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ARTICLE

Competitiveness drivers for soybean exportation and the fundamental role of the supply chain

Direcionadores de competitividade para exportação de soja e o papel fundamental da cadeia produtiva

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Abstract: Brazil is the world's second-largest producer of soybeans and the largest exporter. Despite the growing importance in the international market in the last harvests, activities related to this product threaten this position. Due to its economic importance for the country, this study aims to identify the competitiveness drivers of soybean destined for the international market and to measure their impacts on the export process. Therefore, the used methodology considers the systemic character of different factors that affect the supply chain positively or negatively. As a result, the logistics infrastructure dimension was the only competitiveness driver classified as unfavorable among the analyzed factors. The advances in agribusiness are being subsequently followed by some sectors of the economy such as science and technology. On the other hand, the logistics sector has not been showing the same development, causing some weaknesses to persist, either due to the lack of infrastructure of transport production, or the inability to properly store the national harvest. The current challenge for the State is to ensure the maintenance of the quality of the infrastructure already installed and to promote an environment capable of attracting private capital and a new investment cycle.

Keywords: agribusiness, competitiveness, logistics, transportation.

Resumo: O Brasil é o segundo maior produtor mundial de soja e o maior exportador. Apesar do crescente destaque no mercado internacional nas últimas safras, atividades relacionadas ao escoamento desse produto ameaçam essa posição. Em razão da importância econômica para o país, o objetivo deste artigo foi identificar os direcionadores de competitividade da soja destinada ao mercado internacional e mensurar seus impactos no processo de exportação. Para tanto, a metodologia utilizada considera o caráter sistêmico de diferentes fatores que afetam a cadeia de maneira positiva ou negativa. Como resultado, a dimensão Infraestrutura Logística foi o único direcionador de competitividade classificado como desfavorável entre os fatores analisados. Os avanços do agronegócio estão sendo acompanhados em sincronia por alguns setores da economia, como ciência e tecnologia. Por outro lado, o setor logístico não tem apresentado o mesmo desenvolvimento, fazendo persistir algumas fragilidades, seja pela falta de infraestrutura para escoar a produção, seja pela impossibilidade de armazenar adequadamente a safra nacional. O desafio atual do Estado é garantir a manutenção da qualidade das infraestruturas já instaladas e promover um ambiente capaz de atrair o capital privado e um novo ciclo de investimentos.

Palavras-chave: agronegócio, competitividade, logística, transporte.

1. Introduction

Soybean is one of the most produced grains in the world, accounting for an area of 125.6 million hectares (mha) and reaching 358.6 million metric tons (mmt) of production in the 2018/19 crop, according to the United States Department of Agriculture (2020) (Figure 1). About half of the global cropland is dedicated to cereals and oilseeds. For soybeans, in particular, land use will play a greater role, considering that area expansion and greater cropping intensity

are expected in Latin America (specifically in Brazil and Argentina), according to the Food and Agriculture Organization of the United Nations (2018).

Brazil is the second-largest producer in the world. With 35.9 mha, the production exceeded 115 mmt and, of this total, the South-Central region accounted for 85.6% in the 2018/19 crop, according to the National Supply Company (Companhia Nacional de Abastecimento, 2020a) (Figure 1). The soybean area continues to increase, and Brazil will overtake the United States of America as the world's leading soybean producer this year (United States Department of Agriculture, 2020). Its share in the global soybean exports will rise to 41.8%, with that of Canada and the United States combined declines to 40.6% by 2027 (Food and Agriculture Organization of the United Nations, 2018).

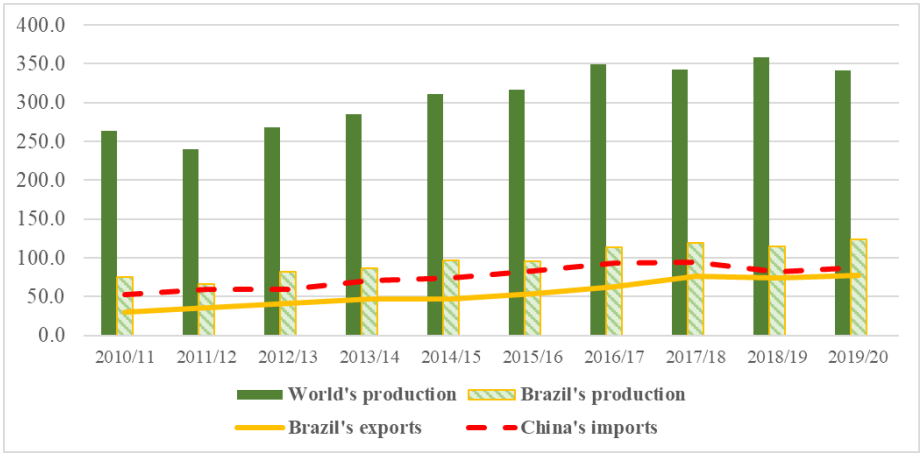


Figure 1. Soybean in million metric tons (mmt). Source: CONAB (Companhia Nacional de Abastecimento, 2020a), USDA (United States Department of Agriculture, 2020). Note: Estimates to the 2019/20 crop.

Brazil is the world's largest soybean exporter, accounting for 50.3% of the 148.3 mmt exported as per the 2018/19 crop (United States Department of Agriculture, 2020). China is the world's largest soybean importer, accounting for 82% of Brazilian sales in 2019, and the Brazilian Association of Vegetable Oil Industries estimates that this figure shall further increase (Associação Brasileira das Indústrias de Óleos Vegetais, 2019). This behavior can be observed by the movement of the Brazilian exports curve following the Chinese imports curve in recent years (Figure 1). China has become the biggest buyer of Brazilian soybean and this has been completely changing the global soybean market configuration and dynamics (Escher & Wilkinson, 2019).

Despite its prominent position in the international commodities market, there are several logistical barriers in the country. Poor road conditions, poor rail efficiency, and lack of capacity, as well as the disorganization and excessive bureaucracy of ports, have resulted in long truck queues at major export container terminals, very long waiting times for ships to dock, and failure to meet grain delivery times for their international buyers, which consist in obstacles to soybean exportation (Filassi et al., 2017). This scenario reduces competitiveness in the foreign soybean market and other commodities such as ethanol. Although Brazil occupies the position of the second-largest producer in the world, the deficiencies of the logistics system make the product lose competitiveness concerning the major world players (Coleti & Oliveira, 2019).

The Brazilian soybean agro-industrial system is complex, with segments ranging from upstream to downstream, and the activities of these segments are performed by different stakeholders. This system is inserted in an organizational and institutional environment where all stakeholders, whether economic or social agents, must work together and efficiently to sustain competitiveness

(Batalha & Silva, 2014). In other words, when there is a problem related to the fulfillment of the activities of one of the segments, the efficiency of the entire system is compromised.

Stakeholders, the input industry, rural producers, trading companies, cooperatives, financial institutions, consultancy services, research institutions, consumers, the Government, and associations are part of the organizational environment and influence the institutional environment of the soybean agro-industrial system. Agents belonging to the organizational environment are the main responsible for the functioning of agro-industrial systems, and stakeholders influence the institutional environment according to their interests (Zylbersztajn, 2000).

Transactions carried out by the stakeholders along the supply chain can be affected by several factors. In this case, twelve factors were identified; credit, taxation, trade agreements, biotechnology, traceability, warehousing, cargo transportation, ports, concentration level, synergy, contracts, and international market.

We believe that the identification of factors that affect the competitiveness of soybean destined for the foreign market, as well as the analysis of the relationships between these factors, are necessary for proposing strategies and possible solutions to the encountered problems.

This study aims to identify the competitiveness drivers of soybean destined for the international market and to measure their impacts on the export process. The analysis of complexities that involves the soybean agro-industrial system is necessary to develop strategic interventions and formulate policies to improve the competitiveness of this commodity. We hypothesize that logistic-related barriers are the main constraints on competitiveness gains.

The study presents relevant literature, the used methodology, collected data, and a developed model. It was divided into the following sections: 1) introduction; 2) presentation of characteristics of the soybean agro-industrial system in Brazil and the definition of competitiveness drivers; 3) methodology development, with the description of the study steps from the choice of the interviewees to the analysis of the answers; and to conclude, in sections 4 and 5, we present the main findings of this analysis and the conclusions of the authors.

2. Brazilian soybean agro-industrial system and competitiveness drivers

The terms "agribusiness" and "agro-industrial systems" are often interchangeably used. Goldberg's (1968) studies on North American agribusiness have become an important reference worldwide due to the globalization pattern of agro-industrial systems. As a result of the complexity of the system, the author redefines the concept of agribusiness as a commodity system that encompasses all actors involved in the production, processing, and distribution of a product. Although it has different definitions, the concept of agro-industrial systems comprises, as a common denominator, the relevance of vertical relations of production along the production chains for the formulation of strategies and public policies (Zylbersztajn, 2000).

This concept covers all institutions, organizations, and markets that affect the coordination of successive product flows, ranging from inputs to the final consumer. Institutions consist of restrictions created by human beings to structure political, economic, and social interactions; they create and define the environment in which the transaction between organizations will take place (North, 1990). Since there is no system in which this transaction cost is null, agents aim at reducing costs through the use of mechanisms capable of regulating the transaction, called governance structures. There are three determinants of the forms of relationships and types of transactions: specificity of the asset involved, uncertainty, and frequency (Williamson, 1985).

The fundamental objective of the Transaction Cost Theory (TCT) is to investigate how transaction costs induce modes of organization of production and how they affect the functioning of governance structures within an institutional environment (Zylbersztajn, 1996). To understand

the concept of TCT, it is necessary to highlight two behavioral assumptions of the agents of the system: limited rationality and opportunism (Williamson, 1993). Limited rationality is the assumption that the agent does not have all the necessary information for the transaction, as the human being is considered to be rationally limited; in this case, complex contracts are inevitably incomplete (Williamson, 2007). Opportunism is the idea that agents seek self-interest, for which they can lie, cheat, steal, and violate an agreement, thus resulting in a breach of contracts (Williamson, 1993).

Thus, one of the ways to understand the performance of organizations in a system is through the analysis of TCT (Esteves et al. 2020), considering that this theory explains the behavior of the agents of that system and how their transactions occur.

A governance structure is chosen among the viable alternatives aimed at ensuring coordination – with or without the presence of the market –, which reduces transaction costs and uncertainty, thus compensating the agents' opportunism and limited rationality (Oliveira & da Silveira, 2013).

A market is only formed when it finds solutions for four central questions: 1) what are the property rights of its participants? 2) What forms of governance are present? 3) What exchange rules do they obey? And 4) what are the conceptions of control over the resources that guide its participants? (Abramovay, 2008).

Governance structures that minimize transaction costs can be implemented via the market (Williamson, 1985), vertical integration (hierarchy) (Belik et al., 2007), or hybrid forms (long-term contracts), which are intermediaries between market and hierarchy (Ménard, 1997, 2004).

The Brazilian soybean agro-industrial fits between a governance/commercialization mechanism via the market or long-term contracts (Oliveira & da Silveira, 2013). This system can be divided into segments structured by different stakeholders and their respective "T" transactions (Figure 2) (Lazzarini & Nunes, 1998).

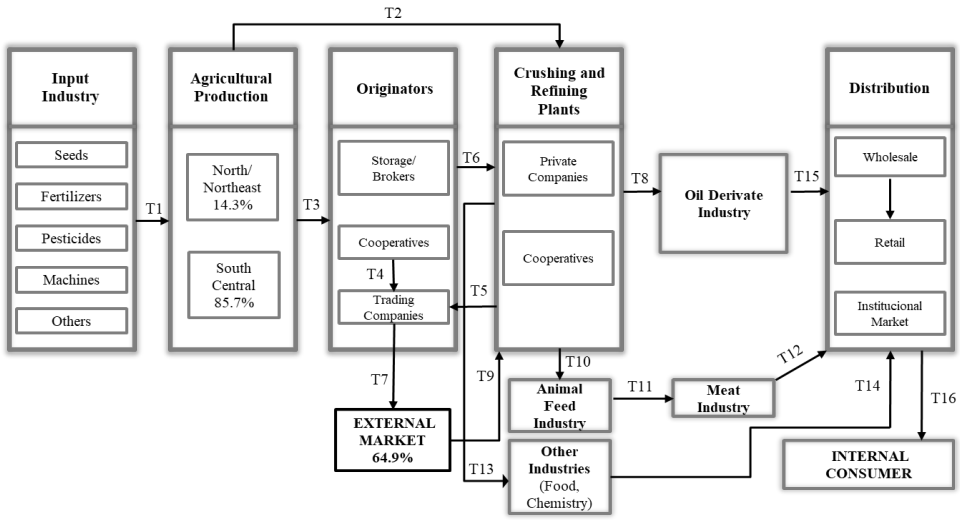


Figure 2. Brazilian soybean agro-industrial system. Source: CONAB (Companhia Nacional de Abastecimento, 2020a), USDA (United States Department of Agriculture, 2020), adapted from Lazzarini & Nunes (1998). Note: Percentages related to the 2018/19 crop.

The segments are classified as: a) Input Industry: industrial agents of seeds, fertilizers, pesticides, machines, and other inputs that are impacted by biotechnology (T1); b) Agricultural Production: soybean producers, mostly concentrated in the South-Central region of the country, negotiate with the crushing/refining companies and their originators (T3); and c) Originators: trading agents, cooperatives, brokers, and stockholders are vertically integrated into the crushing and refining

segment (T6) and are part of different agribusiness clusters, sometimes as research companies, resource providers, financial institutions, consulting firms, rural producers, carriers, cerealists, manufacturing industries, and exporting companies, having the ability to operate in more than one segment (Hirakuri & Lazzarotto, 2014). Cooperatives transact with trading companies (T4), which in turn sell commodities to the foreign market (T7). The foreign market is responsible for the consumption of about 64.9% of all Brazilian production (United States Department of Agriculture, 2020). Soybean is a short-term agricultural product for marketing and export; transnational private companies, such as Archer Daniels Midland (ADM), Bunge, Cargill, and Dreyfus (ABCD), and the national companies Maggi, I.Riedi, and Sperafico were responsible for 70% of this commercialization (Dall'agnol et al., 2007). This scenario changed in 2015, with Asian trading companies, such as China National Cereals, Oils and Foodstuffs Corporation (COFCO), the largest producer and crusher of soybeans, oil refiner, and producer of processed foods, which shipped 45% of the grains exported by Brazil, whereas ABCD accounted for 37% (Bonato, 2016); d) Crushing and Refining Agents: private and cooperative agents concentrate soy processing activities. In the crushing process, part of the bran is exported by trading companies (T5) or by the commercial departments of the crushing industries themselves; and e) Distribution: wholesale, retail, and institutional market agents receive more elaborate products from the oil products industries. Internal consumers consume the final products of the distribution segment, as well as the products of foreign sales of trading companies and processing industries (Lazzarini & Nunes, 1998).

Batalha & Souza Filho (2009) developed two approaches to competitiveness. The first, defined as "revealed competitiveness," results from the performance of a company or product in a given market (market share). The second, defined as "potential competitiveness", results from efficiency in that same market, in which the strategies adopted by stakeholders regarding managerial, financial, technological, and organizational restrictions have a causal relationship, with some deterministic degree, between their conduct and their efficient performance (structure-conduct-performance).

The potential competitiveness of the soybean agro-industrial system can be objectively evaluated by a set of drivers, which were formed by factors that were measured by qualitative and quantitative data (Figure 3).

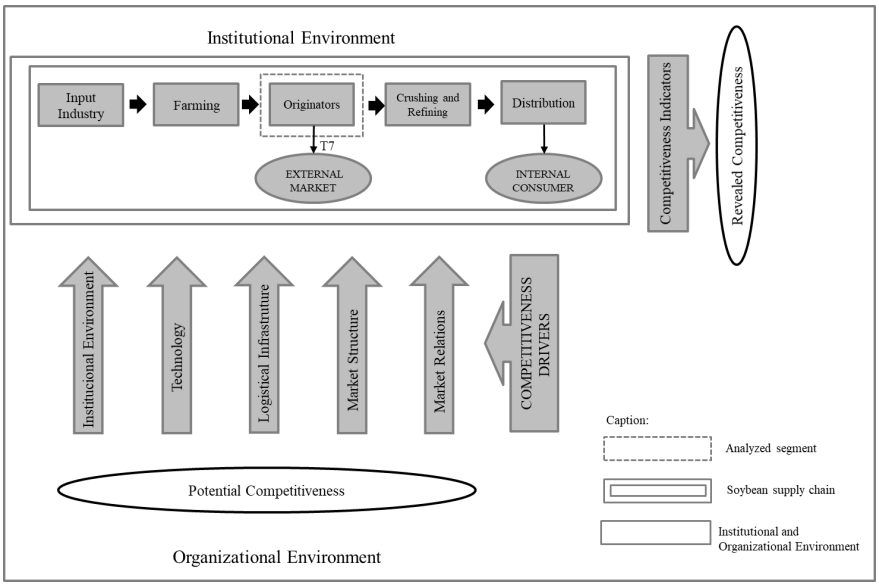


Figure 3. Drivers of potential competitiveness and analysis focus. Source: Adapted from Batalha & Souza Filho (2009), Lazzarini & Nunes (1998).

The authors consider the implicit systemic approach in the notion of the agro-industrial chain. The drivers linked to the different segments have a positive or negative impact on the system as a whole.

For the evaluation of the drivers, some phases must be completed and some prerequisites must be considered. In this case, the definition and establishment of the analysis focus of the agro-industrial system are delimited based on the problem to be studied and the objective to be reached (Batalha & Silva, 2014).

By analyzing the Infrastructure competitiveness driver of the castor bean biodiesel production chain, the road conditions factor was classified as very unfavorable, considering that the conservation situation of the roads through which the castor bean is transported is very poor, which makes the supply logistics for biodiesel plants even more expensive (César & Batalha, 2011). For industries of the acai pulp production chain in Northeastern Pará, Brazil, the factor involving the cost of transportation of the fruit to the foreign market is unfavorable for competitiveness, as the values of freight and customs fees are excessively high, in addition to the high cost of storage and transport in cold chambers (Araújo & Souza Filho, 2018). The issue of logistics, especially when it comes to the quality and costs of the highways, has negatively impacted the competitiveness of different Brazilian agribusiness production chains.

For the analysis of the competitiveness of the beef agro-industrial chain, in addition to the driver, technology was used as a criterion for dividing the agro-industrial system. This division occurred due to the technical differentiation of the agents. The formulation of policies and guidelines for increasing supply chain competitiveness should reflect the diversity of technological situations of each of these systems (Batalha & Silva, 2014). The Technology driver plays an important role within the competitive analysis of different production chains, and different degrees of accessibility by the agents can cause imbalance to agro-industrial systems or divide them.

3. Methodology

The methodology consists of determining and evaluating the competitiveness drivers that impact Brazilian soybean exports and discovering the main problem that involves this supply chain. Several studies in the different agro-industrial systems followed this approach (Batalha & Souza Filho, 2009; César & Batalha, 2011; Araújo & Souza Filho, 2018), but none of them focused on the analysis of the governance/commercialization mechanism via the market or long-term contracts.

The methodology was adapted from Batalha & Silva (2014) and is divided as follows:

- **1st phase** – Characterization of the agro-industrial system and drivers: in the characterization of the soybean agro-industrial system, only the grain product and the originator segment towards the foreign market, represented by the "T7" transaction (Figure 2), were considered as analysis focus.

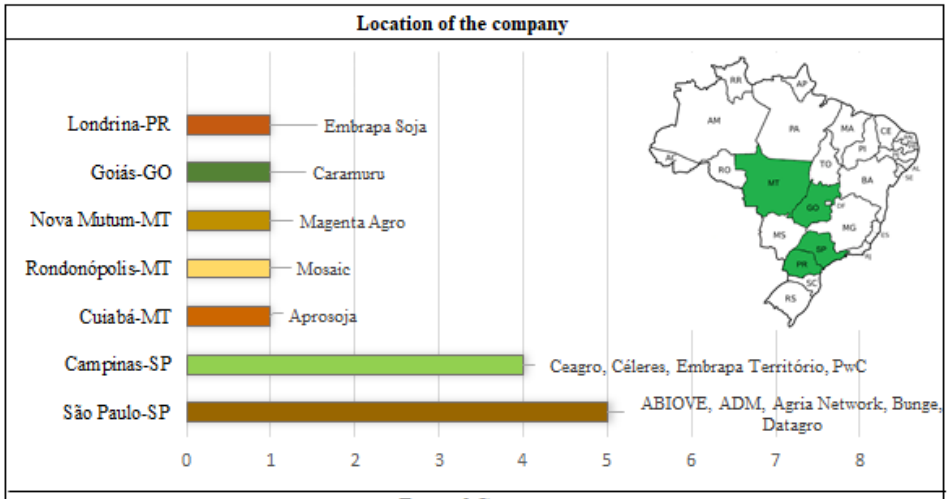
In the last two crops, 2017-18 and 2018-19, Brazil was responsible for 50% of all soybean exporters worldwide (United States Department of Agriculture, 2020). Soybean meal and oil products, related to the crushing and refining segment, were not included in the survey, nor was the domestic consumption of the grain.

When characterizing the drivers, the Institutional Environment, Technology, and Market Structure drivers, developed by Batalha & Souza Filho (2009), and the Logistics Infrastructure and Market Relations drivers, developed by the authors of the present study, were considered

as differentiating elements of this research, based on the literature review of the analyzed supply chain (Figure 3).

- **2nd phase** – Assignment of factors to the drivers: the specificities of the drivers of the analyzed segment were surveyed, following the critical points observed and the information provided by industry experts (Figure 4). The factors were defined as Credit, Taxation, Trade Agreements, Biotechnology, Traceability, Warehousing, Cargo Transportation, Ports, Concentration Level, Synergy, Contracts, and International Market.
- **3rd phase** – Qualitative and quantitative evaluation of the factors: the evaluation took place through electronic means of communication, such as e-mails, telephone calls, and video calls, after the collection and analysis of the data provided in the questionnaire applied to the experts (Figure 4), in 2018, and after approval of the Research Ethics Committee.

A total of 14 industry experts from large companies of the originator's segment were interviewed (Figure 4).



Company	Type of Company	Expert Position
ABIOVE	Business Association	Manager
ADM	Trading	Analyst
Agria Network	Technology Consulting	CEO
Aprosoja	Producers Association	Analyst
Bunge	Trading	Manager
Caramuru	Trading	CEO
Ceagro	Exporter and Importer	Manager
Céleres	Consultancy services	CEO
Datagro	Consultancy services	Consultant
Embrapa Soja	Research	Researcher
Embrapa Território	Research	Researcher
Magenta Agro	Consultancy services	Coordinator
Mosaic	Fertilizers	Coordinator
PwC	Consultancy services	Manager

Figure 4. Experts participating in the research.

These experts, in addition to having vision and access to information on the soybean chain, have a prominent position within large companies (manager, analyst, CEO, coordinator, consultant, and researcher). These companies were chosen because of their national

representativeness and for including different stakeholders (business association, producers association, consultancy services, trading companies, research institutions, and fertilizers) in the soybean chain (Figure 4). Only four companies dominate both the importation and exportation of agricultural commodities: Archer Daniels Midland (ADM), Bunge, Cargill, and Louis Dreyfus Company, which are known as the "ABCD group" or "ABCD." They have ocean vessels, ports, railways, refineries, silos, mills, and factories, and together they represent 70% of the global market for agricultural commodities (Santos & Glass, 2018).

An interview is a methodological approach known as "rapid assessment" or "quick appraisal," as defined by Kumar (1993), Dunn (1994), and Beebe (1995), which use data from secondary sources together with specific samples; moreover, semi-structured interviews with key players can be applied in research aimed at obtaining data and/or more detailed information to understand the dynamics of the sector.

The rapid appraisal is a data collection method aimed at supplying required information in a timely and cost-effective manner. The method provides the perspectives and feedbacks of beneficiaries and other stakeholders, to respond to decision-makers' needs for information.

The objective questions of the questionnaire ensured uniformity of answers within a Likert scale, which ranged from "very favorable" to "very unfavorable." The intermediate values used were "favorable," "neutral," and "unfavorable." Subsequently, this qualitative scale was changed into a quantitative scale by assigning values from "-2," to very unfavorable, to "+2," to very favorable, allowing the graphical representation. To assign the weights for each factor, the arguments and individual opinions of each interviewee were considered.

The third phase originated the following parameters: n = {1, ..., 12} – set of factors of the evaluated drivers, and x*i* – the value assigned to the *i* factors. Z is the sum of the factors weighted by the specificity weight, which is determined by:

$$Z = \sum_{i=1}^{n} x_i \cdot p_i \quad (1)$$

where:

Z = final value of the driver;

x_i = value assigned to the *i* factor;

p_i = weight assigned to the *i* factor;

n = number of factors contained in the driver.

In Equation 1, considering the value assigned to each *i* factor weighted by its *p*, the value of the competitiveness driver, which is the sum of the factors, was determined.

Finally, the factors were classified according to their degree of controllability following van Duren et al. (1991):

i. Controllable by the Company (CC): factors controlled by the actions of non-governmental agents are usually companies or industries;

ii. Controllable by the Government (CG): factors controlled by the actions of government agents, often under the influence of companies or industries;

iii. Quasi-controllable (QC): factors that cannot be directly controlled by a company or the government; however, they are influenced by chain coordination as a result of greater strategic planning;

iv. Non-controllable (NC): uncontrollable factors, considering they are related to natural and/or climatic events.

4. Results and discussion

The study resulted in the development of Table 1 and Figure 5, which allow observing the controllability degree, value, and weight assigned to the factors and consequently the results of the drivers. The Logistics Infrastructure driver is composed of the factors: storage (static capacity, regions), cargo transportation (modes, quality), and port (system). The Institutional Environment driver is composed of the factors: credit (rural loan, rural insurance), taxation (tax war, tax exemption mechanisms), and trade agreements (environmentally sound cultivation practices). The Market Structure driver is composed of the factors: concentrated level (trading companies) and synergy (associations, institutions, companies). The Technology driver is composed of the factors: biotechnology (transgenic soybean) and traceability (biosafety standards). The Market Relations driver is composed of the factors: contract (Chinese market) and the international market (trade disputes). The factors were classified as controllable by the company (CC), controllable by the government (CG), and quasi-controllable (QC).

The storage, cargo transportation, and port factors, related to the Logistics Infrastructure driver, are controlled by the company and the government and were the only ones to show negative results. Many researchers aimed at proposing solutions to problems in this field. Logistical bottlenecks, especially the shortage in warehousing (Filippi & Guarnieri, 2019), the inefficient cargo transportation (da Silva & D'Agosto, 2013; Reis & Leal, 2015; Oliveira & Alvim, 2016), and transaction costs in the exportation port for soybean (Esteves et al., 2020). The Institutional Environment and Market Structure drivers did not show negative results in their factors, but they are below what is considered relevant for competitiveness. The Technology and Market Relations drivers obtained the best results, and biotechnology and traceability factors are also controlled by the company and the government (Table 1).

Table 1. Evaluation of the competitiveness drivers of soybean for export.

Drivers/Factors	Controllability Degree[1]				Value[2]	Weight[3]	Result
	CC	CG	QC	NC	(x)	(p)	
INSTITUTIONAL ENVIRONMENT						1	Z = 0.6
Credit	X	X			F	0.4	0.4
Taxation		X			N	0.4	0
Trade Agreements	X				F	0.2	0.2
TECHNOLOGY						1	Z = 1.0
Biotechnology	X	X			F	0.6	0.6
Traceability	X	X			F	0.4	0.4
LOGISTICS INFRASTRUCTURE						1	Z = -1.0
Storage	X	X			U	0.3	-0.3
Cargo Transportation	X	X			U	0.4	-0.4
Ports	X	X			U	0.3	-0.3
MARKET STRUCTURE						1	Z = 0.6
Concentration Level			X		N	0.4	0
Synergy	X				F	0.6	0.6
MARKET RELATIONS						1	Z = 1.0
Contracts	X	X			F	0.5	0.5
International Market			X		F	0.5	0.5

[1]Controllability degree: CC: Controllable by the Company; CG: Controllable by the Government; QC: Quasi-controllable; NC: Non-controllable. [2]Value assigned to factor (x): VU: Very Unfavorable = -2; U: Unfavorable = -1; N: Neutral = 0; F: Favorable = +1; VF: Very Favorable = +2. [3]Weight assigned to factor (p): Weight of factor over the driver.

In Figure 5, we can observe the quantitative assessment of the factors. None of the final values of the driver (Z) reached +2 or -2. They did not obtain a very favorable (VF) result, and there was neither a very unfavorable VU) result.

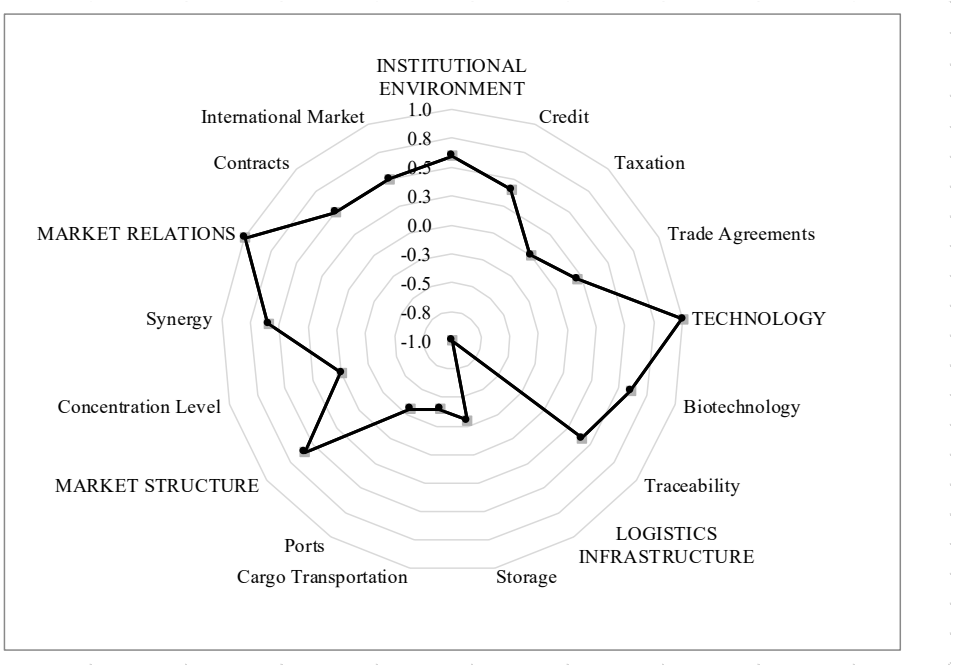


Figure 5. Competitiveness drivers of soybean for export.

4.1. Institutional Environment

According to interviewees, we highlight the Institutional Environment driver. The credit factor that is controllable by the company (CC) and the government (CG) is favorable (F)=0.4 for competitiveness, as well as the trade agreements factor (F)=0.2, which is (CC). The taxation factor that is (CG) is considered neutral (N)=0 due to controversies that this issue represents for the different agents in the soybean chain.

Credit

The access to an agricultural rural loan of producers takes place through the so-called "tie-in sales" of rural insurance, a common practice performed by financial institutions. The coalition between lenders and insurers often causes producers to be dissatisfied with the lack of alternatives. To coerce this practice, Law No. 13,195/2015 introduced a measure whereby the government cannot establish rules that oblige the producer to take out rural insurance to get credit and the financial institutions that need it will be required to offer, at least, the option of two policies from different insurers (Brasil, 2015a). According to the interviewees, despite its importance as a risk mitigation tool, rural insurance has imperfections related to access by rural producers. Decree No. 5,121/2004 establishes the Subsidy Program for Rural Insurance Premium (PSR), which aims to reduce the farmer's acquisition cost of rural insurance policies (Brasil, 2004a).

The rural loan arranged by the government through the National Program for Support Medium-Sized Rural Producers (PRONAMP) increased 37%, which is equivalent to BRL 4 million from the 2018-2019 crop to the 2019-2020 crop, according to the Brazilian Ministry of Agriculture, Livestock and Supply (Brasil, 2019b). However, in 2014, due to budget swings, BRL 693 million were made available and, in 2016, BRL 399 million (Brasil, 2017). The use of financial instruments, such as agricultural derivatives to hedge soybean prices, has grown and contributed to better risk management. According to the interviewees, the rural producers do not commonly make direct use of this negotiation tool, leaving the bargaining power in the market to the input and trading companies.

Taxation

According to the interviewees, the Brazilian tax system is complex and costly, and tax distortions between the different agents of the supply chain must still be overcome. Tax exemption mechanisms, such as Kandir Law No. 87/1996, which exempts the collection of the Tax on Movement of Goods and Provision of Services (from Portuguese, *Imposto sobre Circulação de Mercadorias e Prestação de Serviços* – ICMS) regarding exports of semi-elaborated primary and industrialized products, such as *in natura* soybean (Brasil, 1996), benefits exporters. However, tax incentive mechanisms, such as the different ICMS rates per Brazilian state, create a tax imbalance in the industry's inputs needed for the chain such as fertilizers, pesticides, seeds, machinery, etc. The Constitutional Amendment No. 87/2015 attempts to reduce this tax imbalance between states through a new collection system, in which the interstate rates are also applied when operations are intended for final consumers (Brasil, 2015b).

Trade Agreements

National plans, such as the Soy Moratorium (Associação Brasileira das Indústrias de Óleos Vegetais, 2006), guarantee the commitment of neither commercialization nor financing of soybean produced in deforested areas in the Amazon Biome. According to the interviewees, national and international commercial arrangements such as this contribute to commercialization with private companies that value environmentally sound cultivation practices and favor the improvement of production chains that are linked to the soybean chain.

4.2. Technology

From the perspective of interviewees, the Technology driver has many positive aspects. The biotechnology and traceability factors that are controllable by the company (CC) and the government (CG) are favorable for competitiveness, accounting for (F)=0.6 and (F)=0.4, respectively.

Biotechnology

Transgenic soybean currently occupies 96.5% of all soybean acreage, according to the Biotechnology Information Board (Conselho de Informações sobre Biotecnologia, 2016). In 1997, the sector of the Brazilian Agricultural Research Corporation (EMBRAPA) focused on soybean (Embrapa Soybean) carried out research on transgenic soybeans and, in partnership with the private sector, it incorporated the glyphosate herbicide-tolerance gene into its cultivars (Empresa Brasileira de Pesquisa Agropecuária, 2018). According to respondents, China, our largest importing market, makes no restrictions on the use of this biotechnology, unlike some European countries.

Another aspect pointed out is the contribution for national plans, such as the Soy Moratorium, to be respected, considering that these seeds provide an increase in productivity without the need for expansion of territories in the Amazon Biome. The incorporation of mechanical, biological, and chemical technologies in commodity production allows for the intensification of land use and increases productivity (Ferreira Filho & Vian, 2016). However, a detailed assessment of the opportunities and risks associated with sustainable soybean production in Brazil is paramount for the competitiveness of this grain (van Berkum & Bindraban, 2008).

Traceability

It is a tool that ensures the integrity and transparency throughout the food value chain. For respondents, it is still an incipient practice, but it has been growing due to the lack of conclusive studies on the effects of the use of Genetically Modified Organisms (GMOs). Due to the international market demand for food safety, Law No. 11,105/2005 establishes biosecurity standards through mechanisms for monitoring activities that include handling, construction, cultivation, transfer, transportation, storage, importation, exportation, release into the environment, and disposal of GMOs and their derivatives (Brasil, 2005). There is evidence to show that Brazil's continued production of non-genetically modified soybeans has increased its competitive advantage in European countries, which are preferred to GMO foods (Garrett et al., 2013). Considering the rejection of transgenic soybeans by the European continent, in addition to the biosecurity standards, certification of conventional soybeans, carried out by private certifiers, is necessary due to the absence of legislation. Round table on Responsible Soybeans (RTRS) is a multi-stakeholder roundtable offering certification programs and voluntary governance mechanisms to address sustainability issues (Garrett et al., 2016).

4.3. Logistics Infrastructure

According to interviewees, the Logistics Infrastructure driver has many negative aspects. The storage, cargo transportation, and ports factors that are controlled by the company (CC) and the government (CG) are unfavorable, accounting for (U)=- 0.3, (U)=- 0.4, and (U)=- 0.3, respectively, and pose a threat to competitiveness.

Storage

According to Mascarenhas et al. (2014), the Brazilian logistics system is inefficient in many aspects, and one of them concerns storage, caused by the insufficient quantity of storage units of national agricultural production in harvest seasons. Overall, the deficit occurs at both the public and private levels, and CONAB's storage network accounts for about 1.35% of the country's total deficit (Companhia Nacional de Abastecimento, 2020b). The warehouse deficit increased from 6.6 million tons in the 2008-09 crop to 76.0 million tons in the 2018-19 crop (Companhia Nacional de Abastecimento, 2019). For the respondents, rural producers are the most affected, losing the bargaining power in the market by making the immediate sale of production, often transferring the storage problem to the next agent in the chain. Most respondents indicate the need for investments in the grain storage network of the Central-West (78.6%) and Northern (57.1%) regions. The Rural Warehouse Condominiums is the strategy adopted by rural producers. To avoid economic losses, this type of entrepreneurial organization helps to overcome the storage deficit while condominiums provide cost savings (Filippi & Guarnieri, 2019).

Cargo Transportation

The transportation of soybean to ports can be divided into roads, rails, and waterways. Most of the cargo handled in export corridors is transported via roads, and it accounted for about 48% of total soybean transported in 2017 (Brasil, 2018a). Intermodal terminals play an important role in cargo transportation, having undeniable importance for the competitiveness of grain production in Brazil (Colares-Santos et al., 2017; Landivar et al., 2014). Santos et al. (2018) suggest the existence of two major strategic groups: diversified small-scale terminals and focused large-scale terminals. According to the results of analysis of the intermodal terminals that are part of the grain logistic corridor of the Central-Eastern region, the transport sector is highly concentrated, characterized in an oligopolistic market structure, which is confirmed by the conduct of these terminals (Colares-Santos et al., 2013). In addition to the existing structural logistical inefficiencies, the market structure and conduct can adversely affect the operational performance of intermodal grain transfer terminals in the Central-Eastern corridor in Brazil, disfavoring the competitiveness of the export movement of commodities in the country (Landivar et al., 2013). In research about the performance of intermodal grain terminals, from the perspective of efficiency, through customer satisfaction, the results showed that the analyzed terminals are not achieving full operational efficiency (Colares-Santos et al., 2017; Santos & Sproesser, 2013).

For all respondents (100%), the greatest problem of road transportation is the poor quality of the roads, followed by the cost (according to 86% of respondents), showing that the scenario pointed out by César & Batalha (2011); Batalha & Souza Filho (2009) has not changed, according to which the situation of Brazilian highways is very bad and, despite investments in intermodal systems by private companies, investments in highways by the public sector are scarce and unregulated. Regarding rail and waterway modes of transportation, 64% of respondents pointed out that the problem is the lack of availability in several Brazilian regions. As for the quality of the railways and the waterway cost, half of the interviewees consider it as a limiting factor.

Resolution No. 5,827/2018 resulted from the truckers' strike and establishes the minimum freight price as a governmental measure (Brasil, 2018b). According to 90% of respondents, such a measure is unconstitutional, considering that the fluctuation in freight prices is favorable to free competition. The tabulation will increase the costs, and the final consumer will have to afford it.

Ports

According to interviewees, the port storage over the last years has increased in terms of capacity, mainly with the use of North Arch ports, in the MATOPIBA region – comprising the states of Maranhão, Tocantins, Piauí, and Bahia –, easing the overload of bigger ports such as Santos (state of São Paulo, Brazil) and Paranaguá (state of Paraná, Brazil). The implementation of Law No. 12,815/2013 allows private terminals to operate third-party cargo, enabling a more productive operation of the sector (Brasil, 2013). Despite the positive changes, the capacity does not follow the evolution of soybean exports yet, and the charging of tariffs for the provision of services is mentioned by the interviewees (64.3%) as a bureaucratic, confusing system that does not follow the standards established by the National Agency for Waterway Transportation (ANTAQ). Considering that the major soybean production areas in Brazil are located far from exportation ports (de Lima et al., 2018), the Logistics Infrastructure is a relevant driver to the transfer of production to processing and exporting centers.

4.4. Market structure

From the perspective of interviewees, the Market Structure driver has positive aspects that especially favor certain agents in the chain to the detriment of others. The concentration level factor, which is quasi-controllable (QC) and neutral (N)=0, illustrates this situation; whereas the synergy factor, which is controllable by the company (CC) and favorable (F)=0.6, intends to appease the consequences of the previous factor on the competitiveness of the system.

Concentration Level

Respondents report an increase in the degree of competition resulting from the entry of companies of different sizes, national and international ones, thus reducing the concentration of the world's traditional grain trading companies: Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus (ABCD). Until 2014, the ABCD dominated about 80% of the production of soybean in the state of Mato Grosso, and it currently dominates only about 50%. This loss of capacity by the ABCD mainly resulted from the capacity gain of Asian companies, such as Multigrain/Mitsui, Gavilon/Marubeni, Sodrujestvo, and Olam (in partnership with ADM), but mainly because of China National Cereals, Oils, and Foodstuffs Corporation (COFCO), which in 2017 accounted for about 70% of the volume it sells (Escher & Wilkinson, 2019). The transformation process of Brazilian agriculture can be understood from the perspective of agro-industrial chains in which, without bargaining power, farmers face the so-called "price scissors" (Guimarães, 2008). This term portrays the situation of producers who are directly subordinated to the industry, in which upstream and downstream companies set prices and quantities demanded by the market, and the more concentrated the market, the greater the subordination of producers. These companies take advantage of the limited rationality of the other agents in the system to transform themselves into market opportunities. Opportunism and limited rationality (Williamson, 1993, 2007) can become powerful tools for controlling markets.

Synergy

According to the interviewees, the players still have difficulties seeing the whole structure of the soybean agro-industrial system, and the diversification of the companies operating in this market cause conflicts of interest, mainly due to the margin dispute. However, associations, such as ABIOVE, enable the cooperation between different agents of this system, especially by ensuring the standard expected by the consumer market. The limited access by small businesses to information can also be provided by these organizations.

4.5. Market Relations

According to interviewees, the Market Relations driver has positive aspects that should not be overestimated. The contracts factor, which is controllable by the company (CC) and the government (CG), and the international market factor, which is quasi-controllable (QC), are favorable, accounting for (F)=0.5 and (F)=0.5, respectively.

Contracts

Larger companies can exert market dominance more easily in future soybean sales and purchase agreements, in addition to predicting the appreciation of the sack price at the time

of harvest; conversely, the small producer does not have sufficient technical knowledge to do so. The Decree-law No. 79/1966 establishes norms for the fixing of minimum prices and the undertaking of financing operations and acquisition of agricultural products, among other measures (Brasil, 1966). For respondents, the structuring of contracts has been important because it ensures that transactions will be respected, under penalty of default clauses. Farina (1999) points out that the competitiveness of agribusiness systems suffers from breaches of contracts. More efficient systems reduce their coordination costs by reducing contractual risks and uncertainties. The cost of governance is one of the biggest influences on the complexity of contractual relations in Brazil. Therefore, a better understanding of this phenomenon concerning the main criteria for choosing a governance structure and its main influences on different institutional environments allows a better forecast and understanding of these structures over time (Cunha et al., 2015).

International market

According to the interviewees, Brazil acts with the main global soybean consumers, but is susceptible to the policies imposed by its importers, considering that it does not have its policies. In 2018, the participation of the Chinese market accounted for 82% of the exports of Brazilian soybean (Brasil, 2019a). The major players in the soybean market are China and Brazil (Liu et al., 2015). Trade disputes between China and the United States of America, in addition to the international crisis caused by the COVID-19 pandemic, bring uncertainties to the Brazilian market. It is expected to increase the participation of the Chinese market through new export contracts, but there are also risks related to dependence on this market, and such practice is not recommended, as the presidential staff of the involved countries seeks for alternatives to alleviate trade disagreements between them.

5. Conclusion

The study identifies the influence of competitiveness drivers on the process that occurs between soybean origination and exportation.

Logistics Infrastructure was pointed out as the driver that most contributes to the unfavorable export scenario. Logistical barriers are related to the fact that the performance of the storage network does not keep up with the dynamism of the sector; the deficit occurs at both public and private levels, mainly affecting the producer. Another factor to be considered is the movement of cargo in export corridors, which mostly take place by road transportation. This predominance and the lack of railways and waterways favored the truck strike in 2018, causing a severe shortage crisis in the country, with days of lack of fuel in the stations, of cooking gas at homes, and of food in commerce, among other food products of basic need.

Overall, the problems of road, rail, and waterway modes of transportation are related to the poor quality of the roads, the high cost, and the lack of availability, while the producing regions, especially the Central-West, demand an expansion of the storage network. These problems can be alleviated by joint operations through intermodal transportation and investments in the sector.

Although there is integration between public and private powers, such is insufficient. The main challenges presented by the experts that were interviewed directors are related to the lack of coordination of the system by the different agents concerning the articulation of policies focused on infrastructure investments. The articulation of public policies, such as Public-Private Partnerships (PPP), can be one of the solutions for logistics infrastructure, provided

for in Law No. 11.079/04 (Brasil, 2004b). This type of contract between the parties supplies the insufficiency of the government's resources for investments in infrastructure. There are already examples illustrating that the private initiative in partnership with the State has achieved good results such as the railway sector. To raise funds for the recovery of railway sections and the purchase of assets (wagons and locomotives), some railway companies have made partnerships possible through long-term transportation contracts. In general, the contracts are designed in such a way that the railway guarantees transport and investments for the recovery and/or reactivation of the road network and, in contrast, the transport contracting company, which is the partner trading company, such as ED&F Man, Raízen and Copersucar, takes investment via the Brazilian Development Bank (BNDES) or its own for the acquisition of locomotives and rolling stock (Oliveira, 2011, 2015). Transport policies for promoting intermodal transportation will support the reduction of the environmental impact caused by the displacement of agricultural frontier regions that are increasingly distant from the export ports. Investments in storage could improve the effectiveness of the soybean supply chain in Brazil, strategies like Rural Warehouse Condominiums avoid economic losses and helps to overcome the storage deficit.

The Institutional Environment and Market Structure were not shown as unfavorable drivers of competitiveness, but they reflect imperfections in the collection system and distortions caused by agents in the soybean agro-industrial system. The Brazilian tax system is experiencing a tense dispute; the so-called tax war is aggravated by the differentiation in tax collection between states. The constitutional proposals on this subject bring insecurities to agents of the system, especially to producers who depend on the input industry.

Different companies have recently entered the soybean market, but bargaining power is still concentrated in the hands of large and traditional trading companies. The interaction between associations, institutions, and companies that compose the segments mitigate conflicts of interest. The Brazilian Association of Vegetable Oil Industries (ABIOVE) plays an important role as an instrument to support compliance with the public sector norms and private sector agreements.

The Technology and Market Relations drivers are favorable to the competitiveness of exported soybean, and the relationship between the biotechnology factors and the international market contributes to this result. Joint public-private investments in biotechnology have improved the soybean production process. In recent years, the planting of transgenic soybean has predominated and has been influenced by the increase in international demand from Brazil's largest consumer, the Chinese market. Despite the heating up of this market, dependence on China should not be overestimated as international trade disputes, and instability in Brazilian politics bring uncertainty about future contracts. Another important issue to be considered is the opportunities and risks associated with sustainable soybean production in Brazil. This issue is very important for the competitiveness of this grain and access to other markets, as in the case of the European market.

The challenges to be overcome in this study are related to the sample, which is not necessarily probabilistic. However, the used sampling aimed at presenting common aspects of soybean exports from the perspective of experts in the sector.

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