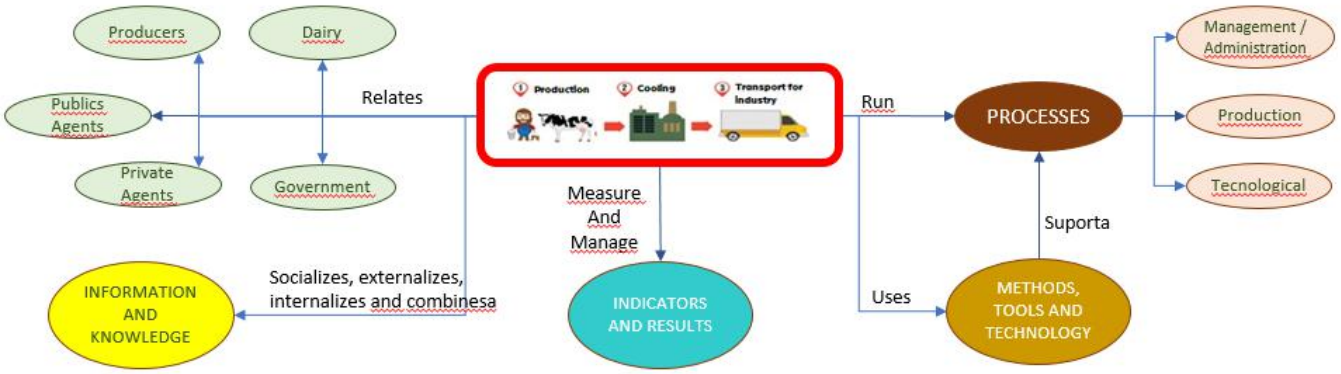


Fig.6 – Producers' perception of the Management Model

Source: Authors

Thus, the Management Model for Small-scale Dairies in the State of Bahia is presented below from a small business perspective. To this end, and considering a vision of the future, we propose some actions based on the interviews with the players involved, the InCaS model, the knowledge accumulation model, and the literature review, in general, namely (i) establish relationships with players; (ii) carry out the processes and rely on the methods, tools, and technology; (iii) socialize, externalize, internalize and combine knowledge; and, (iv) measure and manage the results.

Regarding **the relationship with players**, agro-industries, producers, public and private agents, and the government are considered. Table 1 in the appendix summarizes the actions planned for the relationship of small-scale dairies with the chain players. The bases to outline such information were the interviews with the participants involved, the InCaS model, and the literature review.

As for **process management**, the proposed actions are presented in Table 2 in the appendix.

When it comes to **methods, tools and technologies**, we can state that the ones available in the literature, as well as those commonly employed in the market, can be applied, such as SWOT analysis (strengths, weaknesses, opportunities, and threats), business plans, 5W2H, Balanced Scored Card, Canvas Business Model, Canvas Project Model, PDCA Cycle, BCG Matrix, GUT Matrix (Severity, Urgency, and Tendency), Flowchart, Signoff Sheets, Histogram, Control Charts, Scatter Diagrams, Risk Analysis and Management, Nonconformity Management, Indicator Management, among others.

Finally, regarding **socialization, externalization, internalization, and knowledge combination**, and based on Nonaka and Takeuchi's (1995) approach [42], the information that reflects the consumption tendency and the production bottlenecks must flow normally among all the links of the productive chain, providing an environment of competitiveness in the agro-industrial system. Thus, Table 3 presents some of the actions that make up the management model of the milk chain.

VIII. INDICATORS FOR THE ASSESSMENT OF SUSTAINABLE RESULTS

Finally, regarding indicators and results, we suggest using the approach proposed by INSPIA (Initiative for Sustainable Productive Agriculture).

Since it is an activity that depends on and strongly impacts natural resources (soil, water, carbon emissions), dairy farming must promote sustainable management practices. Sustainability monitoring is based on economic, social, and environmental indicators.

Therefore, INSPIA aims to establish an index to measure these aspects among European farmers, promoting a series of Good Management Practices (GMPs) to protect and improve the agricultural environment.

These GMPs can be implemented to improve the performance of the production chain as a whole under the coordination of the agro-industries, which have come to have their environmental practices indicators regulated by law from the perspective of environmental business management.

Some indicators can be highlighted, such as the rational use of water, the respect for the mandatory environmental reserve quotas, the non-use of pesticides, hormone-free feeding, etc.

The technical assistance team is the party in charge of disseminating this knowledge and requirements among milk producers.

IX. CONCLUSION

This paper does not exhaust the discussions about the competitiveness of the productive milk chain in the state of Bahia. On the other hand, it succeeds in presenting a management model that provides more rational use of human, technical and financial resources.

It is important to emphasize that the points presented in the model were extracted from the specialized literature and the practices adopted in plants and farms. They were also inspired by the needs and expectations detected during visits to plants and agricultural producers.

The model shows that it is necessary to adopt an integrated action involving several players with specific and articulated roles. The engagement of those responsible is vital for the structure of the capitals outlined by the InCaSmodel and the indicators and results presented by INSPIA.

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Table 1. Managing relationships with Milk Agro-Industrial System (SAG Leite) players

Productive Chain	• The relationship between players in the production chain must be formal, and the commitments must be fulfilled. • Create product distribution channels that contribute to expanding and developing the productive chain. • Allow open communication and technology transfer that favor the development of all links in the production chain. • Price milk according to a Sectorial Chamber while considering product quality.
Agro-industry	• Establish a strategy that sets profit concentration limits per client to diversify sales and actions that can boost the organization's business activities. • Agro-industries should transfer technology to producers to qualify the activity through technicians and/or companies, at their expense or through partnerships.
Producers	• Establish that producers have formal contracts to deliver their products to the agro-industries that are partners in improving productive activities. • Create conditions for producers to participate in associations or cooperatives to improve their agricultural production.
Civil Society	• Generate value for society by reducing rural flight, generating jobs, or strengthening the domestic market.
Government	• Create programs in the various spheres of government that provide subsidies to rural producers, including increment and purchase of production so that rural families can settle in one place.
Support Agencies	• Establish mechanisms for institutions, professional associations, and entities to create and keep open communication and technology transfer lines, thus favoring the development of all links in the productive chain. • Financial institutions should grant credit lines with subsidized interest rates to boost the development of dairy activities, including new investments in technological innovation. • Scientific and technological research institutions should promote strategies adherent to the dairy chain innovation. • Provide a structure of technical assistance (training, technology transfer) that improves livestock farming conditions at the field level, thus contributing to the competitiveness of the productive chain. • Educational institutions should make available regular and extension courses aimed at training technicians, producers, entrepreneurs, and workers in general, thus contributing to the development of the dairy chain.

Table 2. Managing processes with Milk Agro-Industrial System (SAG Leite) players

MANAGEMENT AND ADMINISTRATION PROCESSES	
Human Resources	• Define the processes, tasks, and protocols to be followed by workers and collaborators. • Encourage the adoption of structures with functional characteristics to foster improvement, specialization, and teamwork based on flexibility and valorization. • Encourage workers and collaborators to seek innovation in processes and methods to increase the efficiency and quality of processes and products. • Provide training, perform preventive maintenance, dispose of unused/occupied materials and tools, and provide PPE and CPE. • Comply with labor legislation in the scope of your rights and duties. • Design a career plan and grant bonuses for workers. • Structure a leadership system where all workers are motivated and managed by their respective leaders. • Providing workers with the opportunity to engage in management, creation, and use of knowledge within the organization.
Management	• Implement horizontal organization charts to favor greater integration between the structure of the organization and the actors involved through an increased degree of autonomy, flexibility, and informality, mitigating transaction costs and providing conditions to meet demands. • Adopt organization charts that consider the following functions Relationship with the market, especially producers; Collecting (focusing on the product to be collected); Production, focusing on technology and innovation; and Distribution (incorporating adequate logistics for the absorption of the production by the market). • Develop a business strategy plan and disseminate it among workers. • Develop an inventory policy (inputs, raw materials, and finished products) in light of the planned strategy. • Carry out the sales and purchase plan by standardizing contracts to reduce informational costs and eliminate the specificities of contractual relations. • Draft formal sales contracts with after-sales support and product quality traceability. • Establish a marketing strategy that keeps pace with the organization's goals. • Define a specialized account manager whose in line with the company's goals. • Implement a computerized system to manage all processes. • Allow the information that reflects the consumption tendency and the production bottlenecks to flow normally between all links in the productive chain, thus providing a competitive environment to the Agro-Industrial System. • Creating open communication and technology transfer that favor the development of all links in the production chain. • Regulating milk pricing through a Sectorial Chamber while considering product quality.
Processes	• Invest in modern, high-tech machinery, vehicles, and equipment with assured maintenance and automated processes that ensure and improve the quality of milk production and/or transformation. • Create installations that comply with the safety and sanitary norms in force, providing adequate shelter, hygiene, and feeding conditions, mineralization, and plenty of water.

TECHNOLOGICAL PROCESSES	
Products	• Develop new products such as strategies, portfolio management, processes, market research, people, and performance metrics.
	• Agro-industries should transfer technology to producers so as to qualify the production through technicians and/or companies, at their expense or through partnerships.
Processes	• Invest in Livestock 4.0 technologies, such as the automation of milking, handling, and artificial insemination. • Monitor milk quality through surfaces and microbiological analysis to safely carry out all production processes. • Control milk hygiene through handling; analyzing the physicochemical composition of milk, and performing mandatory tests: temperature check, alizarol test, cryoscopy index, density test, fat content measurement, alkaline phosphatase, and peroxidase test, measuring dry extract and fat-free dry extract, and adding acidity neutralizers and microbial growth-inhibiting agents. • Apply technology to comply with the time limit for each process while preserving product quality and following the established standards. • Standardize the transportation from the field to the tank so that producers watch the necessary tank precautions and follow the normative instructions. • Cool the milk to a temperature around 4ºC in the first two hours after milking, pack the product in expansion tanks, and, when collected from farms, in bulk, in isothermal tank trucks. These trucks must transport the product directly to the industry platform, under the industry's supervision. • Provide grazing land suitable for the number of cows (proper forage carrying capacity). The choice of varieties should consider the volume of green fodder produced and the topography. Pasture should be fertilized, maintained, irrigated, and managed. • Create product distribution channels that contribute to growing and developing the productive chain. • Agro-industries should transfer technology to producers so as to qualify the activity through technicians and/or companies, at their expense or through partnerships.
PRODUCTION PROCESSES	
Herd	• Carry out a management adjustment and food plan targeted at milk production's needs, with a complete and balanced diet consisting of a mixture of roughages (silage, hay, chopped green grass), concentrates (energy and protein-rich), minerals and vitamins. • Adopt a synchronization program and daily observation of the estrus cycles according to the heifers' age and employ artificial insemination. • Incorporate veterinary scientific innovations to promote animal health and improve milk quality. • Rely on an intensive system, in the case of a herd of good genetics under adequate management. • Employ technology to ensure genetic selection, aiming to preserve the traits, breed standards, and a predominant blood degree or dairy bloodline.
Sustainability	• Implement composting systems by reusing residues and selling the compost for organic production, thus adding value to the dairy chain. • Implement a renewable energy system (water, sunlight), identify how energy is used in production processes, and ration/optimize non-renewable energy use.

Table 3 – Managing knowledge with Milk Agro-Industrial System (SAG Leite) players

Socializing knowledge	• Create and share tacit knowledge, from direct experience, from individual to individual. • Promote group activities with the participation of people involved in the productive chain, informal sessions and brainstorms, customer interactions, and workshops to share improvement opportunities, best practices, and experiences, among others. • Design a technological architecture to manage the creation and use of knowledge within the organization.
Externalizing knowledge	• Disseminate tacit knowledge through dialogue and reflection, from individual to group. • Prepare instructional materials such as handouts, primers, websites, and applications to improve productivity and the relationships between people involved in the productive chain. • Provide and encourage workers to obtain specialized technical knowledge. • Design a technological architecture to manage the creation and use of knowledge within the organization.
Internalizing knowledge	• Create mechanisms so that producers can learn and acquire new tacit knowledge, from organization to individual. For example, courses, workshops, etc., can be organized. • Invest in specific training. • Enable the organizations to experience the practical result of new knowledge; that is, to develop operational knowledge. • Design a technological architecture to manage the creation and use of knowledge within the organization.
Combining knowledge	• Systematize and apply explicit knowledge and information from group to organization. • Develop resources to prototype and apply real models deriving from the knowledge creation process. • Design a technological architecture to manage the creation and use of knowledge within the organization.