# *Scenarios for the milk production chain in Brazil in 2020*

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**RESUMO**

**Cenários para a cadeia produtiva de leite no Brasil em 2020**

A produção brasileira de leite tem crescido constantemente e o País tornou-se autossuficiente na produção. Dado esse contexto, no presente artigo tem-se por objetivo desenvolver cenários potenciais para a cadeia produtiva do leite no Brasil. Foi realizada uma pesquisa bibliográfica e aplicada uma metodologia de escrita de cenários, incluindo a aplicação do método Delphi e projeções quantitativas. A matriz dos cenários foi criada com dados quantitativos e qualitativos, resultando em quatro cenários: dois cenários exploratórios, um cenário mais provável e um cenário desejado. Foram formuladas potenciais alternativas futuras, a fim de melhorar a qualidade das decisões estratégicas feitas por diferentes agentes.

**Palavras-chave**:  cenários, cadeia produtiva do leite no Brasil, estratégia para o setor de leite.

## 1. INTRODUCTION

Over the last decades, the dairy industry in Brazil has been influenced by many fundamental macroeconomic changes, such as trade liberalization in the beginning of the 90's, the "*Plano Real*" in 1993 (finally bringing inflation under control), the implementation of Mercosul (in 1995), and the application of anti-dumping rules. These measures brought sustainable benefits to Brazilian trade as a whole: the balance of trade has reported positive results since the year 2000, and by 2011 exports reached approximately US$ 256 billion with a trade surplus close to US$ 29.79 billion (MDIC, 2012).

Milk production in Brazil has grown steadily, increasing from 15.6 billion liters in 1993 to 30.7 billion in 2010, growth of 96%. The largest milk-producing region is the Southeast, which accounted for 36% of the domestic production

in 2010 (IBGE, 2010a). The State of Minas Gerais produces 27% of Brazilian milk, leading domestic production (IBGE, 2010a). With increased milk production, Brazil became self-sufficient in total dairy production. The country, however, still imports specific products to meet domestic demand.

Several factors are boosting the consumption of milk and dairy products, such as the increase in income, population growth, and changes in consumption habits. The 2010 per capita consumption of milk in Brazil was 161 liters/inhabitant/year (IBGE, 2010c), still below the recommended level of 200 liters/inhabitants/year (ZOCCAL, 2009). In sum, it is expected that the industry still shows high growth potential.

On the other hand, the aging process of the Brazilian population influences milk consumption negatively, as young people are more likely to consume fluid milk as opposed to other age groups. Given this context, this article developed four possible scenarios for the milk production chain in Brazil by 2020. It is important to point out that this paper does not intend to provide a single scenario forecast for the milk chain, but to formulate possible future scenarios that can be influenced by policymakers and stakeholders in the present , improving the quality of the decisions made by the different agents involved in the industry.

## 2. THEORETICAL FRAMEWORK

Business practices have significantly changed over the last decades. Rigid management practices that were useful at the beginning of the 20th century cannot be considered in the current corporate world of rapid and unpredictable changes (BESANKO *et al.*, 2012). Given this context, concerns with an unpredictable future are of vital importance in the decisions of institutions and organizations worldwide. This fact is influencing the field of future studies, whose importance to business is affirmed by authors like Chandler (1962), Andrews (1971), and Itami (1987). Mason (1994) and Schoemaker (1995) report that good planning is important to avoid common mistakes, such as underestimating or overestimating the impact of changes. Mason (1994) states that planning is a creative and open view of the future, in search of patterns that might arise and that should lead to a process of learning about the future.

As a tool to assist development of a future oriented strategy, the authors opted for the use of scenarios, a method presented by Godet (1982) as a tool for constructing alternative futures and possible pathways leading to them. According to Porter (1986), a scenario is an internally consistent view of what the future might be, and its primary roles are the explicit evaluation of planning assumptions, support for the implementation of goals and strategies, evaluation of alternatives, stimulation of creativity, homogenization of language, and preparation to face discontinuities.

In this sense, Selin (2006) states that scenarios are stories that describe different but equally plausible futures, that are developed through the implementation of methods that systematically combine perceptions about trends and uncertainties. Schoemaker (1995) explains that trends, uncertainties, and their relations are the key elements for building scenarios.

Describing a scenario development method, Godet (1993) states that the scenario must comprise a detailed description of a future situation, including the action of the major players and the estimated probability of uncertain events, structured in such a way as to describe in a coherent manner the transition from the initial situation to a situation in a future moment.

The scenario method has been increasingly used for preparing strategic planning, both for companies and governments, in order to offer an alternative for future reference as a guide to policy choices and decision making (LEÃO *et al.*, 2010).

According to Boaventura, Costa, and Fischmann (2005), the process of building scenarios may be performed using different methods that are always complex and costly to organizations, raising barriers to its broad adoption by companies. Nevertheless, the authors argue that scenarios can be a powerful tool for managers, if rigorously elaborated.

From the literature review, it is possible to find synergies and connections between strategic management and forecasting, as shown in Figure 1.

Regarding the Brazilian situation, academic research on development and use of scenarios has been applied in a wide range of situations, although several authors emphasize the need for more applied studies (SILVA, SPERS, and WRIGHT, 2012).We opted to develop scenarios instead of doing extensive statistical analysis because mathematical projections do not consider the existence of exogenous events that may have considerable effect and significantly change the current situation (SALEH *et al.*, 2008). Carvalho (2009) reinforces this critique of using quantitative techniques to project the past into the long-term future by assuming regularity of results and lack of interference of explanatory variables on the dependent variable, as is the case of time series analysis and trend extrapolation.

Throughout this article the elements of the scenarios, both trends and uncertainties, are referred to as variables. The most influential variables in the system are called key-variables according to Godet's definition (2000).

The concept of expert is defined as individuals who have theoretical or empirical knowledge in the area of study, according to Mckillip (1998). This opinion is shared with Fetterman (1998), for whom an expert is an individual capable of providing detailed information on historical data and the current scenario regarding the field of study in which they operate.

Concerning the type of scenario, the method used refers to industry scenarios, also called first-generation scenarios. According to Georgantzas and Acar (1995), these scenarios are exploratory and aimed at understanding environmental variables through the presentation of basic uncertainties.
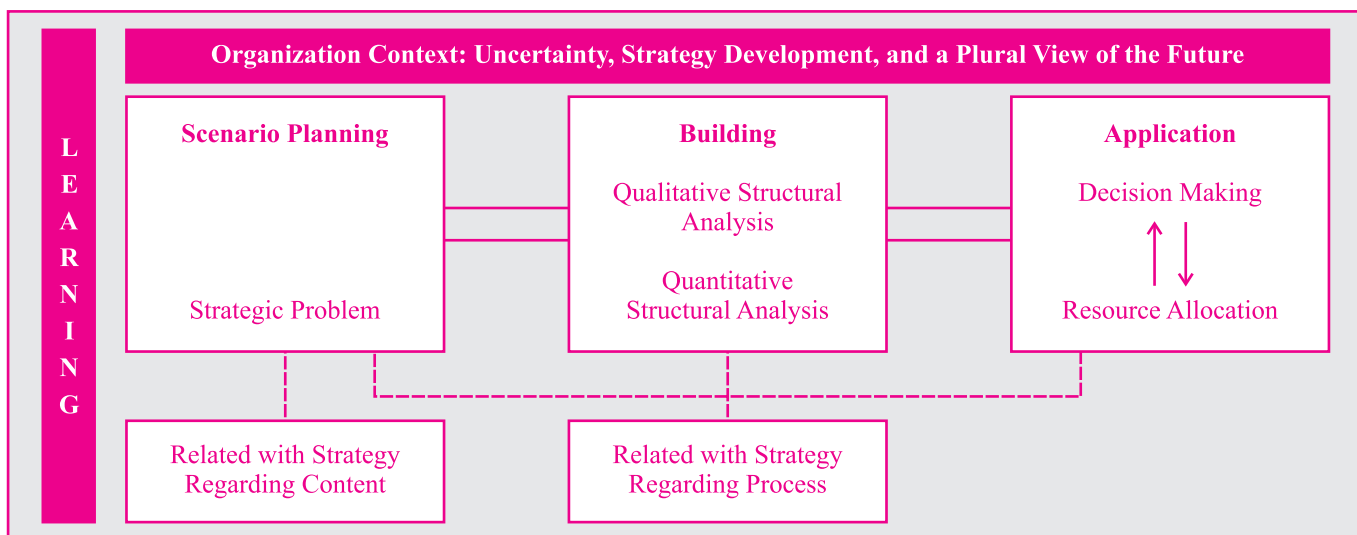
**Figure 1: Interaction Between Strategy Formulation and Scenarios Building**

**Source:** Silva, Spers, and Wright (2012).

The theoretical framework and techniques to build the scenarios presented shows that scenarios are not intended to strictly describe the future situation, given that future reality will be shaped over time. However, knowing these possible future situations prepares decision-makers and stakeholders to set strategies and to cope with the uncertainties of this changing environment to ensure positive results. (SCHWARTZ, 2000; WRIGHT and SPERS, 2006).

This article describes the approach elaborated by Wright and Spers (2006), applied to the milk production chain for the year 2020.

## 3. METHODOLOGICAL APPROACH

According to Wright and Spers (2006), there are seven basic steps to develop scenarios, as detailed below.

• **Step 1 – Definition of the scope and goals of the scenarios**
Characterization of the scope and the decisions to be supported. The core players and stakeholders, the geographical coverage of the scenarios, the temporal horizon, and the institutional environment must be noted.

• **Step 2 – Identification of the variables, trends, and essential events**
The scenarios' main variables are defined using primary or secondary data. Traditional analysis models, such as Porter's five forces (PORTER, 1986) were useful in the identification of variables and trends, according to the methodology used in this paper.

• **Step 3 – Arrangement of the variables of the scenarios**
This step consists of the identification of strong trends and invariable factors; uncertain events and facts that may affect the future, identified by the Interpretative Structural Method; and establishing cause and effect relations between the variables, identifying the causal, intermediate, and resulting variables.

• **Step 4 – Projection of the future states of variables**
Using the variables previously defined, qualitative projections are made for two to four future states, based on the opinions of experts. The technique generally used in this step is a double round Delphi with experts as respondents, together with quantitative projections whenever there is available data.

• **Step 5 – Identification of the driving themes of scenarios**
In this step, distinct themes are presented for the scenarios, which generally comprise the following content:
1. A most likely scenario, that assumes historical forces continue to act as in the past.
2. Two exploratory scenarios that assume the development of outstanding themes or events, focused on future environments.
3. A desired or normative scenario. Due to its prescriptive character, it poses a desirable situation, as a function of the values and beliefs of the experts interviewed.

• **Step 6 – Assembling the morphological matrix of the scenarios**
A morphological matrix is used to consistently combine future states estimated for each variable of the scenarios,

based on their structure and forecasts made (variables and scenarios, including trends and basic events).

- **Step 7 – Text development and validation of the results** Details about the scenarios are provided, each one describing their evolution and explaining the cause and effect relationships between variables. In addition, experts and stakeholders validate the proposed scenarios through presentation and discussion.

The data necessary to construct the scenarios is based on the characterization of the current Brazilian milk production chain, and for this, secondary data were collected

The methodology developed by Wright and Spers (2006) was applied and the majority of the specificities and complexities of the Brazilian milk industry were taken into account, such as the size of the internal and foreign market, and heterogeneities such as the size of properties, milk producers' profiles, and main producing states.

## 4. SCENARIO PRESENTATION AND OUTCOME ANALYSIS

### 4.1. Context: the Brazilian milk production chain

As previously mentioned, Brazil produced 30.7 billion liters of milk in 2010. The largest milk-producing region is the Southeast, which accounted for 36% of domestic production in 2010, followed by the South (31%), the Central-west (14%), the Northeast (13%), and finally the North (6%). The State of Minas Gerais produces 8.38 billion liters, accounting for 27% of Brazil's total (IBGE, 2010a).

Brazilian milk production grew at a rate of 61% from 2000 to 2010 (IBGE, 2010b). States such as Rondônia, Amazonas, Pará, Amapá, Tocantins, Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul, Mato Grosso do Sul, Mato Grosso, and Goiás stand out for their increased production (IBGE, 2002; IBGE, 2010a), whereas in the Southeast region, all states saw a reduction in their share of national production (IBGE, 2002; IBGE, 2010a). With this steady increase in national production, Brazil achieved self-sufficiency in dairy production early in 2003 (AGÊNCIA BRASIL, 2004).

Milk production is distributed throughout the country, and shows great heterogeneity with respect to the size of properties, type of producer, cattle, and production systems. Specialized producers that invest in technology and obtain higher quality milk are concentrated mainly in the States of Minas Gerais, Paraná, São Paulo, and Goiás. These states account respectively for 48, 21, 9, and 8 large producers amongst the one hundred major ones in 2011 (MILKPOINT, 2011).

Small producers represent a relevant force, both in number of producers and amount of production. These farmers live in great part on the income generated by the dairy business, largely constituting small family farms (CARVALHO, HOTT, and OLIVEIRA, 2006).

Milk has been an important economic activity for several distinct profiles of producers, who in turn require distinct public policies. On one hand are producers with access to information, credit, and strong relationships with clients and the milk production chain. On the other hand, the family dairy farm is also seen as an alternative to obtain some extra income and survive in rural areas.

An increase of 15% in the productivity of the domestic milk chain was observed from 1996 to 2010, from 1,138 liters/cow/year in 1996 to 1,340 liters/cow/year in 2010 (IBGE, 2010a). Productivity has also proved to be heterogeneous throughout Brazilian regions: the South and Northeast have obtained significant productivity growth (20.7% and 16% respectively), the North a far more modest rate (6%), and the Southeast and Midwest have seen a decrease of 22% and 7.5% respectively (IBGE, 2010a).

Cooperatives play an important role in the milk production chain in Brazil. Competition and increased consumer purchasing power has led many multinational companies to increase milk collection and introduce new products to market, such as UHT milk (BIALOSKORSKI NETO, SOUZA, and GARCIA, 2006).

As of 2006, Brazil had 1,350,809 dairy producers, most of them small: 51.6% had an installed capacity of 10 to 200 liters of milk/day. Only 3.3% had an installed capacity of over 200 thousand liters/day (ZOCCAL, 2012). The dairy industry in Brazil is not very concentrated, since the annual intake of the five largest companies represented only 27.5% of the total milk formally acquired in 2005 (16.7 billion liters), while the 14 largest companies accounted for 41%. In terms of the use of milk by the industry itself, cheese stands out as the most milk-intensive product, accounting for 34% in 2007. UHT milk and powder milk accounted for approximately 18.7% and 18.6%, respectively, while 6.8% of production is destined to A, B, and C grade fluids. The remaining products account for a small portion of the industrial use of milk, but have potential to grow in the market (CARVALHO *et al.*, 2007).

The traditional food service segments such as restaurants, bars, bakeries, cafeterias, and kitchens maintain their importance in the sector, but fast food chains, hotels, and convenience stores are increasing their share (DONNA, 2005).

It is important to note that the rise in consumption of dairy products is both a result of gains in real income and population growth. For example, between 1996 and 2010 the Brazilian population increased from 161 million to 190 million inhabitants, a growth of 18%, and in this same period milk production rose from 16.5 billion to 30.5 billion liters, an increase of 85%.

Current per capita consumption of milk in Brazil is 161 liters/inhabitants/year (IBGE, 2012b), below the recommended level of 200 liters/inhabitants/year (ZOCCAL, 2009), indicating possibilities for further growth.

On the other hand, the population aging negatively influences milk consumption, as young people are more likely to consume fluid milk than other age groups.

With respect to the export market, there is a perception that Brazil might occupy a sigificant portion of the international trade in dairy products since there is plenty of available land area, relatively cheap inputs, and a lack of weather or environmental restrictions. However, it is especially important that the country meets international agribusiness market requirements.

### 4.2. Data analysis for scenario elaboration

The seven steps were applied as described below, resulting in four scenarios for the milk production chain in Brazil.

With regard to **Step 1** (Definition of scope and goals of the scenarios), a period up to 2020 was defined to analyze projections for medium and long-term strategic alternatives, in addition to guiding short-term actions. Target stakeholders for the scenarios include: the industry in general, milk producers, cooperatives, small dairy producers, governments, professional associations, input companies, and service providers. The market for dairy products which comprises, in order of volume, cheese, long-life milk, powder milk, pasteurized milk, and others, has proven to be competitive, with the 14 major companies, such as DPA, Itambé, Eleva/Perdigão, and Parmalat, holding approximately 41% of the market share under federal inspection in 2005 (CARVALHO *et al.*, 2007)

In 2003, Brazil achieved self-sufficiency in milk and production is still growing (AGÊNCIA BRASIL, 2004). However, the country's share in the international milk trade is still very limited, mainly due to subsidies in several countries and food safety agreements. Europe and New Zealand are major global exporters while the Middle East, North Africa, Mexico, Venezuela, and Southeast Asia are major importers.

Producers of up to 50 liters/day represented 55% of all producers and accounted for 19% of Brazilian production in 1995. In 2006 this group represented 79% of all producers and accounted for 25% of total production. In 1995, producers of more than 500 liters/day represented only 1.8% of the total producers and accounted for 10.6% of the production; in 2006, they represented 0.7% of the total producers and accounted for 16% of the production (ZOCCAL, 2012).

The production system presents great diversity and very little standardization, even at the regional level. Concerning quality, 66% of production is sold under the federal inspection system, while the remaining comply with state and municipal systems or are part of the informal market sector.

Therefore, when considering the industry context, stockholders, and decisions to be supported, the scenarios cover the themes detailed in Table 1.

With regard to **Step 2** (identification of variables, trends, and basic events), it was possible to identify the variables as shown in Figure 2. When organizing these variables, Porter's Five Competitive Forces model (PORTER, 1986) was employed to ensure that the scenarios will comprise all elements that are relevant for the milk industry in Brazil.

In **Step 3** (arrangement of the variables of the scenarios), relevant invariable factors were defined for the milk production chain in Brazil, such as the population profile (aging), and distribution of wealth, which should improve for all scenarios, and is thus considered a heavy trend.

In order to identify the resulting intermediate and causal variables that will determine the scenarios, we applied Interpretative Structural Modeling (ISM) (WRIGHT, 1991). This technique was developed to increase the efficiency of group works, aiming at analyzing difficult and complex issues. With the aid of computers and this technique, a hierarchized structure is created for the problem in question. According to Wright (1989),

### Table 1

### *Themes of the Scenarios of the Milk Production Chain*

| Themes of the Scenarios | Details |
|---|---|
| International competitiveness and insertion of Brazilian producers in the global market | Potential opportunities for Brazil as a milk exporter. |
| Domestic demand | Consumption habits, income, competition, new products for the domestic market, institutional market, growth opportunities in the domestic market, and the impact of the informal sector on the market. |
| Production framework and production systems | Concentration and characteristics of producers, technology used in production, production processes, quality of products. |
| Institutional and legal aspects | Subsides, informal sector, consumption restrictions (Law 11.265), Public Consultation 71, by ANVISA (National Health Surveillance Agency). |
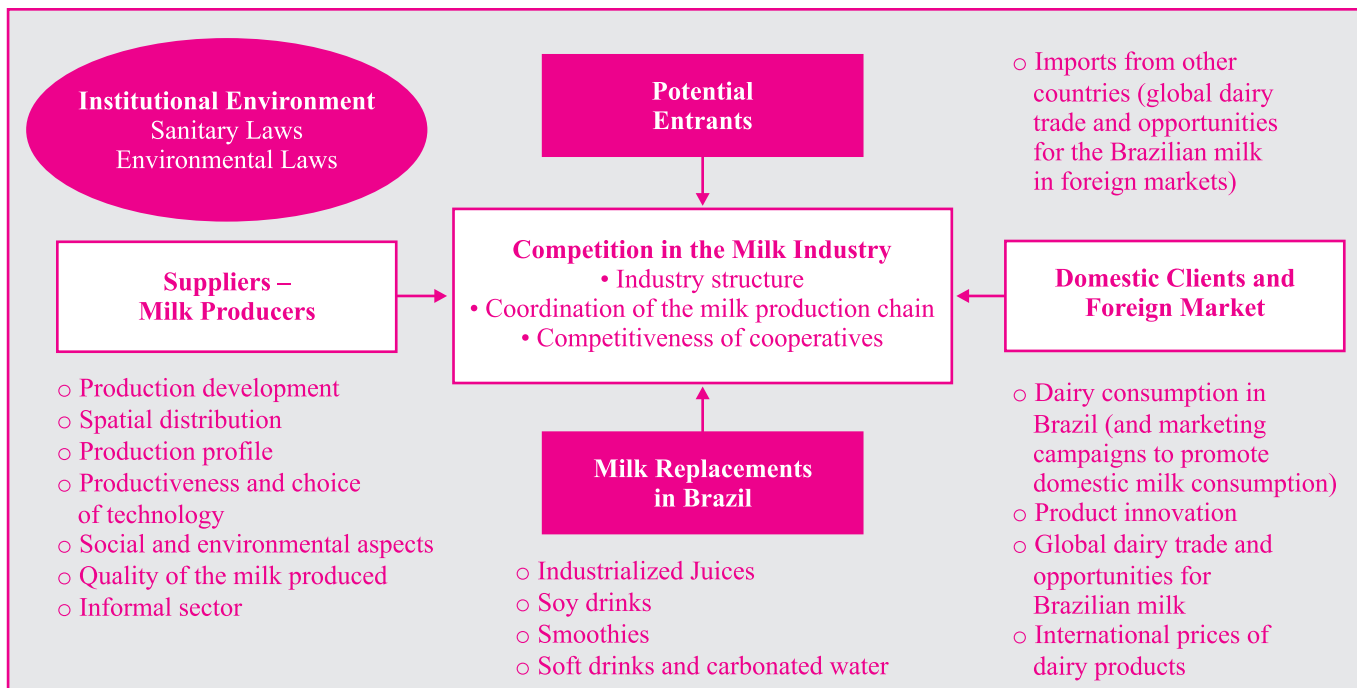
**Figure 2: Relevant Elements for the Milk Production Chain Scenarios**

**Source:** Adapted from Porter (1986).

the ISM technique has proven to be useful in the following situations: organization of goals, definition of priorities, and a hierarchy of policies and guidelines. This technique enables the structuring of a large amount of non-quantitative information, contributing to the analysis and the decision-making process regarding policies and guidelines, where quantitative models do not typically capture many of the critical conditioners that the situation discloses (WRIGHT, 1991).

The set of information required to define a structure of this nature may be represented by a binary matrix and a mathematical operation that enables it to transform so as to evidence all inferences and hierarchical levels contained in the original information in a clear manner (WARFIELD, 1976, *apud* WRIGHT, 1989).

After the definition of the context, a group using the ISM method must, according to Wright (1991), extract a precise set of pertinent elements. Following the discussions of the group and the questions presented by the computer, the structural map is generated through the potential logical references. After the discussion, the structural map is presented for analysis. With this procedure, it is possible to achieve an enhanced understanding of the group in question, to systemize the logical thought and communication about the problem.

The results arising from this application are:
• Causal variables – socioeconomic factors, health and safety laws and economy, milk consumption in the domestic market

and informal sector, international prices of milk and import and export values.
• Intermediate variables – number of dairy producers, relation between industry and producers, milk collected by cooperatives, suppliers of raw material, milk quality, yield productivity, regional production, and impact of sugar cane and other cultures.
• Resulting variables – milk production in Brazil and production profile.

With the combination of the variables and the projection results of the variables' future states, it was possible to develop the scenario matrix using the morphological analysis method. According to Godet (2000), the morphological analysis aims at methodically analyzing possible futures, based on a study of all combinations resulting from the decomposition of a system.

In **Step 4** (Projection of the variables' future states) the WebDelphi method was used, consisting of the Delphi survey carried out via internet to collect data. According to Wright and Giovinazzo (2000), the Delphi method is used for the identification of trends and future events, through a consultation with a group of experts on the theme. Delphi's main characteristics, as set out by Martino (1993), are:
• Anonymity of the respondents, by completing the questionnaire in a form on the website.

- Statistical representation of the distribution of results: tabulation and statistical treatment of the results.
- Feedback from the group for re-evaluation in subsequent rounds, and the results of the first round are disclosed so that they can be considered by the group when they complete the second round.

The technique is implemented by the completion of an interactive questionnaire, which passes through a group of experts several times. The questions must be carefully formulated and different types of questions must be used, as suggested by Wright and Giovinazzo (2000). Two rounds of questions were asked and the basic assumptions of the Delphi methodology were preserved.

Round 1 comprised eight detailed questions and was answered by 119 experts related to the milk industry.

It was possible to identify a most likely scenario and two contrasting scenarios for the milk production chain up to 2020. In Round 2 we obtained answers from 43 experts, and the scenarios identified in Round 1 were presented, redefining opinions and generating data for the creation of a desired scenario to complete the scenario matrix.

A profile on the respondents of both Delphi's rounds is pictured in Figure 3.

Figure 3 shows an heterogeneous profile of the specialists consulted, in keeping with the Delphi's aim to avoid bias. Together with the huge number of respondents, the integrity of the research inputs are assured.

Quantitative projections were also conducted for certain variables: milk production, annual milk consumption, and productivity. For the achievement of quantitative projections, we carried out the time series analysis and the simple regression analysis. The quantitative projections were combined with Delphi's inputs so they could become more complete and consistent.

With regard to **Step 5** (Identification of the scenarios' driving themes), there are distinct themes for the four scenarios, according to the structure:
- A most likely scenario that assumes the historical forces are still acting as in the past.
- Two exploratory scenarios that assume the development of outstanding themes or events, focused on future environments.
- A desirable or normative scenario. With prescriptive character, it presents an undesired situation, as a function of the values and beliefs of the interviewed experts.
- In Line 1, the following scenarios have been set out by Round 1, based on medians and quartiles, as well as the reasons for the answers and the qualitative data:
  – More likely scenario 1: "A continuous but uneven growth";
  – Contrasting scenario 2: "Milk, the new agribusiness star";
  – Contrasting scenario 3: "A wasted future".
  With Round 2, all variables of the desirable scenario have been outlined, defining the scenario 4 named "Competitive family agriculture".
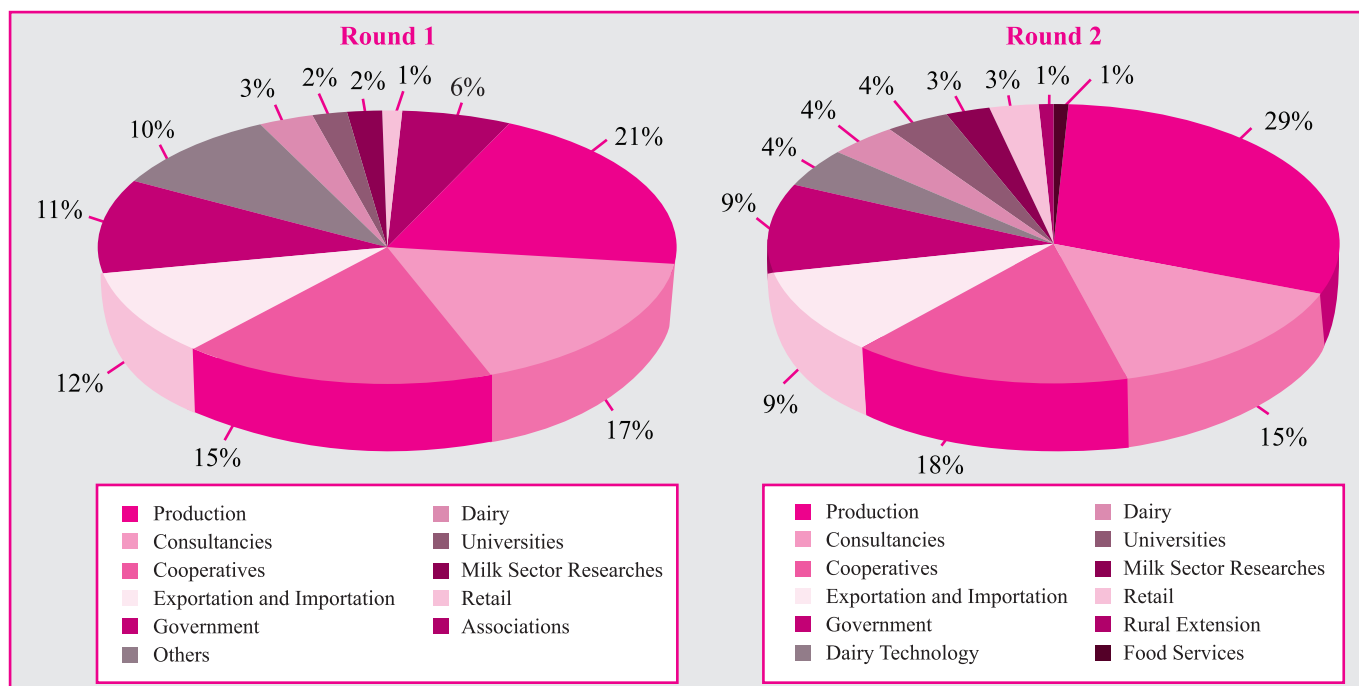


*Figure 3: Delphi's Respondents Profile*

In **Step 6** (Assemblage of the morphological matrix of the scenarios), an analysis has been carried out combining all variables of the scenarios, and providing the basis for the scenario descriptions.

The scenario matrix for the milk production chain in 2020 is shown in Table 2.

With regard to **Step 7** (Description and validation), details were provided for each scenario, such as analyses of consistency, plausibility, and relevance for decision making in the milk industry. Another important point is the analysis of the implications of each scenario, anticipating threats, forecasting opportunities, and structuring actions with a view to creating favorable conditions.

*Table 2*

*Morphological Matrix of the Scenarios*

| | Scenario 1 – "Continuous but Uneven Growth" – Most Likely | Scenario 2 – "Milk, the New Agribusiness Star" | Scenario 3 – "A Wasted Future" | Scenario 4 – "Competitive Family Agriculture" – Desirable |
|---|---|---|---|---|
| Variables | (Median of Round 1) Growth and development continue heterogeneously. | High competitiveness of the industry and international insertion, with concentration in major producers. | Poor dynamics in the industry, with focus on the domestic market and deficient international competitiveness. | Competitiveness and international insertion, with major and small producers and sustainability. |
| Milk production | 40.25 billion liters | 50 billion liters | 34 billion liters | 50 billion liters |
| Milk production profile (small and major producers and production framework) | Increased ratio of milk produced by the major producers. Small producers in activity promoted by governmental support. Milk production in agricultural frontier areas continues to grow. Increase or maintenance of the heterogeneity of the systems. | Concentration and increase of productivity of major producers. Family farmers participate in a relatively smaller degree, but sustainably and with increased productivity. | There will be no relevant productivity increase for family farmers, due to the difficulty in obtaining credit and accessing the market. Increased number of family farmers due to the lack of other economic options. Several major producers will go out of business. | Moderate concentration of major producers. Greater homogeneity in the systems per region. Public policies contributing to the improvement in the production of these family farmers and the establishment of equal rules for the entire chain. |
| Regional production | Southeast – 33%; North – 10%; Northeast – 12%; South – 29%; Mid-West – 16%. | Southeast – 35%; North – 8%; Northeast – 12%; South – 28%; Mid-West – 17%. | Southeast – 32%; North – 11%; Northeast – 13%; South – 28%; Mid-West – 16%. | Southeast – 32%; North – 10%; Northeast – 12%; South – 30%; Mid-West – 16%. |
| Productivity per cow | 23 millions of milked cows productivity= 1,750/L/cow/year. | 20 Millions of milked cows productivity= 2,500/L/cow/year. | 22 Millions of milked cows productivity= 1,545/L/cow/year. | 20 Millions of milked cows productivity= 2,500/L/cow/year. |
| Milk quality | Quality improvement via the market. | Quality improvement via the market. | Laws alone will not improve milk quality. | Quality improvement will mainly occur via the domestic market. |
| Average number of raw materials suppliers that serve the major dairy producers | 4,000 suppliers – decrease due to the need for a greater production of scale and to the demand for competitive and better--located producers. | 3,000 suppliers – concentration aiming at acquiring returns to scale, quality, and competitiveness to satisfy the main dairy producers. The global number of producers decreases. | 5,000 suppliers – lesser reduction in the number of suppliers, with a greater number of producers in agricultural frontier areas. The total number of producers remains the same or increases. | 4,000 suppliers – there is concentration with a view to acquire returns of scale, quality, and competitiveness, but with family farmers also taking part in the market, competitively and sustainably. |

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*... continuation*

| | | | | |
|---|---|---|---|---|
| Relationship between industries and producers | The relationship will improve, in terms of greater transparency, long--term agreements, price differentiation and win-win relationships. | Institutional marketing of dairy products contributes to the improvement of the relationship between links. | The relationship among industries will not improve, because the power of the production chain is rather dispersed and its links are quite different. | Improvement in the relationship between industries and producers. |
| Number of dairy producers | The number of dairy producers will decrease, due to intense competitiveness, to health, environmental, safety, and food requirements and inspection. | The number of dairy producers will decrease significantly with a concentration in the major industries and increased scale and production quality. | It will increase or remain similar to the current scenario. Tax evasion and frauds will occur, generating reduced activity for major companies. | Reduction in the number of dairy producers, with a trend toward concentration, increased scale, new technologies, reduced informality, and environmental and health and safety requirements. |
| Milk collected by cooperatives | 40% of the total milk produced. | 45% of the total milk produced. | 30% of the total milk produced. | 50% of the total milk produced. |
| Sales channels | The supermarket will continue as the primary sales channel, allowing a restricted space for other channels. | Supermarkets will become the primary distribution channel, but other competitive groups will increasingly participate. | Supermarkets will continue as the primary sales channel and will tend to acquire a growing share of the value generated by the industry. | Supermarkets will be the primary dairy products distribution channel, but other competitive groups will increasingly participate. |
| Domestic consumption | 167 liters/per capita/year. | 190 liters/per capita/year. | 150 liters/per capita/year. | 190 liters/per capita/year. |
| Inspection | 80% of milk production will be inspected. | 82% of milk production will be inspected. | 75% of milk production will be inspected. | 82% of milk production will be inspected. |
| Export and Import of production | 12% of milk production will be exported. 3% of the total of milk consumed will be imported. | 22% of milk production will be exported. 4% of the total of milk consumed will be imported. | 5% of milk production will be exported. 2% of the total of milk consumed will be imported. | 20% of milk production will be exported. 4% of the total of milk consumed will be imported. |
| International price of dairy products | Maintenance of international prices. | Maintenance of international prices. | Reduction of international prices. | Increase in the price of dairy products. |
| Health and safety and economic laws | There will be greater severity in the health and safety requirements. Tax reform, an adjusted exchange currency policy, and an increased income are expected. | There will be greater severity in the health and safety requirements. Increase in domestic and international demand, with increased competitiveness and population growth. | Anvisa's requirements will be incremented, which will adjust consumption and the advertisement of food, affecting dairy products. | There will be greater severity and health and safety requirements. Adjustments in currency exchange policy and an increased income are both expected. |

## 5. DESCRIPTION OF THE SCENARIOS

In the scenario writing phase, previously detailed by Wright and Spers (2006), four scenarios were developed for the milk production chain in Brazil; each is described in the following paragraphs.

### 5.1. Scenario 1 – "A continuous but uneven growth"

Scenario 1, named "A continuous but uneven growth", results from the extrapolation of current forces, based on the favorable perspectives for the milk industry in Brazil and worldwide. The local milk industry will continue to grow above the global average, approximately 3.4% a year, reaching 40.25 billion liters in 2020. The milk production increment will overcome the growth in consumption, similar to what has been occurring over the past decade. Therefore, the production intended for the export market will increase, accounting for 12% of the Brazilian production, significantly higher than the current 2% or 3%. There will be a displacement of the production, at a certain degree, to areas that offer lower opportunity cost, especially to areas bordering agricultural or peripheral areas. This

is due to the expansion of crops intended for the production of bioenergy, such as sugarcane, incorporating technologies that traditionally produce milk.

The competition will contribute to the moderate increase of productivity per animal, which will reach 1,750 kg of milk per cow/year in 2020, representing an increase of 2.5% a year. There will be 23 million cows, representing an increase of 11.6% over the current number, producing 40 billion liters. There will be an incorporation of technology, in addition to an increased ratio of milk produced by the major producers, reflecting a concentration in production, especially in traditional regions. Thus, the average number of suppliers feeding the major dairy producers will decrease by 26%.

Despite the reduction in the number of producers for the major dairy producers, the total number of producers will not significantly change. Therefore, the technological dichotomy will be preserved and the traditional production areas will increasingly advance towards a competitive model, with emphasis on scale and quality, and with a technified, efficient, and globally competitive production, whereas less traditional areas will remain stagnant, with subsistence and poorly qualified production.

The stability of the number of producers is well explained by the milk producers in the South region, where family agriculture prevails. Thus, the production of the South Region will grow, competing in volume with the total production of the Southeast. However, in spite of certain negative percentage variations in the regional productions, in overall terms all regions will increase their production. Quality inspection will be intensified by the official agencies, and the rate of inspected production will increase from 66% to 80%. Furthermore, the cooperatives will continue to participate in approximately 40% of milk collection. Another relevant perspective is the percentage of milk intended for the spot market; although less than the 30% estimated for the beginning of the decade, it will remain relevant at around 20%.

The major challenges for the dairy industry – the global need for export, increased environmental and healthy and safety requirements, and the consolidation of the retail sector – will lead to the reduction in the number of dairy producers, while leaving enough room for the companies to operate in market niches. The supermarkets will continue to be the primary sales channel. Per capita consumption will annually increase around 1.5%, reaching 167 kg per person a year. The increased average income in Brazil will promote the creation of a series of dairy products for emerging classes. However, the consumption of dairy products is still rather low compared to that in developed countries and even in countries with similar income, such as Argentina and Uruguay.

In the international trade sphere, Brazil will be integrated as an important producer in the dairy industry, with imports at approximately 3% of its demand and exporting a relevant amount of milk. Brazil will account for 6.8% of the total milk traded between countries in 2020, compared to approximately 1% in 2025.

## 5.2. Scenario 2 – "Milk, the new agribusiness star"

Concerning scenario 2, called "Milk, the new agribusiness star", the milk industry accomplishes certain profiles that can be observed in other chains of the domestic agribusiness. Production growth will be approximately 5% a year, reaching 50 billion liters, and will be mainly based on the production of major producers and efficient dairy producers, although with an important participation of family agriculture restricted to certain regions of the country, mainly the South.

There will be relevant growth opportunities in the sales of dairy products to the domestic and international markets. Brazil will import and export only 4% of its milk needs. Brazil will devote 20% of its production to the foreign market, which will represents about 12.5% of the entire foreign market. With these figures, the country will probably reach the fourth place in global exports. There will be progress in domestic efficiency and competitiveness, favoring export to global markets. Due to increased international prices, along with structural changes, there will be an increasing deficit in the supply of milk, which will encourage competitive countries to stimulate their production. Higher prices will decisively change the export sector, influencing the competitiveness concepts. The favorable foreign scenario will also influence the domestic environment. With the growing pace of the economy and the increased income, consumption will rise.

Along with other offices and the government, the industry will be able to implement an ambitious food education program with the population, thus increasing the rate of milk inspected by the federal system to 82% of the total produced.

The number of new product releases in the dairy market will remain high, above the food industry's pace of innovation as a whole. This will generate significant investments in product research and development.

If all of these factors are integrated, the per capita milk consumption will increase at a rate of 2.35% p.a., which is significantly higher than the historic average. Several factors, such as globalization, the consolidation of the retail sector, and improvements in income will make gains of scale essential, forcing concentration in the industry, which will have to work mainly with major producers and cooperatives focused on milk collection. This favorable environment will make major global food companies join the dairy industry, in addition to the insertion of investment funds related to the industry.

With regard to distribution channels, supermarkets will continue to be the most influential means. However, markets such as Food Service and specialized stores will represent growing opportunities in the dairy industry. Due to the concentration of the production of major producers, there will be a reduction of 48.3% in the number of suppliers of the

14 major dairy producers. However, despite the increasing concentration of the production in major producers, small producers, especially in the South, which manage to develop will be competitive and sustainable, and heavily anchored by cooperativism. The competing cultures will force the increase of productivity per productive unit and will generate by-products and integration opportunities. Furthermore, the dynamic environment will force the increase in productivity and rates above the historic average. With this context, production will remain focused on the most traditional areas, especially Minas Gerais, which will continue to lead the production ranking. The Southeast region will lose market share, but will bear the greatest absolute growth.

Cooperatives will be a robust foundation for the activity, and will play an important role in a more fair division of earnings. In this sense, cooperatives will increase their market share to 45% of the total collected.

### 5.3. Scenario 3 – "A wasted future"

Scenario 3, called "A wasted future", represents the frustration of growth expectations and the evolution of the milk industry. Items pointed out by the experts – such as income rise, international insertion, consolidation in the industry and industrial investments in the sector, strengthening of cooperativism and cooperative relationships among the links – will not be sufficient to produce the expected growth. Health and safety and environmental issues will pose major problems, which will become barriers for the growth of exports and even for the development of the activity in the country.

The industry will not be able to promote improved co-ordination of the production chain. Short-term initiatives in the relationship between the links of the production chain; cooperatives losing ground; the impossibility of enforcing institutional marketing; poor sectorial coordination; lower increase in per capita income, with a growth rate of 0.75% a year (half of the amount observed between 1989 and 2006); change in the demographic profile of the population, with fewer children and more adults and seniors; drop in international prices – all of these factors combined will reflect on the production, which will grow at rates below the historic averages, reaching 34 billion liters in 2020 with an annual growth of 2.2%.

Due to an unstable environment and low growth, several milk producers with a more advanced technology level will migrate to other more profitable activities. The most attractive areas for the harvesting of sugar cane will endure notable losses in milk production, which will be more concentrated in peripheral regions, facing difficulty in increasing the returns to scale and high costs. The production model will not change much. The average number of suppliers for the 14 major dairy producers will change from 5,400 in 2006 to 5,000 in 2020, a reduction of 7.4%. The production per producer will grow

from 204 liters/producer/day to approximately 301 liters/producer/day, an increase of 48%, which is lower than the inflationary cost. This increase will be anchored in family agriculture, and the South region will see major participation in this process. The Southeast region will see a decline in its share of milk production. The Southeast region will lose ground, the South will not grow much, but the Middle East, North, and Northeast regions will increase their proportional participation.

### 5.4. Scenario 4 – "Competitive family agriculture"

Scenario 4, called " Competitive family agriculture", is based on the structuring of the milk industry based on family agriculture. The growth of family agriculture will be essentially driven by the solid and increasing activity in the South region. Cooperatives will play an increasingly relevant role and will account for half of the milk collection in the country.

The production in the South Region will be equivalent to the production in the Southeast Region, and will represent the greatest growth in the period. The total production in Brazil will rise nearly 5% a year, reaching the production of 50 billion liters a year in 2020, destined for the domestic market and, gradually, the foreign market.

The government will recognize the importance of family agriculture and will maintain and broaden acquisition programs for social purposes, especially in the Northeast region, in addition to the support through credit and extension, in the sense of formalization of the milk industry and the structuring of the production chain in several states. Agrarian reform will play an important role in the growth of activity based on family farmers, who see in the milk activity a feasible economic option, especially due to this growth and government support. The milk market will not only grow in the states with of the most settlements, but also in settlements located in traditional regions. Both family and major farmers will incorporate technologies, will enter into long-term agreements, and will have a transparent relationship. Based on the 14 major dairy producers, the module will rise from 204 liters/producer/day to 541 kg/day, with an average of 4,000 suppliers per company, an increase of 165%. The strategic importance of family agriculture in the activity, along with the economic importance of milk and the intense sectorial interconnection, will provide the industry with a favorable position in domestic and international negotiations. The quality will improve due to inspection, requirements of the domestic market and the increase of exports in the country, which will account for the consumption of 20% of domestic production, or 10 billion liters. Due to increased governmental participation in family agriculture, along with the growth of cooperatives, the number of producers in the formal market will rise, thus increasing the income and quality of milk. As a result, 82% of milk will undergo federal inspection, which represents a major increase.

## 6. FINAL CONSIDERATIONS

In accordance with Selin (2006), this paper does not intend to forecast a specific single scenario for the milk production chain in 2020. It is likely that the future reality will be a combination of more than one scenario, even though the result may tend more towards one of them.

There are uncertainties regarding certain variables related to the milk industry and there are very little reliable data in statistical terms, whereby the qualitative evaluations and the perception of the experts become more appropriated, as previously mentioned (SALEH *et al.*, 2008; CARVALHO, 2009).

Besides the practical application, this study suggests a seven-step method through the methodology developed by Wright and Spers (2006), including the Delphi Method, for the development of scenarios to be applied to a specific industry, the Brazilian dairy industry.

Four future scenarios emerged from the method. Each is internally consistent regarding the future, and their primary roles are the explicit evaluation of planning assumptions, support for the implementation of goals and strategies, the evaluation of alternatives, the stimulation of creativity, the homogenization of language, and preparation to face discontinuities (PORTER, 1986). The need for a detailed description, raised by Godet (1993), is also contemplated.

It is also possible to notice that, from a general point of view, the perspectives are favorable to the dairy industry. Even scenario 3 ("A wasted future"), which is undesirable, indicates population growth, an increase in the amount of milk going through federal inspection, greater per capita consumption and an increase of exports, although its obstacles will not be eliminated. However, scenarios 2 ("Milk, the new agribusiness star") and 4 ("Competitive family agriculture") are very positive and represent a development above the trend observed in recent years. In the sectorial sphere, it is important to recognize and analyze the threats and opportunities that might affect the growth and sustainability of the industry. Moreover, through this study, it is possible to identify what should be done so that the normative or desirable scenario can be fully achieved, at least to the extent possible. In addition to the sectorial evalua-

tion, the various players of the dairy industry are expected to reflect on their roles and chances for future development, through the growth and integration of the production chain. Therefore, this paper can be an important planning tool for specific players. For governments and professional associations, this could be a source of guidance on public policies, whose effects will be perceived in the future.

Nearly all scenarios point to concentration in the industry, forecasting a greater consolidation period. Furthermore, there are several opportunities in addition to market niches and the development of cooperativism. Small and medium companies that understand these values and develop strategies to meet the opportunities hidden in this new reality, as well as the managerial preparation of companies, will be a crucial step ahead in effective market positioning.

The scenarios indicate two major paths for cooperatives; the supply of raw milk (scenarios 1, 2, and 4) or the supply focused on short-term and opportunist behavior (scenario 3). This way, cooperatives will be increasingly focused on the supply, the quality of the raw material, and producers' management, and the industry will be responsible for the processing, transformation, and marketing of the raw material. The challenge faced by cooperatives is achieving greater collection, reaching, for instance, the ratio of 60% observed in the 1990s.

For companies in the industry, opportunities and threats can be detected so that strengths and weaknesses of the organization can be analyzed in each scenario. Producers can also take advantage of this study, as they can analyze, for instance, their relationship with major companies and the impacts of meeting increasingly demanding criteria.

As underpinned by Wright and Spers (2006) and Schwartz (2000), these possible future situations prepare decision-makers and stakeholders to set strategies and cope with the uncertainties of this changing environment to ensure positive results.

Finally, this paper aims to fill the gap in national research on the development and use of scenarios, as previously mentioned by Silva, Spers, and Wright (2012).To enhance the Brazilian contribution in corporate strategy, further studies should be developed through the implementation of this method on other industries.◆

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**ABSTRACT**

**Scenarios for the milk production chain in Brazil in 2020**

Brazilian milk production has grown steadily and in 2004 the country became self-sufficient in dairy production. This article develops possible scenarios for the milk production chain in Brazil for the year 2020 in order to contribute to decisions that must be made by stakeholders. A literature review on foresight and the use of scenarios was conducted, and a scenario writing approach based on Wright and Spers (2006) was adopted, which includes the use of the Delphi method, Michael Porter's Five Competitive Forces model, Interpretative Structural Modeling (ISM) (WRIGHT, 1991) and quantitative projections. This methodology provided four scenarios, with quantitative and qualitative elements: two exploratory scenarios ("milk, the new agribusiness star" and "a wasted future"), a most probable scenario ("continuous but uneven growth") and a desired scenario ("competitive family agriculture"). Overall, it is possible to note many market opportunities, as well as niche markets and the strengthening of cooperatives. Future prospects are also favorable to the dairy industry in general, but nearly all scenarios point to a concentration in the industrial sphere.

*Keywords*: scenarios, milk production chain Brazil, strategies for milk.

**RESUMEN**

**Escenarios para la cadena de producción de leche en Brasil en 2020**

La producción de leche en Brasil ha crecido de manera constante y, desde 2004, el país es autosuficiente en su producción. En este artículo se desarrollan escenarios posibles para la cadena de producción de leche en Brasil. Se llevó a cabo una revisión de la literatura y se aplicó una metodología de construcción de escenarios. Asimismo, se utilizó el método Delphi y se realizaron estimaciones cuantitativas. Esta metodología proporcionó cuatro escenarios, con base en datos cuantitativos y cualitativos: dos escenarios exploratorios, un escenario más probable y un escenario deseado. Se desarrollaron potenciales alternativas futuras, con el fin de mejorar la calidad de las decisiones estratégicas de los distintos actores.

*Palabras clave*: escenarios, cadena de producción de leche en Brasil, estrategias para el sector de producción de leche.