

OPEN ACCESS



International Food and Agribusiness Management Review

Please cite this article as 'in press'; DOI: 10.22434/IFAMR2018.0031

Received: 24 February 2018 / Accepted: 30 November 2018

Insights of innovation and competitiveness in meat supply chains

REVIEW ARTICLE

Alice Munz Fernandes[Ⓐ], Odilene de Souza Teixeira^ᵇ, Heitor Vieira Rios^ᵃ, Maria Eugênia Andrighetto Canozzi^ᶜ, Glauco Schultz^ᵈ and Júlio Otávio Jardim Barcellos^ᵉ

^ᵃ *Researcher, Center of Agribusiness Studies – CEPAN, Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS), Avenue Bento Gonçalves 7712, CEP 91540-000, Porto Alegre, RS, Brazil*

^ᵇ *Researcher, Department of Animal Science (Zootecnia), Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Avenue Bento Gonçalves 7712, CEP 91540-000, Porto Alegre, RS, Brazil*

^ᶜ *Researcher, Instituto Nacional de Investigación Agropecuaria (INIA). Programa Producción de Carne y Lana. Estación Experimental INIA La Estanzuela. Ruta 50 km 11, 39173, Colonia, Uruguay*

^ᵈ *Professor, Department of Economic Science and Center of Agribusiness Studies – CEPAN, Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS), Avenue João Pessoa 52, CEP 90040-000, Porto Alegre, RS, Brazil*

^ᵉ *Professor, Department of Animal Science (Zootecnia) and Center of Agribusiness Studies – CEPAN, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Avenue Bento Gonçalves 7712, CEP 91540-000, Porto Alegre, RS, Brazil*

Abstract

The world demand for food in parallel with environmental concerns is a paradigm for the competitiveness of agro-industrial production chains. The present study intended to propose insights on the contribution of innovation and competitiveness in meat production chains. A systematic review of the literature was carried out, considering manuscripts published in the Scopus, Web of Science and Science Direct databases. Based on the search and exclusion criteria, the analyzed portfolio consisted of 18 works related to the main animal production chains (i.e. pork, chicken, beef, and sheep). The results obtained include three theoretical constructs, under which the studies of competitiveness and innovation in meat production chains were based, namely: (1) institutional environment; (2) business capacity; and (3) consumer behavior. These are composed of *a posteriori* variables, which have influences in the innovation and competitiveness of such systems, meeting the postulate by the literature.

Keywords: agribusiness, competitive advantage, convergence, market relations

JEL code: Q13

[Ⓐ]Corresponding author: alicemunz@gmail.com

1. Introduction

The world demand for food is estimated to increase around 60% in the next decades. Aspects related to food supply chains such as availability, accessibility, utilization, and stability are the main aspects of food safety of this new socioeconomic scenario (FAO, 2016a). In parallel, environmental aspects emerge as a concern in discussions about maximizing agricultural productivity (Irias *et al.*, 2004). This establishes a paradigm for the sustainable competitiveness of agribusiness (Romeiro, 1998). Under this approach, meat production has been the focus of extensive debates since the activity, despite providing high amounts of protein and generating employment and income, is recurrent seen as environmentally unsustainable (Nguyen *et al.*, 2010). However, there are inputs for the development of agro-industrial productive chains, such as innovations driven by adjustments to the institutional environment and market gains (Porter and Linde, 1995). In this way, a set of strategies and entrepreneurial skills and competencies is considered a promoter of competitiveness (Porter, 1985), which in turn, occurs in a systemic way (Batalha and Silva, 1999; Mattuela *et al.*, 1995). There is no consensus about the definition of competitiveness (Ferraz *et al.*, 1997), perhaps because it is based on the relationship between many variables in different contexts. However, the subject is a topic that guides discussions in different areas of knowledge, being also important for the creation of public policies (Farina, 1999). In the literature, this concept can be found with different meanings and acceptances (Pagano, 2001). Under this approach, Schultz *et al.*, (2011) point out that these different variations of meanings are configured as tautological concepts, evincing the difficulty of establishing a comprehensive definition of the functioning of markets.

Alternatively, it is a consensus that competitiveness is not delimited in a sector view; it actually crosses the limits of companies, occurring between systems (Batalha and Silva, 1999; Mattuela *et al.*, 1995). In the scope of agribusiness, Batalha and Silva (2007) corroborate that there is a particular object of analysis, namely supply chain, which is an open system and cannot be studied as the sum of the competitiveness of the agents that compose it. They also emphasize the possible market gains obtained through the articulation and efficient mechanism of governance of this structure. In this perspective, the innovation can be considered a competitive advantage, especially in a dynamic environment (Dess and Picken, 2000; Tushman and O'Reilly, 1996), being also determinant for supply chain performance (Mone *et al.*, 1998). Although there is a close relationship between innovation and competitiveness (Perosa and Baiardi, 1999), they are not synonyms. The concept of competitiveness, the concept of innovation also has different definitions that emphasize different aspects (Crossan and Apaydin, 2010).

The pioneering definition of innovation was made by Schumpeter in 1911, who considered it a process of 'creative destruction' (Schumpeter, 1982). However, because it was developed under a specifically economic approach and based on the monopoly, Schumpeter's definition of boarded innovation considered the company as an isolated agent (Crossan and Apaydin, 2010). Additionally, there are discussions about other aspects related to innovation, such as its diffusion (Rogers, 2003) and its beneficial nature (Camison-Zornoza *et al.*, 2004). In the productive chain scenarios, there is relevant interest about the mechanism that innovations can be the actors of transformations in productive systems (Rainelli, 1991), until the point of modifying the geography itself (Morvan, 1991). By analyzing markets, it is also possible to identify necessities of innovation due to changes in consumer behavior (Fanfani *et al.*, 1991). Thus, the investigation of the phenomenon of innovation in a supply chain approach is advocated by many authors, such as Wilkinson (1998) and Batalha and Silva (2007).

Thus, specifically regarding innovation and competitiveness in meat production chains, different changes driven by environmental concerns and moral and ethical debates have led to the creation of products that are subtitled to animal protein (such as plant proteins and cultivated meat, for example), which take up market space due to changes in the consumption habits of the population (Siegrist *et al.*, 2018; Winiwarter *et al.*, 2014). Soon, conventional animal protein production chains must find mechanisms to meet these new requirements, improving their efficiency in terms of product quality, environmental sustainability of the production process, and animal welfare (Novoselova *et al.*, 2007).

In parallel, estimates of population growth point to the need to maximize world meat production on the order of 50 to 73% by 2050 (FAO, 2009), being that the conventional production of the protein is reaching the limits of its productive capacity (Bonny *et al.*, 2015). Thus, the effects of this bias on the emergence of innovation development of different dimensions and typologies. Thus, it is possible that innovation can be considered both as a contribution to competitiveness and as a result of this, so that a set of variables is involved in this phenomenon, especially in an environment endowed with complexity and dynamism.

Therefore, the present study intended to propose insights about the contributions of innovation and competitiveness in meat supply chains. A systematic literature review was carried out, the portfolio of which was composed of manuscripts published in Scopus, Web of Science, and Science Direct databases, after selection by specific criteria and filters. The study is composed of three other sessions aside from this introduction: the methodological procedures used in the research; the results obtained, which are compared with the literature findings; and, eventually, the final considerations, where the research limitations and suggestions for future studies were contemplated.

2. Materials and methods

The present study can be classified as qualitative regarding the approach of the problem, and exploratory with regard to its purpose. As a technical procedure, was made a systematic review of the literature, intending to provide insights through the synthesis of knowledge in a given set of studies to develop well-founded premises (Van Aken, 2001). This method makes it possible to systematically evaluate the contribution of a given set of literature to the construction of knowledge (Ginsberg and Venkatraman, 1985), based on the use of an explicit algorithm rather than the heuristic (Crossan and Apaydin, 2010).

To impede the subjectivity and researcher bias, which are likely to occur in systematic revisions (Fink, 1998), making science popularist and not very rigorous (Hodgkinson, 2001), the pragmatic revision structure proposed by Tranfield *et al.* (2003) was adopted. This structure is composed of 10 phases distributed in three stages, as shown in Figure 1.

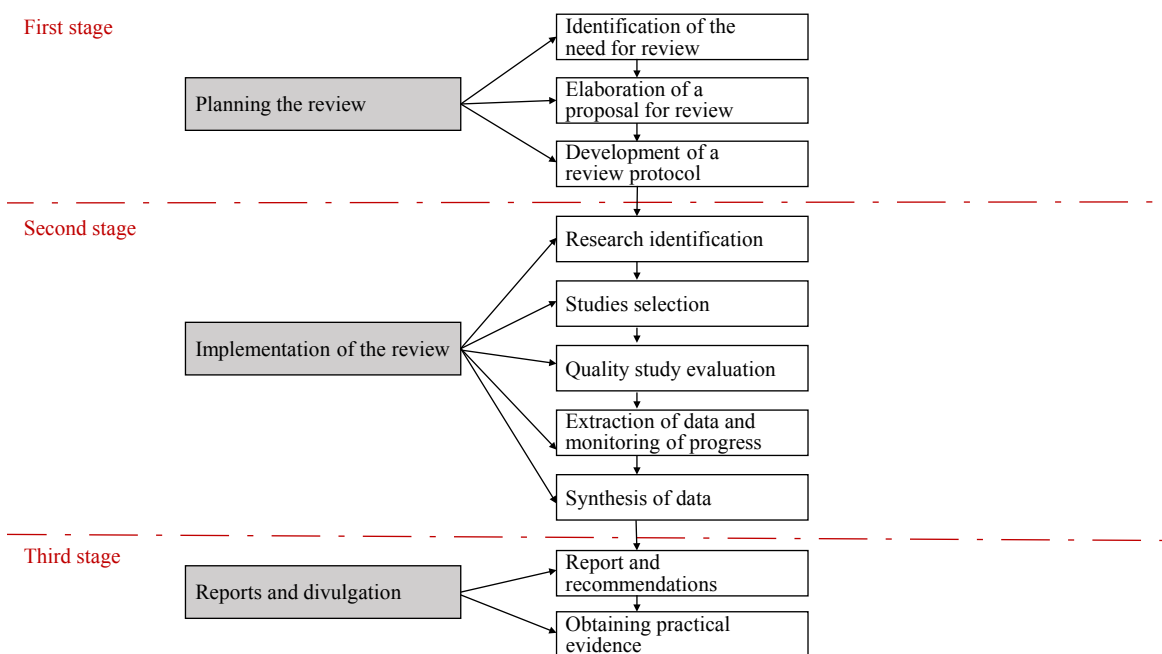


Figure 1. Pragmatic revision structure (adapted from Tranfield *et al.*, 2003).

As the first stage of the pragmatic structure of the review postulates, considering the review protocol, with the view to compose the portfolio of studies analyzed, the Scopus, Science Direct, and Web of Science databases were utilized. Only peer-reviewed journals were included in the analyzes since they are considered important disseminators of valid knowledge and promote greater impact in the scientific environment (Podsakoff *et al.*, 2005). The search was filtered to find only manuscripts, and no limitations for language and year publication were defined. The search period comprised every year up to July 19, 2017, that is, without initial temporal limitation. The initial search totaled 54 manuscripts, considering the three databases and the five inclusion rounds of terms and booleans (Table 1).

The Zipf law, or minimum effort law, was used, which considers the existence/ occurrence or frequency of the appearance of words in the text (Vanti, 2002). Because we understand that the title, abstract, and/ or keywords hold the central theme of the studies, we chose these filters. To define the search criteria, we considered the variation of the different terms about the main production chains of the meat, mainly due to the corresponding animal species.

Additionally, manuscripts that met more than one search criterion and/or were present in more than one database were excluded, using the EndNote bibliographic manager, totaling 27 studies. Considering the stage of implementation of the review, the evaluation of the quality of the studies verified from the adhesion of these with the proposal of the research, nine manuscripts were excluded during the initial screening process, since, although they met the search criteria, they were not about the object of study. Four of these were referred to wool production, two to sheep's milk production, one was about tilapia meat, one was related to textile fibers, and one referred to the development of drugs based on incubation of chicken eggs. Eventually, the portfolio of documents analyzed was composed of 18 manuscripts, the temporal distribution of which is presented in Figure 2.

Already belonging to the third stage of the systematic review of the literature, regarding the journals in which these manuscripts were published, it was verified that only the Brazilian journal 'Ciência Rural' has two publications. The other publications were from different countries, spread over all continents, except Asia and Antarctica, and contributing with one manuscript each.

The study analysis was guided by two interrogatives: (1) How does innovation contribute to the competitiveness of meat supply chains? and (2) How does competitiveness contribute to the innovation in meat supply chains? These elements were treated as both dependent and independent of each other, that is, innovation as a determinant for competitiveness and, simultaneously, as a result of it. A thorough study of the publications found was carried out and the data were extracted for a word processor and spreadsheets and were checked by two researchers in the area. From this, conceptual schemas were created and, consequently, theoretical and variable constructs of direct influence that explain the existence of innovation and competitiveness in meat supply chains emerged.

Table 1. Distribution of manuscripts according to database and search terms used.

Search criteria	Scopus	Web of science	Science direct	Total
'competitiveness' and 'innovation' and 'meat'	8	6	2	16
'competitiveness' and 'innovation' and 'beef'	11	5	3	19
'competitiveness' and 'innovation' and 'pig'	2	0	0	2
'competitiveness' and 'innovation' and 'sheep'	10	4	1	15
'competitiveness' and 'innovation' and 'chicken'	2	0	0	2
Total	33	15	6	54

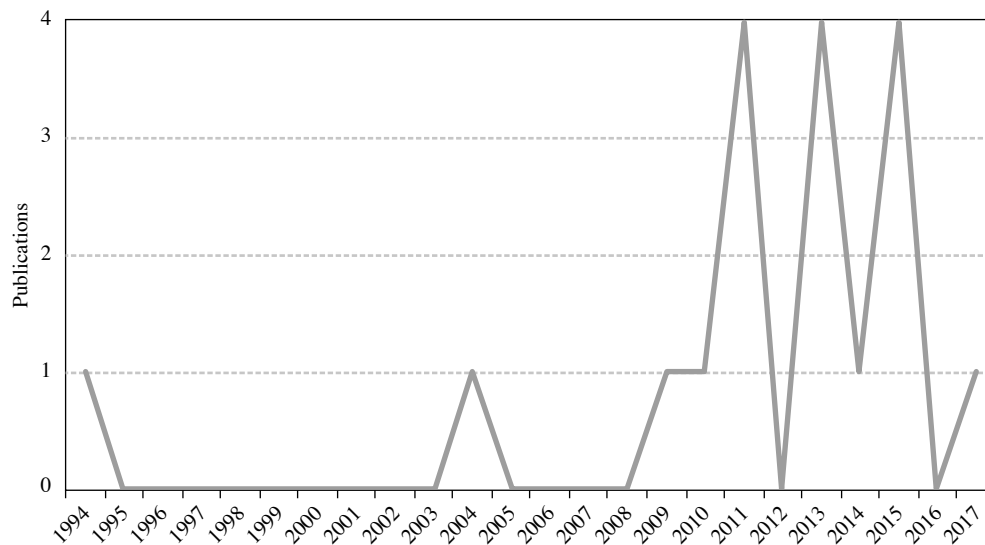


Figure 2. Temporal distribution of publications.

3. Results and discussion

Analyzing the agro-industrial productive chain under the *filière* approach (Batalha and Silva, 2007; Morvan, 1991), it is possible to have a systemic perspective (Morvan, 1991). The object of this study is limited to the productive chains of the meat, what is justified by the constant population growth, and by the increase in the world demand for animal protein, in a scenario of limited expansion of land and space destined for livestock production (FAO, 2017). In this prism, a new record in world meat production is expected in 2017 considering the main forms of meat production, namely: pork, chicken, bovine, and ovine. An equivalent of 262.8 million tons of these meat types were projected in the same year, which corresponds to the double produced in 1986 (USDA, 2017). According to FAO's outlook (FAO, 2016b), world meat production is expected to be 16% higher in 2025 compared to the base period (2013-2015). From this, the two main elements of current research – innovation and competitiveness in meat supply chains – have distinct interfaces that signal a competition pattern in the industry in this sector (Barcellos *et al.*, 2010). Table 2 presents an isolated analysis of the productive meat chain, pointing to the innovation circumscription (technological or non-technological) and the link in which it occurred, as well as the competitive reflex under a systemic perspective.

As a summary of the frame above, it is visualized that from the analysis of all articles used in the systematic review, the construction of two points that interact with each other, innovation and competitiveness, emerging second to production and technology (Figure 3), where the sizes of 'nodes' refer to the recurrence or higher incidence of certain terms in purchase with others. This, as postulated by the theoretical aspects, means innovation as a contribution to competitiveness and *vice versa*. Thus, it is not possible to identify which of these variables is characterized as dependent or independent, since all secondary variables are self-related, either to a greater or lesser degree of interaction.

It is observed that beef consists of the production chain that is the focus of the largest number of publications, which can be justified by the significant changes in the consumer market of this product in comparison to other production chains in the last decades (Schlesinger, 2010). In this way, different elements and variables are involved in such changes, from genetic aspects of production to practices and consumption patterns, from a systemic approach (Ferreira and Padula, 2002). As for the stage of the productive chain where the innovations occur, one can perceive the predominance of the production link. However, the productive chain approach in agricultural activity establishes a complex network of rural activity relations with its industrial and commercial context (Castro *et al.*, 1998). In this sense, the modernization of primary activity defines the

Table 2. Innovation circumscription and competitive reflex in the meat production chain.

Type of meat	Link	Innovation circumscription	Competitive reflex	Author
Sheep and pig	Agroindustry	Electrical stimulation to minimize stress development, late bone cutting, and anaerobic meat storage	Improvement of food quality, seen as a promoter of structural change in the industry, which imposes barriers to entry	Sainsbury (1994)
Pig	Production	Need for reproductive improvement of animals, exploitation of technologies and management techniques	Minimization of the environmental impacts in the production of meat and proposal of implantation of system quality and control in all links of the chain, not only in the final product	Pál <i>et al.</i> (2004)
All	Systemic perspective	The scarcity of continuous support for technological modernization of production and processing and high costs of adaptation to the new institutional environment before joining the EU	Reduced bureaucracy for the marketing of meat from Slovakia, minimizing the time to approve processes for insertion of new technologies and production procedures and the possibility of implementing an efficient export policy	Matosková and Gálik (2009)
Beef	Agroindustry and final consumer	Consumer behavior in relation to different meat processing technologies	Consumer aversion to meat obtained from 'invasive' technologies	Barcellos <i>et al.</i> (2010)
Beef and Sheep	Production	Technical changes, changes in technical efficiency and structural adjustment	Investments in R&D, infrastructure, and education foster competitiveness, in contrast, the lack of political incentives aligned to encourage the adoption of new projects, impedes agricultural innovation	Gray <i>et al.</i> (2011)
Beef	Production	Reproduction technologies	Improved relationship with regulatory institutions regarding reproductive biotechnology	Franco <i>et al.</i> (2011)
Beef	Production	Use of the driver's technology, management, institutional environment, and market relations to measure competitiveness	Access to technological innovation, investment in herd genetics, and management practices maximize competitiveness	Marques <i>et al.</i> (2011)
Beef	Production	Technology innovation	Technological innovation and entrepreneurship are seen as insight for the development of the sector	Oaigen <i>et al.</i> (2011)
Sheep	Production	Genetic improvement of herds	Genetic selection technologies promote increased productivity, profitability, and competitiveness of the production chain	Islam <i>et al.</i> (2013)
Beef	Production	Specialization of business activity and training	Access to technological innovations is a factor limiting competitiveness, which can be solved through the actions of agencies to promote research and rural extension	Oaigen <i>et al.</i> (2013a)

Table 2. Continued.

Type of meat	Link	Innovation circumscription	Competitive reflex	Author
Beef	Production	Technological innovations as critical factors of competitiveness	The lack of accessibility of technological innovation to producers is a difficult factor in the institutional environment. Questioning about the effective benefits of the diffusion of technological knowledge among stakeholders	Oiagen <i>et al.</i> (2013b)
All	Final consumer	Behavior of purchase of innovative products of animal origin	Aggregation of value to the product and creation of new market niches	Kowalczyk <i>et al.</i> (2013)
Beef	Agroindustry	Industry-driven innovation	To provide innovation throughout the chain requires a strategic approach. The use of sophisticated programs for information management and the use of the Internet foster the improvement of the relationship between the chain	Storer <i>et al.</i> (2014)
Beef	Systemic perspective	The perspective of the sustainable value chain, from the drivers of competitiveness: market structure, chain coordination, logistics, quality, and value added	Threats to the chain come from the institutional environment based on free trade agreements and the concentration of retail. Animal genetics, nutrition, and animal welfare, as well as the optimization of logistics routes and more efficient quality systems, would foster competitiveness	Kristkova and Coque (2015)
Beef	Production	Interference with access to information on the adoption of management practices	Producers who access the Internet participate in a larger number of agricultural associations, receive technical assistance more frequently and are more likely to use management techniques	Dill <i>et al.</i> (2015)
Chicken	Systemic perspective	Influence of the institutional environment, the relevance of the standardization of processes and reflexes of investments in the productive chain	Lack of coordination and inefficient communication between the links in the production chain hinders gains in economies of scale. Need to explore new market niches	Chatellier <i>et al.</i> (2015)
Sheep	Production	Genetic improvement to leverage weight gain and improve nutrition and nutrition through the development of technologies and support programs for cost management	Minimizing production costs and improving product quality	Espinosa-Garcia <i>et al.</i> (2015)
All	Agroindustry	Metabolic activities of coagulase-negative staphylococci bacteria in the production of fermented meats	Improvement of sensory and food safety properties	Mainar <i>et al.</i> (2017)

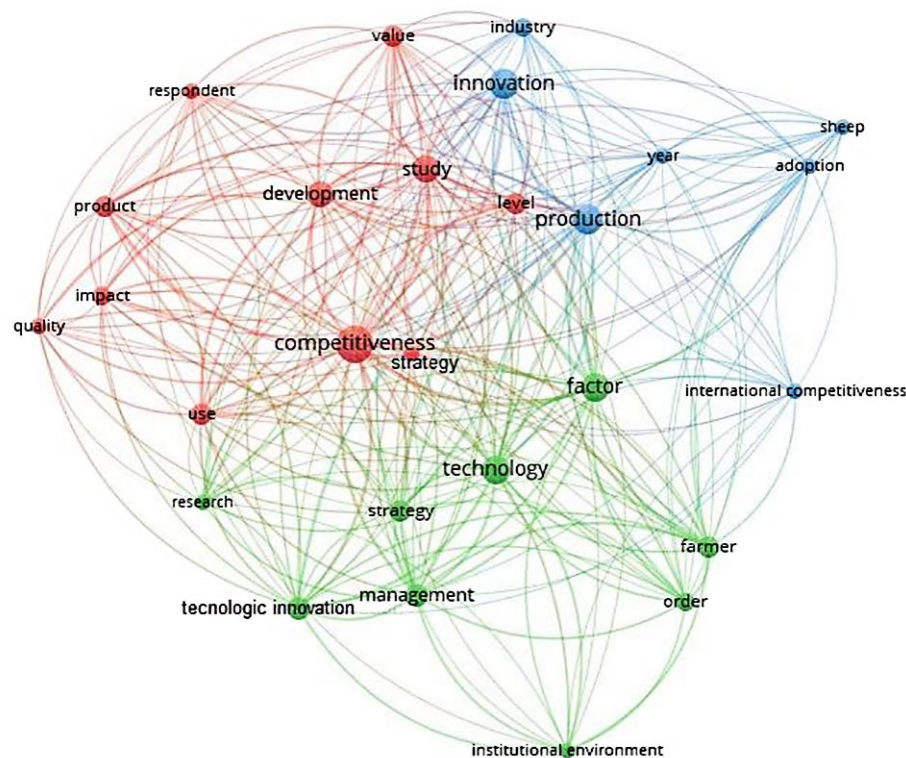


Figure 3. Network with the main associations between prevailing terms in the articles analyzed. The red cluster refers to competitiveness and the elements that have a direct influence on this variable. The blue cluster corresponds to non-technological innovation that covers aspects related to market, innovative culture, and internationalization. The green cluster includes aspects of technological innovation, such as technology itself and research.

narrowing with the link of inputs and processing (Delgado, 1985). Also, the predominant innovation approach is technological since technology is the driving force for change (Toffler, 1970). However, Christensen (1996) points out that the production of technological innovations requires not only an effort in R&D but also the use of innovative assets. For Tidd *et al.*, (2005), the technological strategy is fundamental for the implementation of effective strategic management of innovation, which integrates elements of organization, processes, and resources (Quadros, 2008). However, despite the nature of agricultural activities and the interdependence and multiplicity of factors, technology is only one of the determinants of innovation (Irias *et al.*, 2004).

It should be noted that this frame and their respective network of associations are derived from this specific set of studies. Therefore, using other databases or other search guidelines, the results obtained would probably be different. But, considering the perspective approach of each manuscript, they were organized and grouped respecting their theoretical approach, as well as their ambience and empiric investigation. In the light of this, three great constructs emerged that circumscribe the contribution of innovation to competitiveness and/or vice versa, in meat supply chains. The first construct corresponds to the institutional environment, which involves technical, financial, social, and cultural aspects that guide organizational functioning (Scott, 1992). Also, this perspective defines legitimacy and isomorphism as essential factors for the existence of organizations (Perrow, 1990). Thus, it considers that the context in which these factors are inserted makes it possible to understand its processes and structures (Pettigrew, 1985). The second construct, firm capability, includes different definitions of competitiveness. This concept can be understood as the capability to meet specific markets with quality products (Haguenaer, 1989), develop individual strategies (Kupfer, 1996), develop abilities to exercise competition, maintain a sustainable position on the market (Coutinho and Ferraz, 1995), and conquer new markets (Jank and Nassar, 2000). In this perspective, among the elements that compose

this construct, can be identified: systemic or non-controllable factors by companies, structural factors that may or may not be controlled by companies and, finally, internal factors that are totally controllable by the companies. The third construct concerns consumer behavior, which can be defined as a process composed of activities directly related to acquisition, consumption, and disposal of products and/or services (Engel *et al.*, 2000). This process also includes decisions substantiated in mental, social, physical, and cultural aspects that precede these actions (Sheth *et al.*, 2001). Therefore, this construct has the greatest emphasis on the market. Figure 4 shows the three theoretical constructs that subsidize innovation and competitiveness in meat supply chains that emerged through the systematic review of the literature, as well as the variables that compose them.

Among the studies that highlight the importance of the institutional environment to the innovation and competitiveness in meat supply chains, noteworthy is the one developed by Matosková and Gálík (2009), which pointed out the cost-benefit ratio of Slovakia toward its accession to the European Union. In this case, the authors identified the necessity of continuous support for technological modernization of meat production and processing, as well as the reduction of bureaucracy in commercialization to compete on the European market. All this effort resulted in the implementation of more efficient export policies. Alternatively, government incentives in R&D, infrastructure, and education foster innovation and maximize competitiveness (Gray *et al.*, 2011). Nevertheless, the development of an appropriate relationship among the links of the supply chains and institutions that regulate them naturally promote improvements on systemic competitiveness (Franco

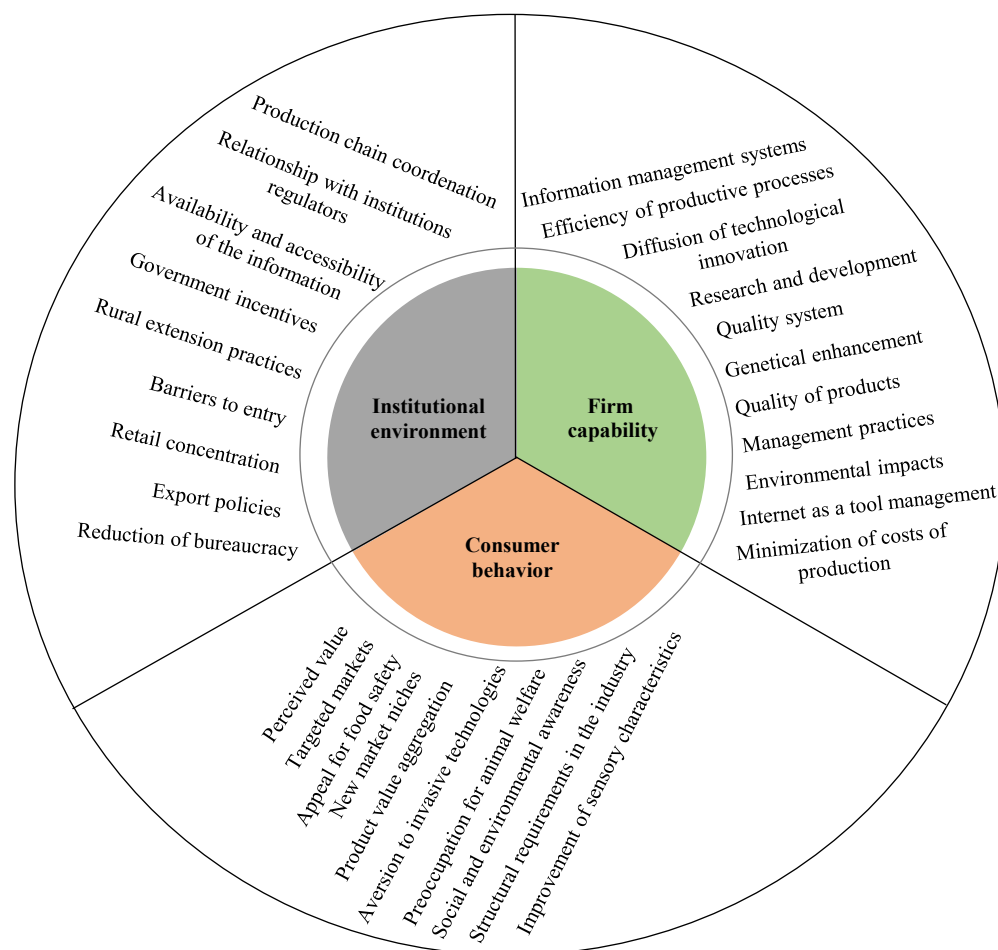


Figure 4. Theoretical constructs and their variables with regard to innovation and competitiveness in meat supply chains.

et al., 2011). As can be noted, competitiveness is closely linked with macroeconomic, institutional, and social factors (Perosa and Baiardi, 1999). Ergo, competitive distributors and suppliers can be considered key elements of competitive advantages, evincing the idea of collective performance (Porter, 1990). Thereby, a favorable institutional environment is required to improve competitiveness and develop an efficient national innovation system (Islam *et al.*, 2013).

The results obtained are not substantiated in the traditional view of competitiveness (competitiveness as performance or revealed and competitiveness as efficiency or potential) (Ferraz *et al.*, 1997), which defines it in a static way. On the contrary, the studies found approach competitiveness in a systemic way, as proposed by Coutinho and Ferraz (1995), Ferraz *et al.* (1997), Batalha and Silva (2007) and Batalha and Souza Filho (2007). The same authors conceptualize it as the set of strategies, capacities, competencies, and abilities of a supply chain for the purpose of acquiring and maintain markets, not forgetting the interdependences between the links as well as its interaction with the environment in which it is immersed. In this context, Kristkova and Coque (2015) emphasize that the institutional environment can also threat and inhibit the competitiveness of a supply chain, by concentrating retail and making difficult the access of technological innovation, for example. Chatellier *et al.* (2015) corroborate that the low competitiveness of the French poultry production can be justified by a rigorous environmental regulation and by the new European standards. Also, the lack of standardization in processes and low investments in appropriate tools in all supply chain activities are contributors to this reality. The same authors comprehend that there are failures in coordination and inefficient communication between the links of the supply chain that preclude gains in economies of scale. As a result, government support is required to leverage competitiveness, commercially develop the industry products, and foster R&D investment in the sector.

Under the aegis of firm capability, elements related to micro and meso environment emerge, which can be controlled or not, in an individualized way, by firms or by links of the supply chain (Batalha and Silva, 2007). For Pál *et al.* (2004), the socio-environmental approach of meat production is closely related to the capacity of the agents of minimizing the effects of their activities, which can be facilitated by a quality mechanism system that comprehends every link of the supply chain. In contrast, Oaigen *et al.* (2011) elucidate that the technological innovation is responsible for subsidizing the entire firm capability of the supply chain agents, resulting in the maximization of the systemic competitiveness (Oaigen *et al.*, 2013a,b). Thereby, the predominance of this innovative approach is justified by the role of technology in promoting changes (Toffler, 1970). However, the production of technological innovations does not require R&D efforts only, but also the utilization of innovative assets (Christensen, 1996). It can be considered a fundamental factor for the implementation of effective strategic innovation management (Tidd *et al.*, 2005), which in turn, integrates elements of organization, processes, and resources (Quadros, 2008). Despite the importance of technology due to the nature of farming activities and the interdependence and multiplicity of factors, it is only one of the determinants of innovation (Irias *et al.*, 2004). Aspects related to cost productions are part of the environment of a firm's capability and refer strictly to competitive strategies (Porter, 1990). This phenomenon is clearly perceived when commodities are analyzed, given that pricing corresponds as the main element for the occurrence of economies transactions (Coase, 1937).

It is relevant to consider that factors involving the consumer behavior are also important to comprehend the dynamic of innovation and competitiveness in meat supply chains. Under the market view, improvements in the meat food quality can be a promoter of structural changes in the industry (Sainsbury, 1994), affecting all links in the supply chain. In addition, the aversion of consumers to invasive food processing technologies based on the idea that it modifies the aspect and quality of *in natura* meat and leads consumers to express negative opinions about the use of these innovations (Barcellos *et al.*, 2010), whereas the aggregation of value to the product encourages the creation of new niches and market segments (Kowalczuk *et al.*, 2013). According to Mainar *et al.* (2017), the necessity for improvements in sensorial properties of meat and for food safety is the focus of debates about human nutrition, establishing new market guidelines. Thus, aspects related to the consumer purchase decision are considered relevant to the study of agro-food supply chain competitiveness, mainly due to the specificities of this segment (Batalha and Souza, 2007). Regarding this,

Kowalczyk *et al.* (2013) observed that consumers tend to pay higher amounts for products perceived as innovations, in other words, that have distinct elements from those of conventional foods, such as functional aspects, the degree of environmental impact, traceability, etc.

The results obtained also demonstrate that innovation is a determinant aspect of competitiveness given that its adoption in supply chains promotes innumerable benefits that result in the maximization of positive results, both economically and socially. In this way, distinct variables and constructs emerged from the relation between innovation and competitiveness, regardless of the type of meat and the supply chain link approached. This finding makes it possible to verify the technological and innovative trajectory of meat supply chains, as well as, their issues and their possibilities of improvements to maximize competitiveness. Therefore, the institutional environment, regarding the regulations and incentives in R&D, foster the diffusion of knowledge and technological innovation to the entire supply chain. Under another prism, the market structure knowledge enables the development of meat processing technologies, which affect the creation of new systems of food safety and the improvement of organoleptic characteristics, adding value to the products and opening new niche markets.

In the production's context, the firm capability promotes animal reproductive, genetic, and nutritional enhancements also improving animal welfare through the adoption of efficient: management techniques, information management, development of coordination strategies, and technological innovations. From the neo-Schumpeterian perspective, the environmental variables are endogenous of innovation strategies, since it has the potential to generate asymmetries that create competitive advantages (Romeiro and Salles-Filho, 1997). In this sense, it reflects a new pattern of competitiveness where the diffusion of innovation provides benefits to the entire supply chain presupposing an efficient bilateral information flow (Rogers, 2003).

4. Final considerations

The transformations occurred in all contexts of our society induced modifications in our scenarios, including in supply chains. The increasing world food demand and, in parallel, the augmented concern about environmental issues are noteworthy. These modifications promote the adoption of innovations, especially in agribusiness, interfering directly in the competitiveness of these systems. Using this perspective, the current investigations objected to proposed insights about the contribution of innovation and competitiveness in meat supply chains. The results obtained demonstrate that the technological approach is predominant in the papers analyzed and that the constructs institutional environment, firm capability, and consumer behavior, in a generic way, are the main pillars for the scientific investigation on this thematic. Therefore, our findings corroborate with the literature since it synthesizes the elements that circumscribe the study about this subject, resulting in variables and constructs *a posteriori* that also have a consolidated theoretical foundation. However, the authors recognize the study limitation regarding the utilization of only three databases; although the databases researched have unquestionable scientific relevance, they do not contemplate all studies about the subject.

For future investigations, we suggest realizing empirical analyzes in the different agents that compose the meat supply chains to verify the applicability of the constructs obtained and emerging variables. In addition, we recommend comparing competitiveness and innovation among meat production chains to allow the equation of innovation efficiency and the possibility of implementing improvements.

References

- Barcellos, M.D., J.O. Kügler, K.G. Grunert, L.V. Wezemaal, F.J.A. Pérez-Cueto, O. Ueland and W. Verbeke. 2010. European consumer's acceptance of beef processing technologies: a focus group study. *Innovative Food Science and Emerging Technologies* 11(4): 721-732.
- Batalha, M.O. and A.L. Silva. 1999. Gestão de cadeias produtivas: novos aportes teóricos e empíricos. In: *(Des)equilíbrio econômico & Agronegócio*, edited by M.F.M. Gomes and F.A. Costa. Universidade Federal de Viçosa, Viçosa, Brazil, 249-266.

- Batalha, M.O. and A.L. Silva. 2007. Gerenciamento de sistemas agroindustriais: definições, especificidades e correntes metodológicas. In: *Gestão agroindustrial*, edited by M.O. Batalha. Atlas, São Paulo, Brazil, 23-63.
- Batalha, M.O. and H.M. Souza Filho. 2009. Analisando a competitividade de cadeias agroindustriais: uma proposição metodológica. In: *Agronegócio no Mercosul: uma agenda para o desenvolvimento*, edited by M.O. Batalha and H.M. Souza Filho. Atlas, São Paulo, Brazil, 1-22.
- Bonny, S.P.F., G.E. Gardner, D.W. Pethick and J.F. Hocquette. 2015. What is artificial and what does it mean for the future of the meat industry. *Journal of Integrative Agriculture* 14(2): 255-263.
- Camison-Zornoza, C., R. Lapiedra-Alcami, M.A. Segarra-Cipres and M. Boronat-Navarro. 2004. A meta-analysis of innovation and organizational size. *Organization Studies* 25(3):331-361.
- Castro, C.C., A.D. Padula, J.L. Mattuella, L.A. Müller and A.N. Angst. 1998. Estudo da cadeia láctea do Rio Grande do Sul: uma abordagem das relações entre os elos da produção, industrialização e distribuição. *Revista de Administração Contemporânea* 2(1):143-164.
- Chatellier, V., Y. Magdelaine and Y. Trégaro. 2015. The competitiveness of the French poultry sector: between doubts and hopes. *Productions Animales* 28(5): 411-428.
- Christensen, J.F. 1996. Innovative assets and inter-asset linkages: a resource-based approach to innovation. *Economics of Innovation and New Technology* 4(3): 193-209.
- Coase, R.H. 1937. The nature of the firm. *Economica* 4(16): 386-405.
- Coutinho, L. and J.C. Ferraz. 1995. *Estudo da competitividade da indústria brasileira*. Papyrus, Campinas, Brazil.
- Crossan, M.M. and M.A. Apaydin. 2010. A multi-dimensional framework of organizational innovation: a systematic review of the literature. *Journal of Management Studies* 47(6): 1154-1191.
- Delgado, G. 1985. *Capital financeiro e agricultura no Brasil*. Hucitec, São Paulo, Brazil.
- Dess, G.G. and J.C. Picken. 2000. Changing roles: leadership in the 21st century. *Organizational Dynamics* 28(3): 18-34.
- Dill, M.D., G. Emvalomatis, H. Saatkamp, J.A. Rossi, G.R. Pereira and J.O.J. Barcellos. 2015. Factors affecting adoption of economic management practices in beef cattle production in Rio Grande do Sul state, Brazil. *Journal of Rural Studies* 42: 21-28.
- Engel, J., R. Blackwell and P.W. 2000. *Miniard. Comportamento do consumidor*. LTC, Rio de Janeiro, Brazil.
- Espinosa-García, J.A., J. Quiroz-Valiente, G. Moctezuma-López, J. Oliva-Hernández, L. Granados-Zurita and A.C. Berumen-Alatorre. 2015. Technological prospection and strategies for innovation in production of sheep in Tabasco, México. *Revista Científica de la Facultad de Ciencias Veterinarias de la Universidad del Zulia* 25(2): 107-115.
- Fanfani, R., R.H. Green, M.R. Zuñiga and J. Wilkinson. 1991. Mudança tecnológica e reestruturação da indústria agroalimentar na Europa: uma reflexão teórico-metodológica. *Ensaio FEE* 12(2): 496-531.
- Food and Agriculture Organization of the United Nations (FAO). 2016a. *Climate change and food security: risk and responses*. OECD Publishing, Paris, France.
- Food and Agriculture Organization of the United Nations (FAO). 2016b. *OECD – FAO: Agricultural Outlook 2016-2025*. OECD Publishing, Paris, France.
- Food and Agriculture Organization of the United Nations (FAO). 2017. Meat consumption. FAO, Rome, Italy. Available at: <http://www.fao.org/ag/againfo/themes/es/meat/background.html>.
- Food and Agriculture Organization of the United Nations (FAO). 2009. *The State of Food and Agriculture*. Electronic Publishing Policy and Support Branch, Communication Division, FAO, Rome, Italy.
- Farina, E.M.M.Q. 1999. Competitividade e coordenação de sistemas agroindustriais: um ensaio conceitual. *Gestão & Produção* 6(3): 147-161.
- Ferraz, J.C., D. Kupfer and L. Haguenaer, 1997. *Made in Brazil: desafios competitivos para a indústria*. Campus, Rio de Janeiro, Brazil.
- Ferreira, G.C. and A.D. Padula. 2002. Gerenciamento de cadeias de suprimentos: novas formas de organização na cadeia da carne bovina do Rio Grande do Sul. *Revista de Administração Contemporânea* 6(2): 167-184.
- Fink, A. 1998. *Conducting research literature reviews: from paper to the internet*. Sage Publications, London, UK.

- Franco, M.M., A. Pellegrin, R.A. Figueiredo, A.R. Garcia, L.S.A. Camargo, H.C. Azevedo and J.H.M. Viana. 2011. The innovation network in animal reproduction: EMBRAPA's experience in organizing a research project on reproductive biotechnology. *Acta Scientiae Veterinariae* 39(1): 135-138.
- Ginsberg, A. and N. Venkatraman. 1985. Contingency perspective of organizational strategy: a critical review of the empirical research. *Academy of Management Review* 10(3): 421-434.
- Gray, E., Y. Sheng, K. Nossal, M. Oss-Emer and A. Davidson. 2011. Improving productivity: the incentives for change. *Australian Commodities* 18(1): 218-234.
- Haguenauer, L. 1989. *Competitividade conceitos e medidas: uma resenha da bibliografia recente com ênfase no caso brasileiro*. Texto para Discussão, volume 211. Universidade Federal do Rio de Janeiro, Instituto de Economia Industrial, Rio de Janeiro, Brazil.
- Hodgkinson, G.P. 2001. Facing the future: the nature and purpose of management researcher - assessed. *British Journal of Management* 12: S1-S80.
- Irias, L.J.M., G.S. Rodrigues, C. Campanhola, P.C. Kitamura, I. Rodrigues and C.C.A. Buschinelli. 2004. *Sistema de avaliação de impacto ambiental de inovações tecnológicas nos segmentos agropecuário, produção animal e agroindústria (Sistema Ambitec)*. Circular Técnica No. 5. Embrapa: Jaguariúna, São Paulo, Brazil.
- Islan, M.M., A. Renwick, C. Lamprinopoulou and L. Klerx. 2013. Innovation in livestock genetic improvement. *Euro Choices* 12(1): 42-47.
- Jank, M.S. and A.M. Nassar. 2000. Competitividade e globalização. In: *Economia e gestão dos negócios agroalimentares: indústria de alimentos, indústria de insumos, produção agropecuária, distribuição*, edited by D. Zylbersztajn, M.F. Neves. Pioneira, São Paulo, Brazil.
- Kowalczyk, I., K. Gutkowska, M. Sajdakowska, S. Zakowska-Biemans, A. Kozłowska and A. Olewnik-Mikolajewska. 2013. Innovative consumer of food of animal origin. *Zywnosc Nauka Technologia Jakosc/Food Science Technology Quality* 5(90): 177-194.
- Kristokva, Z.S. and J.M.G.A. Coque. 2015. Competitiveness of the EU beef sector: a case study. *Agris on-line Papers in Economics and Informatics* 7(2): 77-92.
- Kupfer, D. 1996. Uma abordagem neo-schumpeteriana da competitividade industrial. *Ensaio FEE* 17(1): 355-372.
- Mainar, M.S., D.A. Stavropoulou and F. Leroy. 2017. Exploring the metabolic heterogeneity of coagulase-negative staphylococci to improve the quality and safety of fermented meats: a review. *International Journal of Food Microbiology* 247: 24-37.
- Marques, P.R., J.O.J. Barcellos, C. McManus, R. P. Oiagen, F. C. Collares, M.E.A. Canozzi and V.N. Lampert. 2011. Competitiveness of beef farming in Rio Grande do Sul State, Brazil. *Agricultural Systems* 104: 689-693.
- Matosková, D. and J. Gálik. 2009. Selected aspects of the internal and external competitiveness of Slovak agro-cultural and food products. *Agricultural Economics* 55(2): 84-93.
- Mattuela, J.L., J. Fenstersifer and E.A. Lanzer. 1995. Competitividade em mercados agroindustriais integrados. *Revista de Administração* 30(4): 34-42.
- Mone, M.A., W. McKinley and V.L. Barker. 1998. Organizational decline and innovation: a contingency framework. *Academy of Management Review* 23(1): 115-32.
- Morvan, Y. 1991. Filière de production. In: Y. Morvan (ed.) *Fondements d'Economie Industrielle*. Economica, Paris, France.
- Nguyen, T.L.T., J.E. Hermansen and L. Mogensen. 2010. Environmental consequences of different beef production systems in the EU. *Journal of Cleaner Production* 18(8): 156-766.
- Novoselova, T., M.P.M. Meuwissen and R.B.M. Huirne. 2007. Adoption of GM technology in livestock production chains: an integrating framework. *Trends in Food Science and Technology* 18: 175-188.
- Oaigen, R.P., J.O.J. Barcellos, M.E.A. Canozzi, J.C.R. Soares, L.C. Canellas, C.O. Alves, H. R. Tavares and F.M. Costa. 2013a. Competitividade inter-regional de sistemas de produção de bovinocultura de corte. *Ciência Rural* 43(8): 1489-1495.
- Oaigen, R.P., J.O.J. Barcellos, M.E.A. Canozzi, L.F. Christofari, J.C.R. Soares and C.O. Alves. 2011. Competitividade interna na bovinocultura de corte no Estado do Rio Grande do Sul. *Ciência Rural* 41(6): 1102-1107.

- Oaigen, R.P., J.O.J. Barcellos, J.C.R. Soares, V.N. Lampert, C.S. Gottschall, P.R. Marques and H.R. Tavares. 2013b. Beef cattle production system competitiveness in the South of Brazil. *Archivos de Zootecnia* 62(238): 161-170.
- Pagano, L. 2001. O conceito da competitividade. *Revista da ESPM* 8(4): 39-47.
- Pál, R., B. Mihály, Z. László and S. Gyorgy. 2004. Biological and ecological aspects of improving the hungarian pig production. *Magyar Allatorvosok Lapja* 126(12): 732-740.
- Perosa, J.M.Y. and A. Baiardi. 1999. Especificidades institucionais/regionais no conceito da competitividade. *Organizações & Sociedade* 6(16): 77-87.
- Perrow, C. 1990. *Sociología de las organizaciones*. McGraw-Hill, Madrid, Spain.
- Pettigrew, A.M. 1985. *The awakening giant: continuity and change in ICI*. Basil Blackwell, Oxford, UK.
- Podsakoff, P.M., S.B. Mackenzie, D.G. Bacharach and N.P. Podsakoff. 2005. The influence of management journals in the 1980s and 1990s. *Strategic Management Journal* 26(5): 473-88.
- Porter, M.E. and C.V.D. Linde. 1995. Green and competitive: ending the stalemate. *Harvard Business Review* September-October: 120-134.
- Porter, M.E. 1985. *Competitive advantage*. Free Press, New York, NY, USA.
- Porter, M.E. 1990. The competitive advantage of nations. *Harvard Business Review* 73-93.
- Quadros, R. 2008. *Aprendendo a inovar: padrões de gestão da inovação tecnológica em empresas industriais brasileiras*. Instituto de Geociências, São Paulo, Brazil.
- Rainelli, M. 1991. Les filières. In: *Traité d'Economie Industrielle*, edited by R. Arena, L. Benzoni, D. Bandt and P.M. Romani Economica, Paris, France, 222-226.
- Rogers, E.M. 2003. *Diffusion of innovations*. Free Press, New York, NY, USA.
- Romeiro, A.R. 1998. Meio ambiente e dinâmica de inovações na agricultura. FAPESP, São Paulo, Brazil.
- Romeiro, A.R. and S.L. Salles Filho. 1997. Dinâmica de inovações sob restrição ambiental. In: *Economia do meio ambiente: temas, políticas e a gestão de espaços regionais*. Edited by A.R. Romeiro, B.P. Reydon and M.L.A Leonardi. Unicamp/IE, Campinas, Brazil, 83-122.
- Sainsbury, D. 1994. Technology and international competitiveness. *Business Strategy Review Spring* 5(1): 1-13.
- Schlesinger, S. 2010. *O gado bovino no Brasil*. Fase, Rio de Janeiro, Brazil.
- Schultz, G., C. Zanetti and P.D. Waquil. 2011. Análise da competitividade das cadeias produtivas agroindustriais. In: *Políticas públicas e provadas e competitividade das cadeias produtivas agroindustriais*, edited by G. Schultz and P.D. Waquil Editora da UFRGS. Porto Alegre, Brazil, 13-44.
- Schumpeter, J.A. 1982. *Teoria do desenvolvimento econômico: uma investigação sobre capital, crédito, juro e ciclo econômico*. Abril, São Paulo, Brazil.
- Scott, W.R. 1992. The organization of environments: network, cultural and historical elements. In: *Organizational environments: ritual and rationality*, edited by J.W. Meyer and W.R. Scott, Sage Publications, London, UK, 129-153.
- Sheth, J.N., B. Mittal and B.I. Newman. 2001. *Comportamento do cliente*. Atlas, São Paulo, Brazil.
- Siegrist, M., B. Sütterlin and C. Hartmann. 2018. Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science* 139: 213-219.
- Storer, M., P. Hyland, M. Ferrer, R. Santa and A. Griffiths. 2014. Strategic supply chain management factors influencing agribusiness innovation utilization. *International Journal of Logistics Management* 25(3): 487-521.
- Tidd, J., J. Bessant and K. Pavitt. 2005. *Managing innovation: integrating technological, market and organizational change*. John Wiley & Sons, Chichester, UK.
- Toffler, A. 1970. *Future shock*. The Bodley Head, London, UK.
- Tranfield, D., D. Denyer and P. Smarrt. 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management* 14(3): 207-222.
- Tushman, M.L. and C.A. O'Reilly. 1996. Ambidextrous organizations: managing evolutionary and revolutionary change. *California Management Review* 38(4): 8-30.
- United States Department of Agriculture (USDA). 2017. Meats. Available at: <https://www.ers.usda.gov/data-products/livestock-meat-domestic-data/livestock-meat-domestic-data>.

- Van Aken, J. 2001. *Management research based on the paradigm of the design sciences: the quest for field-tested and grounded technological rules*. Eindhoven University of Technology, Eindhoven Centre for Innovation Studies, Eindhoven, the Netherlands.
- Vanti, N.A.P. 2002. Da bibliometria à webometria: uma exploração conceitual dos mecanismos utilizados para medir o registro da informação e a difusão do conhecimento. *Ciência da Informação* 31(2): 152-162.
- Wilkinson, J. 1998. The R&D priorities of leading food firms and long-term innovation in the agrofood system. *International Journal of Technological Management* 16(7): 711-720.
- Winiwarter, W., A. Leip, H.L Tuomisto and P. Haastrup. 2014. A European perspective of innovations towards mitigation of nitrogen-related greenhouse gases. *Current Opinion in Environmental Sustainability* 9(10): 37-45.

