SUSTAINABILITY IN A COMPLEX SUPPLY CHAIN: a literature review on the Brazilian Beef Supply Chain

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Abstract

This study aims to analyze how sustainability is being addressed in the complex Brazilian beef supply chain. A literature review was carried out, identifying 43 papers. Results indicated that sustainability has been addressed in the Brazilian beef supply chain in two different ways: (1) to reduce environmental and social impacts and (2) to manage these impacts. This study emphasizes sustainability related to a complex supply chain. Understanding how sustainability is being addressed in the Brazilian beef supply chain can contribute to understand the effectiveness of these initiatives in a highly complex supply chain, when compared to less complex supply chains.

Keywords: Sustainability, Complex Supply Chain, Brazilian Beef Supply Chain.

Introduction

Operating in a dynamic and uncertain environment, complexity is inherent to supply chains. According to Serdasaran (2013), a complex supply chain encompasses a high number and variety of stakeholders and, consequently, various relations, processes and interactions between and within these stakeholders. The complexity of a supply chain involves static complexity (related to supply chain structure), dynamic complexity (related to supply chain environment), and decision making complexity (related to both static and dynamic aspects of complexity) (Serdarasan, 2013). Sustainability, in this context, is one of the variables that influence the supply chain complexity.

One of the most complex supply chains is the food supply chain, particularly the beef supply chain. Considering sustainability issues, the beef supply chain is considered a complex supply chain, especially because of environmental impacts, and animal welfare and social issues. For instance, the Brazilian beef supply chain is characterized by the lack of integration between slaughterhouses and farmers, the variety of stakeholders involved and different scandals concerning mainly deforestation, slave labor and corruption (Knoll et al., 2017).

Brazilian beef supply chain may be labelled as 'sensitive', since its activities are prone to impact the environment and the society as a whole (Gold, 2016). Taken together, these circumstances have created a sense of urgency to re-examine sustainable practices introduced in this food supply chain (Kirwan et al, 2017). Particularly motivated by external market pressures, organizations have been introducing sustainability in the supply chain. However, it is necessary to understand how sustainability has been introduced and disseminated in the Brazilian beef supply chain.

In this context, discussions about sustainability in supply chain focus generally on the concept of Sustainable Supply Chain Management (SSCM). The concept aims to integrate social, environmental and economic dimensions of sustainability into strategies, routines and processes of the supply chain (Pagell and Wu, 2009). In the last decade, SSCM has become a topic of interest for academics and practitioners (Dubey et al., 2017), and the subject continuously evolves (Gold and Schleper, 2017).

This study aims to analyze how sustainability is being addressed in the complex Brazilian beef supply chain. We argue that the literature review on sustainable supply chain and Brazilian beef supply chain will enable us to overview the research on the topic and to understand the sustainability in this complex supply chain.

Besides this introduction, this paper is structured four sections. First, we present the theoretical background which supports this research. Second, we describe the method of this study. Third, we present the preliminary findings and, finally, we present the discussion and final considerations of this research.

Theoretical Background

In this section, we discuss sustainability, complex supply chains and Brazilian beef supply chain. Thus the theoretical background is divided into two topics, which are presented below.

Complex Supply Chain and Sustainability

According to Serdasaran (2013, p.533), the supply chain is defined as a "complex system with various companies, high number and variety of relations, processes and interactions between and within the companies, dynamic processes and interactions in which many levels of the system are involved and vast amount of information needed to control this system". Therefore, the complexity is part of the nature of the supply chain. Variables such as the type of product or service delivered, the context in which the supply chain operates, globalization and sustainability may contribute to increase complexity (Kirwan et al, 2017; Serdarasan, 2013). The complexity of a supply chain can be analyzed in a continuum, according to these variables.

The complexity of a supply chain involves static, dynamic and decision making complexity, that are interrelated. Static complexity is related to the structure of the supply chain, the variety of its components and their interactions. Dynamic complexity includes the aspects of time and randomness, and represents the uncertainty in the supply chain. Decision making complexity is associated with the high number and variety of elements and interactions of the supply chain that must be considerate when making a decision; and also with the fact that the system is dynamic, non-predictable, and non-linear. Thus decision making complexity involves both static and dynamic aspects of complexity (Serdarasan, 2013).

There are three generic approaches when dealing with complexity in supply chains: complexity reduction, complexity prevention, and complexity management. Considering this last approach, Serdarasan (2013) affirm that Supply Chain

Management (SCM) is about managing the complexity of the supply chain. Thus, managers need integrate complexity management into SCM.

In this context, issues related to sustainability in supply chains are by themselves very complex (Pullman et al., 2009). This is because, for example, supply chains should be managed not only in close connection to suppliers, but also with regard and respect to other stakeholder that may be crucial to any sustainable approach (Frostenson and Prenkert, 2015). In addition, Seuring and Müller (2008) indicated that sustainability in supply chain requires the exam of social and environmental impacts, besides economic impacts; involves more performance objectives, due to the introduction of socio-environmental aspects and requires more integration and cooperation between supply chain partners. Therefore the introduction of sustainability increases the complexity of the supply chain.

Discussions on sustainability and supply chain generally share a focus on concepts that aim to meet economic, environmental and social performance, based on the Triple Bottom Line approach (Elkington, 1998), and investigate this performance over an extended period of time (Pagell and Shevchenko, 2014). These discussions usually focus on Sustainable Supply Chain Management (SSCM) concept. There are different definitions of SSCM. Touboulic and Walker (2015) argue that SSCM definitions also emphasize that SSCM goes beyond the traditional conception of business while still being concerned with economic performance.

According to Seuring and Müller (2008, p.1700), SSCM is defined as "the management of capital flows, materials and information, as well as cooperation among companies along the supply chain, aiming at three dimensions, economic, environmental and social, which are requirements of customers and stakeholders". As emphasized in Seuring and Müller's (2008) concept, cooperative or collaborative approaches between stakeholders are necessary for SSCM, especially because of the complexity inherent in supply chains (Frostenson and Prenkert, 2015). Beske and Seuring (2014) affirm that collaboration in SSCM includes structural decisions about how to integrate partners technically and logistically, and the joint development of sustainable products and processes.

Although the supply chain complexity is recognized, Frostenson and Prenkert (2015) criticize the prevalent non-complexity assumption in the literature of supply chain management and sustainable supply chain management. The focal company is seen as a noncomplex entity or at least an entity that is not further analyzed or problematized. According to the authors, Andersson and Sweet (2002) recognize relative internal structural complexity of focal firms; however, still do not address the internal complexity in their analysis of sustainable supply chain management (Frostenson and Prenkert, 2015).

In this context, we highlight the food supply chain. Food supply chains over recent years are being pressured on environmental and social impacts of their activities. Food supply chains are variously defined and understood, dependent on the supply chain complexity, perspective of stakeholders involved and the geographical context. Aiming to achieve SSCM and consequently to mobilise all stakeholders around a shared vision for sustainable development, it is necessary to acknowledge and understand the inherent supply chain complexity and the plurality interests that result from the range of stakeholders (Kirwan et al., 2017). In the next topic, we discuss a specific food supply chain: the Brazilian Beef Supply Chain.

Brazilian Beef Supply Chain: a complex supply chain

The beef industry is an activity of large representation for the economy and agricultural production in Brazil (Florindo et al., 2017). In the domestic market, there is consumer demand for low prices and high product quality in different distribution channels. According to Knoll et al. (2017), the beef industry in Brazil is no longer a traditional supplier of beef carcass, and has transformed itself into a supplier of specialised products. In the international context, Brazilian beef has been has increased its international market share (Vieira and Traill, 2008). Brazil is considered one of the world's biggest beef exporting countries (Knoll et al., 2017).

Concomitantly, Brazilian beef industry has been facing criticism related to product safety, environmental issues, and social responsibility along the whole supply chain (Knoll et al., 2017). For instance, Greenpeace released in 2006 the report Eating Up the Amazon, in 2009 the report *A Farra do Boi na Amazônia* (or Bull Party in Amazon, free translation), and in 2015 the report *Carne ao Molho Madeira* (or Beef with Wood Sauce, free translation). These reports have analyzed irregularities in the beef supply chain in the Amazon region, including pasture, meat processing, final export destinations and beef by-products. The organization reported that large slaughterhouses were receiving beef from small slaughterhouses located in the Northern Region of Brazil, whose suppliers were involved in illegal deforestation and slave labor (Greenpeace, 2006; 2009; 2015).

As a result, the Brazilian beef supply chain has been under pressure from national and international organizations because of deforestation (Walker et al., 2013), global warming (Ruviaro et al., 2016) and carbon footprint issues (Florindo et al., 2017). Additionally, Knoll et al. (2017) affirm that Brazilian beef supply chain remains a work in progress and needs to deal with challenges, such as animal handling and animal age in the primary sector, food safety, logistical inefficiencies throughout transportation (Soysal et al., 2014), trust and governance of the supply chain (Vieira and Traill, 2008; Carrer et al., 2014) and processing issues in beef processors (slaughterhouses) (Vieira and Traill, 2008; Knoll et al., 2017).

The Brazilian beef supply chain is mainly composed of suppliers of inputs for livestock, farmers, slaughterhouses and distributors, wholesalers, retailers and final consumers – and other stakeholders, including the governmental organizations, non-governmental organizations and the media (Knoll et al., 2017; Carrer et al., 2014). In general, this supply chain is characterized by the lack of integration between these partners (Euclides Filho, 2004; Knoll et al., 2017).

The Brazilian beef supply chain is complex, not necessarily because of the number of stakeholders, but rather because of the variety of them. In addition, there is the variety of complex transactions in the supply chain (Carrer et al., 2014). The complexity highlights two important issues: (1) the need for cooperation between partners to achieve supply chain objectives and to react more quickly to the pressures (Euclides Filho, 2004); and, (2) difficulty of management and coordination, which are necessary to match the heterogeneity of the consumer beef market with the heterogeneity of the supply sources for the production (Carrer et al., 2014).

In response to the pressures, there is a need to gain a deeper insight into the complexity of the Brazilian beef supply chain – especially related to the introduction and dissemination of sustainability in the supply chain. According to Gianezini et al. (2014), the analysis of sustainability in Brazilian beef supply chain is relevant because it can contribute to discussions that support scientific understanding and managerial decisions. Thus, currently, it is necessary to examine ways forward to a more sustainable beef supply chain management.

Ruviaro et al. (2016) point out that it is necessary to include not only environmental aspects for a sustainable supply chain. It is important to consider social aspects, such as the promotion of social responsibility, improvement of working conditions, ethical relationships with employees, clients, suppliers and other stakeholders; occupational health and safety at work and compliance with human rights and labor laws. The sustainability of beef supply chain is also dependent of the economic performance and competitiveness factors (Nunes et al., 2014).

In this context, the combination of economic, social and environmental issues in the supply chain result in a beef that is produced with respect to its relationship with the environment, given its direct impact and connections among social, economic and environmental systems (Nunes et al., 2014; Gianezini et al., 2014). In the next topic, we describe the methodological procedures that allowed us to analyze how sustainability is being addressed in the complex Brazilian beef supply chain.

Method

We carried out a literature review following the steps based on Gimenez and Tachizawa (2012). The authors proposed the subsequent steps to conduct a literature review: (1) meta-research; (2) elimination of duplicate papers; (3) abstract analysis according to predefined criteria; and, then, (4) full paper analysis. Figure 1 shows the steps used in this study.

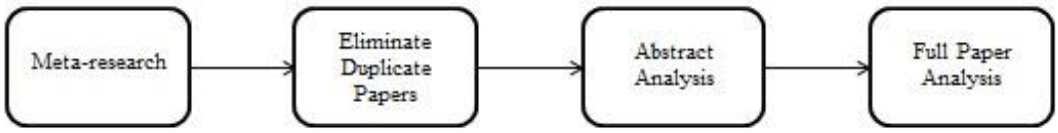

Figure 1 – Literature Review Steps
Source: adapted from Gimenez and Tachizawa (2012)

In meta-research, different sources of research were used in meta-research – Science Direct, Emerald and Web of Science. This step involved several rounds of combining the keyword 'Brazilian beef supply chain' with different keywords (sustainability; corporate social responsibility; sustainable practice; sustainable initiative; sustainable supply chain management; supply chain complexity). The meta-research was conducted in December 2017 and January 2018, and identified 937 articles.

The second step involved the exclusion of duplicate articles. Once duplicate papers were excluded, there were a total of 285 articles for the abstract analysis. Thus abstract analysis focused on two criteria: (1) sustainability, as Triple Bottom Line, and (2) the Brazilian beef supply chain, as a complex supply chain. Thus the question "does this study address sustainability issues in the Brazilian beef supply chain?" guided the analysis. Papers had to meet both criteria in order to be considered. After this analysis, 50 papers were considered for the full paper analysis.

Considering full paper analysis, Gimenez and Tachizawa (2012) recommend to go beyond simple description of the papers included in this study, including information and knowledge that were not apparent from reading the individual papers in isolation. Each paper was read according to the purpose of this research – to analyze how sustainability is being addressed in the complex Brazilian beef supply chain. After the full paper analysis, a total of 43 articles remained.

Findings

The results of this study are organized into two topics: descriptive analysis of the papers; and, initial analysis of sustainability in Brazilian beef supply chain.

Descriptive Analysis

Our review included 43 papers related to sustainability in Brazilian beef supply chain. The articles were published over a period of nineteen years, from 1999 to 2018. The years with the highest number of publications are 2014 (9), 2017 (8) and 2016 (7). These three years represent more than half of the analyzed articles. Results indicate a growth in the number of studies on sustainability in the Brazilian beef supply chain, published mainly in the last four years. In addition, this result may indicate that interest in the topic is increasing, especially by academics who publish in international journals.

In this context, the papers were published in 28 different journals. The scopes of journals are from different areas. This finding highlights the interdisciplinarity of the theme. The journals with the largest number of publications are Global Environmental Change (5); Journal of Cleaner Production (4); Land Use Policy (3); British Food Journal (3); and, Meat Science (3). The scopes of these journals are related to sustainability or food, and the use of land.

The papers have a qualitative approach in their majority. Case studies (13); based on documental analysis (8); theoretical studies (6); and multiple case studies (2) are methodologies used in these studies. Most of the papers have a descriptive character, describing and investigating the case and/or solutions for the case. There are also articles that do not explicitly describe the methodological procedures used in the research.

Moreover, the articles address issues related to environmental impacts in the Brazilian beef supply chain (23), to the supply chain structure (12), allowing that collaboration and sustainability initiatives can be adopted, for example; and, to sustainability in the beef supply chain in Brazil (5). Considering the papers dealing with environmental impacts in the Brazilian beef supply chain, they are mostly related to deforestation, land use and reduction of greenhouse gas emissions. The next topic presents an initial analysis of the articles in line with the purpose of this study.

Initial analysis of sustainability in Brazilian beef supply chain

Serdasaran (2013) defines a complex supply chain as the interorganizational relationship with high number and variety of stakeholders and, consequently, various relations, processes and interactions between and within these stakeholders. Due to the diversity and quantity of stakeholders, the Brazilian beef supply chain is considered a highly complex supply chain. Another factor that contributes to the understanding of the beef supply chain as complex is the nature of its activity, with high environmental, social and economic impact.

In order to introduce sustainability in supply chain, it is necessary to include all the stakeholders that influence and are influenced by supply chain business – even competitors, which traditional supply chains generally ignore or treat just as adversaries (Pagell and Wu, 2009; Seuring and Müller, 2008). Aiming to achieve sustainability, Brazilian beef supply chain has been expanding the relationship with its stakeholders and introducing sustainable practices in supply chain. The introduction of sustainability in supply chain requires a continuous and collaborative relationship between supply chain partners. Thus sustainability increases the complexity of this supply chain.

Therefore, there are three generic approaches when dealing with complexity in supply chains: complexity reduction, complexity prevention, and complexity

management (Serdasaran, 2013). Managers should evaluate the best strategy to deal with the three types of complexity: static, dynamic and decision making complexity.

Most of the papers aim to highlight sustainable practices adopted by different stakeholders of the Brazilian beef supply chain with the purpose of reducing its socio-environmental impacts. Sustainable practices seem to contribute to increase static, dynamic and decision making complexity of the Brazilian beef supply chain. Following Serdarasan (2013), we identified that the most common approaches to deal with sustainability in the Brazilian beef supply chain are related to the reduction of unnecessary complexity and to the management of necessary complexity. For example, one of the initiatives is the Brazilian Roundtable on Sustainable Livestock. This initiative aims to discuss complex issues related to sustainability in the beef industry/supply chain, reducing and managing static, dynamic and decision making complexity.

Therefore, according to the published papers, sustainability has been addressed in the Brazilian beef supply chain in two different ways: (1) to reduce environmental and social impacts and (2) to manage these impacts. The adoption of sustainable practices in this complex supply chain seems to be related to socio-environmental risks involved, to respond reactively to stakeholders' pressures.

Although sustainability is mentioned, which addresses the integration between social, environmental and economic dimensions; most initiatives are aligned mainly with environmental and economic dimensions. Thus we identified that there is a need for greater discussions on social issues, especially in the Brazilian beef supply chain, where organizations have already been assessed for poor working conditions.

Final Considerations

This study emphasizes sustainability related to a complex supply chain. Thus there are contributions for the analysis of sustainability in the complex Brazilian beef supply chain. Understanding how sustainability is being addressed in the Brazilian beef supply chain seems to be a good direction to understand how sustainable initiatives are being adopted and disseminated in a highly complex supply chain.

This knowledge can also contribute to the understanding of the effectiveness of these initiatives in a highly complex supply chain, when compared to less complex supply chains. Additionally, this study emphasizes sustainable initiatives related to a complex supply chain. Thus managers can be encouraged to invest in sustainability, considering the static, dynamic and decision making complexity of the supply chain.

Finally, we recognize that the selection of the Brazilian beef supply chain can be a limitation to the research. However, we believe that the knowledge related to this specific supply chain can contribute to understand other complex supply chains, as well to understand the introduction of sustainability in complex supply chains. We understand that more studies and discussion about sustainable supply chain management and complexity must to be developed. We hope that our discussion will stimulate further studies in the topic.

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