Sustainability and Market Orientation in the Brazilian Beef Chain

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Abstract: The demand for natural resources, energy and food facing the contemporary perception of sustainability is imposing challenges to the productive sectors in accordance with market guidelines. In this context, the Brazilian agribusiness seeks to maintain external competitiveness and to satisfy growing domestic demands. In beef production, this competitiveness pervades traceability, food safety and sustainability. This article aims to identify the sustainability state of the art in agribusiness and characterize it within the Brazilian beef chain. Descriptive methodology, combining a literature review and a documentary data survey were adopted. An outline of the dimensions of agribusiness sustainability, drawn from benchmark practices, indicates that environmental, social and technological demands have become part of the industry's agenda. The data for beef cattle point to a growth in production but demonstrate that expansion has occurred in areas of environmental tension, which creates a demand for sustainability in the beef chain. A table of guidelines for sustainability demonstrates that although perceptions are not yet harmonized among the links in the whole beef chain, many of the technological guidelines for sustainable production may increase the producer's economic efficiency. In the Brazilian case, the increment of initiatives and dissemination of sustainable practices among the beef chain is desirable to provide a coordinated response of production, processing and distribution organizations facing market opportunities for sustainable livestock.

Key words: Agribusiness, livestock, process, sustainable production, demand chains.

1. Introduction

The era of the knowledge society can also be regarded as the era of the consumer society, due to the growing demand for natural resources, energy and food. In this contemporary setting, there is a perception of multidimensional sustainability [1-5] that influences the opinion and habits of society. This perception represents a challenge for various sectors, which analyze and implement adjustments in their

supply chains in accordance with the guidelines of the emerging markets.

The concept of market orientation (MO) and its influence on organizational performance have been the focus of several studies demonstrating that organizations aligned with their clients and with market demands are more suitable to offer products, services and solutions of superior performance [6-8]. The term market-oriented can be interpreted in many ways. For the sector of research and development, this term may mean the product specifications and technical characteristics; for manufacturing, it may

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mean durability and safety; for marketing, it may mean consumer desires; and for business planning, it may mean “having the product in the appropriate market niche” [9].

In the evolution of the concept of MO, two approaches have been adopted [10]. The first is a cultural perspective on organizational norms and values that encourage behaviors consistent with the MO [6]. The MO is shown as a concept created from three elements: customer orientation, with the enterprises being directed toward the needs of customers; competitor orientation, which analyzes the opposing strategy and market movements; and inter-functional coordination, which introduces cooperation among employees.

The second approach identifies three primary components of the concept: the generation of market information on current and future customer needs and the skills to meet them; the integration and dissemination of such information among departments and individuals within the company; and the design and implementation of a coordinated response across the organization to market opportunities [7, 11, 12]. This behavioral perspective focuses on organizational

and human activities related to creating and propagating market intelligence, as well as reacting to it [13].

Both approaches to MO are complementary in explaining companies' behavior [14]. Therefore, the second approach leads to the idea of a demand chain (DC) as a complex network of enterprise entities that not only follows demand in a reactive or oriented perspective but is also capable of leading it [15].

The underlying theories that contributed to the formation of supply chain management (SCM) and their evolution into demand chain management (DCM) are presented in Fig. 1.

These theories have been sources for SCM and also fundamentally influence the concept of DCM. In short, as SCM is derived from logistics, DCM is an extension of SCM but with a strong emphasis on demand management due to the incorporation of the MO perspective [15].

Noting the key features of DC, it is clear that its focus is on meeting the demand within certain markets. The demand goal in DC is to generate revenue through consumer understanding and demand management, and the supply goal is to align the business

Fig. 1 Sources of the concept of SCM and their evolution into DCM.

Source: Authors' adaptation based on Ref. [15].

processes within and among enterprises, thereby increasing their effectiveness. The DC is also characterized for aggregating greater value, being short and having a flow of information with the consumer permeating all its stages [16-18].

Based on this theoretical development, it is observed that DCM aims to manage and coordinate an entire chain (in reverse), from the final customer (downstream) and working backward to suppliers of raw materials (upstream).

In the context of agribusiness, this possibility represents a challenge because its importance in the economic development process of many countries means it is necessary to ensure harmony between the expansion of farming and issues involving environmental preservation.

As an emerging economy, Brazil has built an efficient and competitive production system in agribusiness [19] but still seeks an economic and socio-environmental balance to maintain its competitiveness within a global production system.

In this context, an imposing movement deserves attention, involving the broader concept of sustainability. This concept is the phenomenon of transitioning from a focus on the environment alone to a broader focus—complex and subjective—of which the environment is part [20]. For many consumers, it is not sufficient for the product to be “green”, and its production process must be sustainable [21].

This perception of sustainability in agribusiness has marked recent discussions of animal production systems, focusing on the cattle industry’s influence on the environment [22]. This is especially the case in Brazil, where the relevance of studies and analysis of beef production is supported by the magnitude of its commercial bovine herd, repeatedly considered the largest in the world [23-25]. However, attaining this position has attracted the world’s attention, and the maintenance of such a leadership implies challenges that pervade competitiveness, traceability, food security, innovation and sustainability [26, 27].

Therefore, the characterization of sustainability in Brazilian beef production becomes relevant not only because there are few publications that support scientific understanding and managerial decisions but also because it may signify an important trend in a market in which the productive and commercial orientations are not fully captured by the various chain agents.

The objective of this study is to review the current conceptual state of agribusiness sustainability in the framework of MO and to describe the condition of sustainable livestock breeding in Brazil, focusing on the beef supply chain.

2. Materials and Methods

This report describes a descriptive study that combines bibliographical and documentary research based on secondary information from 2001 to 2012. Research procedures, data collection techniques and result analyses consisted of:

(1) Literature review of MO and demand chains theories and concepts of agriculture and livestock sustainability. The search for references was carried out using Web of Science, Scopus and other databases;

(2) Surveying documents—from directories, reports and websites—of beef market data in Brazil and information from the agents promoting sustainable livestock production within the country. The documents were searched in secondary databases from Brazilian institutions and enterprises, such as the livestock directory (ANUALPEC), the agricultural research agency (EMPBRAPA) linked to the Ministry of Agriculture, Livestock and Food Supply (MAPA), the decennial farm census data obtained from the Brazilian Institute of Geography and Statistics (IBGE), and sustainable initiatives promoted by Brazilian retailers companies.

Secondary quantitative and qualitative data were used to describe the Brazilian scenario, elaborate an illustrative scheme for agricultural sustainability and build a characterization table of sustainable practices

in the Brazilian beef chain that was analyzed according to the concepts of MO and DCM (Fig. 1).

3. Results and Discussion

3.1 Sustainability, Sustainable Production and Agribusiness

The subject of sustainability became popular with the publication of “Our Common Future: The World Commission on Environment and Development” [28], as elaborated by the World Commission on Environment and Development. This report presents the first definition of sustainability, understood as “the ability to meet the needs of the present generations without compromising the ability of future generations to meet their own”.

In the 1990s, the sustainability of agricultural systems and practices were clearly integrated into this discussion in different dimensions. The environmental dimension consists of sustainable development as improvement in humanity’s life quality, respecting the supporting capacity of ecosystems. The economic dimension contains the sustainable economy as a product of sustainable development maintaining the production basis of natural resources. The social dimension contains the sustainable society, as one which would continue to develop itself by adapting and expanding knowledge, organization, technical efficiency and wisdom [2, 29].

During this period, we highlight the Food, Agriculture, Conservation and Trade Act, in which the United States government defines sustainable agriculture as “an integrated system of plant and animal production practices having a site-specific application that will, over the long term, satisfy human food and fiber needs, enhance environmental quality and the natural resource base upon which the agricultural economy depends, make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls, sustain the economic viability of farm operations, and enhance the quality of life for farmers

and society as a whole” [30].

In the first decade of the 21st century, private conglomerates entering this scenario and the previous concepts gained complementarities on the concept of the Sustainable Agriculture Initiative Platform: “Sustainable agriculture is a productive, competitive and efficient way to produce safe agricultural products, while at the same time protecting and improving the natural environment and social/economic conditions of local communities” [4].

The result of this evolution is also accompanied by contemporary studies, ranging from proposals for structuring a specific scientific field to study sustainability [5] to recommendations for innovative policy developments in sustainability [31] and approaches to sustainability applied to different areas of knowledge.

Among these approaches, there are readings, interpretations and derivations, as well as suggestions for new types of sustainability to complement the triple bottom line—economic, social and environmental—with a fourth type of sustainability such as institutional sustainability [32], cultural sustainability [33], territorial and political sustainability [34] or financial sustainability [35].

There is also a recent trend used in this study that became important in the recent discussions of sustainability. That is technological sustainability, which means the equilibrium or adequacy of technology for developing a certain rural or agro-industrial activity. Further, this technological balance should not only be associated with the size of the property or company but also with the geographic location, competition, industry, the consumer market and other factors.

The contemporary understanding of sustainability, when applied to agribusiness, demanded the elaboration of a scheme from the assemblage of various sources (Fig. 2), representing the evolution of the concept, as well as the actions and elements that the involved parties must observe.

Fig. 2 Scheme of dimensions, actions and elements of sustainability in agribusiness.

Source: Elaborated by authors.

The analysis of the results that is summarized in the scheme refers to the search for sustainable production—understood as the creation and processing of products using clean processes and systems that conserve energy and natural resources, are economically viable and are safe and healthy for workers, communities and consumers [36]. The result is a sustainable product that is designed with respect to its relationship with the environment [37], given its direct impact and connections among social, economic and environmental systems.

Therefore, it is observed that “clean” agricultural technologies, classified as sustainable in the literature, can provide both environmental conservation and more equitable economic systems [38, 39].

The development of these new technologies will meet worldwide interest in the sustainability of agricultural systems. This interest has increased due to

factors as environmental problems, constant pressure on farm incomes, concerns about animal welfare and occurrence of diseases that impact the reputation of Brazilian livestock.

In this context, in which sustainability appears as a key element in agribusiness’ market orientation, strengthening socially and environmentally correct productive (and economically viable) options also becomes a concern of the agents in the Brazilian beef supply chain that—initially by pressure from external markets but also by the potential of the internal market—have adhered to such initiatives as sustainable livestock breeding, which is discussed next.

3.2 Livestock and Sustainable Breeding in Brazil

The Brazilian beef cattle industry previously has been characterized by its resistance to technological

innovation and archaic management [40]. The sector's stagnation until the mid-nineties was the result of the extensive exploration model based on the great offer of land. The cattle herd served as a capital reserve at the time of inflation and as an instrument for consolidating the country's agricultural frontier [41].

During the first decade of this century, this picture changed. With political and economic stability, Brazil was able to develop its productive potential and consolidated its position as a world food supplier. Livestock has become a protagonist of agribusiness expansion in the country, while professionalization of the activities was initiated [42] inside (i.e., management, nutrition, health, genetics and management) and outside the farm (i.e., slaughter, processing and distribution) [41].

The Brazilian bovine herd had as many as 173 million heads in 2009, 79% for meat and 21% for milk production within an area of 175 million ha [25]. The country is one of the world's two major beef producers, with 7.6 million tons carcass weight equivalence (CWE) per year, and is the leading beef exporter, with 1.6 million tons CWE per year commercialized [24, 25].

These numbers represent the economic result of the growth in cattle breeding—although it is not fully consolidated, and its environmental consequences are not yet fully known—associated with the expansion of the Brazilian agricultural frontier.

In the last 15 years, it was observed that the expansion of this frontier, especially in the Center-West and North regions, had resulted in approximately 40% growth of the cattle herd (Fig. 3).

However, it must be highlighted that this expansion occurred in legally and environmentally complex areas, known as the Brazilian Legal Amazon, where herd expansion was 178% [43]. This indicated the migration of consolidated breeding areas into new areas [44] and also reduced technology use and investment to produce more in the same area [45].

In this case, the negative impact on productivity appears in the “stocking rate” (0.76 animal unit AU/ha), which is smaller compared to other countries and below the real potential of Brazil. If this ratio was 1 AU/ha, then the herd would come to 230 million heads without increasing the explored area [24, 45].

Based on these data, it is observed that the increasing professionalization of management may, at

Fig. 3 Graph of the evolution of Brazilian cattle by region 1994-2009.

Source: Ref. [43].

first, overcome these issues. In a second stage, it becomes necessary to turn attention to other practices to raise livestock to a more productive level.

In this new level, sustainability demanded by the advance of cattle in some regions must be pursued, which generates an environmental liability, followed by internal and external pressures.

Such pressures have widened with the publication of the report *Livestock's Long Shadow* [46]. This document indicates that population growth has required greater use of natural resources, energy and food. Thus, the cattle industry is considered one of the main sectors responsible for greenhouse gas emissions and environmental degradation, which also involves the performance of refrigerated stores and retail chains.

However, the FAO estimated that the global demand for livestock products should experience strong growth by 2050. In addition, the critical approach of 2006 gave way to a recent review of livestock's role in this context, within the report *Review of Evidence on Drylands Pastoral Systems and Climate Change* [47].

This new document concluded that good management can make farming one of the activities providing greater mitigation of greenhouse gases. However, this management requires a coordinated global effort to overcome the economic and socio-political barriers and facilitate both productivity and carbon sequestration in pastures around the globe [47].

In this environment, the need arises for a response from the beef production chain, through the initiative of sustainable farming.

This type of farming has been characterized in Europe [48] as one that involves protection and improvement of natural environment, animal welfare and the conditions of local communities while being productive and efficient.

In Brazil, the most advanced experience is organic farming ("organic beef"), which already has a certification seal. Animals are exclusively at pasture and treated with homeopathic and herbal products [22, 27].

The authors and agents believe that organic livestock farming is different from sustainable livestock farming ("green cow" or "natural beef") discussed in this article but recognize that both represent opportunities to demonstrate sustainability in beef cattle.

Livestock farming sustainability requires a balance with environmental laws, which has led to discussion among the agents within the chain. On one hand, there are obligations relating to the environment and law (legal reserve and productivity) and on the other hand, there is societal pressure regarding livestock in the areas of deforestation, greenhouse gas emissions and water consumption [49].

To contribute to the discussion characterizing sustainable farming within the Brazilian beef chain, a framework was elaborated from various documentary sources, gathering the perceptions and demands of consumers and non-governmental organizations (NGOs), understandings and results of research institutions, actions and directives of the government, and guidelines for producers, processors and distributors (Table 1).

The analysis of the results gathered in Table 1 refers to the second approach presented regarding market orientation, as breeders, processors and retailers must generate information (that today is published by NGOs) concerning the current and future needs of consumers of sustainable livestock in efforts to develop the abilities to fulfill these needs along with research and technology institutions. This strategy has already been used by international retailers operating in Brazil followed by boutique meats and breeders.

Examining the information from the perspective of demand chains, it is clear that certain opportunities to demonstrate sustainability in the beef cattle industry will focus on meeting the demand in certain markets. The objective in the DC is to generate revenue through consumer understanding and demand management. An example that could be mentioned is

Table 1 Sustainability and agents of the beef chain in Brazil.

Chain links	Agents	Action
Consumption	Consumers NGOs	Perceptions/demands
		<ul style="list-style-type: none"> -Concerned about consuming products from productive chains that adopt environmentally and socially correct practices [45] -I wish to “eat well, safe, and with a clean conscience” [50] -Animal welfare and food security [27] -Many consumers are taking part in groups about sustainable livestock [51]
Research	Research & technology institutions	Understandings/results
		<ul style="list-style-type: none"> -Development of environmental accounting methodologies that better portray Brazilian reality: ecological footprint (ha per capita) and carbon footprint (greenhouse gas emissions: kg CO₂-e/kg product) [52] -Vegetation cover and fragmentation -Comparative studies of the economics of mitigation alternatives -Research of more productive fodder varieties and farming/breeding integration [53] -Invest in researching the carbon cycle in Brazilian soils and productive systems
Distribution	Retailers	Orientations
		<ul style="list-style-type: none"> -Suspend the purchase of meat from deforestation areas in the Amazon [54] -Cattle Origin Guarantee Program [55] -Comply with the “Cattle Breeding Pact” [56] -Signature of specific term commitment [57] -Creation of sustainable labels (certificates) -Meat brands, with differentiation and added value [58]
Processing	Beef industry	Orientations
	Slaughter-houses	<ul style="list-style-type: none"> Program for the cattle purchase procedure [59] -Investments in sustainability and incentives to sustainable livestock breeders -Do not raise cattle or purchase meat from conservation areas (or brazilian native reserves) -Observe the labor regulation from ministry of work and data from IBAMA [56] -Reuse tannery waste as soil fertilizer -In addition to competing with other countries for markets, there is also competition among national and international chains [60]
Production	Breeders	Orientations
		<ul style="list-style-type: none"> -Mitigation of greenhouse gases through: natural recovery/reform of degraded pastures, genetic improvement, feedlot and farming/breeding integration -Increase in pasture capacity; increase in pasture biodiversity; improve soil fertility and permeability conditions; reduction of residue levels; natural control of plagues and conservation of water resources -Explore the Brazilian Development Bank (BNDES) funding lines in pasture recovery [61] -Demystify livestock breeding as a villain in the environmental degradation process -Education: diffusion of such concepts in schools [62] -Sustainable Brahman Project and “Boi Guardião” Program [63] -Carbon credit (often called a carbon offset) commercialization
	Suppliers	Orientations
		<ul style="list-style-type: none"> -Genetics for sustainable livestock breeding [64] -Specific inputs for organic livestock breeding [27]
Regulation	Government	Actions/guidelines
		<ul style="list-style-type: none"> -Allocate resources for environmental adequacy projects regarding livestock activities -New Forest Code (undergoing the approval process) -Brazilian System of Beef and Buffalo Meat Identification (SISBOV): Brazilian identification and certification system of cattle and buffalo origins -“Brazilian Beef”: highlight the natural pasture breeding system, efficacy of herds’ sanitary control programs and excellence of slaughterhouses -Brazil’s competitive advantages in sustainability: large availability of land, water and sunlight, cheap workforce, good supply of inputs, access to production technologies, privileged position in climatic diversity, adaptation of the zebu breed to the tropics and breeder vocation [44, 65]

organic livestock. Additionally, depending on the case, the principle of demand chains can serve to guide supply actions and align business processes within and

among actors, increasing the effectiveness of those already pursuing more sustainable livestock.

Having as principle the study of MO and DC

theories, an understanding of the sustainability concept in agribusiness, the analysis of global livestock data in Brazil, and information from a documental survey about sustainable livestock breeding, it was found that the traditional beef chain's characteristics do not change in the short and medium term because beef is still considered a commodity.

Therefore, from the moment, Brazil became one of the world's largest producers and exporters, the pressure for sustainability—which was previously restricted to particular forms and alternatives of production—became an element of competitiveness. Thus, livestock sustainability *latu sensu* (“natural” cattle and “green” cattle) would today be a market orientation, whereas certain of its possibilities in *stricto sensu* (“organic” cattle) could form demand chains.

4. Conclusions

This paper aims to identify the sustainability state of the art in agribusiness and contribute to the discussion characterizing sustainable farming in Brazil and focusing on the beef chain.

The outline dimensions of sustainability in agriculture from the benchmark practices indicate that the requirements of environmental, technological and social order definitely entered the agenda of agribusiness organizations and is necessary to deepen the inter-dimensional joint in which various interests are being equated.

The livestock data confirm the importance of Brazil in the world scenario of beef production but indicate that the expansion has occurred in areas of environmental stress. This may mean production restrictions and particularly for the commercialization of beef produced in such areas, as it has caused external pressure and demand reaction for sustainability among the chain links.

The table of sustainability orientations organized from different documental sources demonstrates that consumers' and NGOs' perceptions and demands

encompass the idea of producing and consuming with security, as well as social and environmental responsibility, even though this creates a cost to be equated with all segments; the results of research institutions note the development of environmental accounting methodologies that portray the Brazilian reality; government actions aim to regulate the expansion of and bestow credibility in the internal and external markets; orientations to breeders, processors, and distributors pervade reducing pasture degradation, mitigating greenhouse gas emissions and increasing productivity as the most important factors for advancing sustainability according to current understanding.

It was found that many of the technological guidelines for sustainable production were the same ones that might increase the producer's economic efficiency. It was observed that perceptions had converged among the chain agents, although they were not yet fully harmonized. In the Brazilian case, the increment of initiatives and dissemination of sustainable practices among the beef chain in the next years is recommended to provide a coordinated response of production, processing and distribution organizations facing market opportunities for sustainable livestock.

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