

Information Systems in the Soybean Brazilian Supply Chain: an Analysis from the Trading Companies Perspective

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Abstract. Soybean is one of the largest grain production in Brazil, playing an important role in the local economy. In this context, the use of information systems are essential to ensure the communication between the several stages of Brazilian supply chain. Therefore, we will stand out in this paper the role trading companies play in the soybean market, emphasizing the aspects of the use of information systems. Thus, we did a study of the major organizations in Brazil mapping the information systems used. In accordance with several studies, we observed the relevance of business management systems as an organizational strategy.

Keywords: System Information, ERP, Supply Chain, Soybean

1 Introduction

The expansion of the soy market in Brazil enables to achieve progress in the soybean chain study, from seed use up to distribution. Among the various stages found in the chain, we observe the strategic role of trading companies and the technology employed.

Brazil is placed among the three biggest countries in soybean production and in the export of grain, bran meal and oil. In the 2014/2015 harvest, the states of Mato Grosso (first Brazilian soy producer) stands out with an output of 27,868 million tons, as well as Paraná (the second producer) with 17,136,000 tons, and Rio Grande do Sul (third producer) with 14,688,000 tons [1]. This shows strength in grain production.

The production of soybeans in Brazil has presented a growing curve in recent years. Such expansion is associated with the improvement of the production chain processes and working methods. Brazil's climate favors soybeans as the backbone of Brazil's agriculture and industry, which plays an important role in the national economy [2].

According to the Ministry of Agriculture data, the soy complex (grain, bran meal and oil) is the main factor responsible for the entry of foreign exchange in Brazil, with annual negotiations that exceed US\$ 20 billion. In 2019, Brazilian domestic production should account for 40% of the soybean world trade and 73% of soy oil. We should remember that not only Brazil is self-sufficient in soy production, but also the country is able to supply the domestic market and send the surplus to foreign markets [3].

The soy productive chain has several stages that are interconnected by logistic transport operations, including production, distribution and commercialization. These stages have waste factors that need to be analyzed and eliminated by producers in an attempt to reduce costs and increase market competitiveness [4].

Thus, it is important to establish greater control over the process, turning data into information to anticipate the decision-making. To enhance the use of resources becomes the great challenge for the actors in the supply chain, supported by system information. The use of information technology have gained prominence and relevance to the control of the data that will make information to support decision-making processes in corporate business.

The aim of this paper was to identify the information system tools in the strategies and capabilities of the main trading companies in the soy supply chain in Brazil. Furthermore, the study aims to conduct a study of the soybean supply chain, focusing on information systems used by major trading companies of Brazil and the relevance of these tools as a competitive factor for the companies.

2 References

2.1 Information Systems

Information allows decision-making, however, knowledge is necessary [5]. Thus, the importance of the information is anticipating scenarios and outcomes in order to generate new possibilities in the procedures and methods.

Information system is based on four components: a) information (formatted data, images, sounds and free texts); b) human resources (that collect, store, retrieve, process, disseminate and use information); c) information technology (hardware and software); d) work practices (methods used) [5].

Two factors that surely contributed as drivers of the process of adoption, use and development of various applications of information technology in agribusiness, were: a) demand - internal factor: the need for sector organizations using information technology made direct and indirect stages of its processes and activities more effective; b) supply - external factor: the interests of the information technology organizations (software, hardware, microelectronics, automation, internet and telecommunications) by the sector [7].

Technology information based on innovation supports farmers in their decision-making, serving as support in monitoring the soil conditions and culture [8]. The need to create a systemic view encourages the use of software.

2.2 Management Software

The software has been expanded in various market segments, gaining strength in the agricultural sector. Knowing what to do and how to do it has become vital for a higher productivity in an unstable environment. It is not enough just to collect data, but it is necessary to give a new dimension of how to word so that there is a greater accuracy in the production process [9].

Management software are increasingly present in rural areas, focusing mainly on productive activities in order to improve performance of the agricultural income. In order to have success in the process of decision-making in agribusiness it is necessary to carry out data collection to generate concise information. [9].

ERP (Enterprise Resource Planning) is a business application that weaves together all business data of an organization, processes and associated functional areas [10]. Organizations implement ERP to gain visibility into business processes and to be ready to work in a dynamic environment [10].

ERP systems aim to automate and integrate the organization business processes and to enable information sharing between the different business functions [11].

The benefits include: easier access to reliable information in time, removal of operations or redundant data, reducing cycle times, reducing inventory levels, automation or acceleration of business processes, improving management supply chain, improving the quality and competitiveness, and greater efficiency and lower costs [12].

For the expansion of the business, the Internet becomes vital when the e-procurement plays a key role in the proceeding with suppliers. E-procurement is defined as a system that uses technologies and Internet services to automate and to speed up the processes of an organization from payment request, including operations such as negotiation, ordering, receiving and post-purchase evaluation [13].

Advantages include: the reduction in administrative costs by reducing the time from order fulfillment cycle, reducing inventory levels and the price paid for the goods, and preparing organizations to collaborate with each other [14].

Successful practices that maximize the potential of e-procurement are reducing or eliminating authorization stages; regulation of exceptions to a limited degree, at first; elimination of paper; integration of suppliers throughout the supply chain [15].

3 Materials and Methods

3.1 Procedure

We conducted a document research whose main characteristic is that the data source, the field where the data was collected, produces knowledge and an analysis. The data collected allowed traces a profile and characteristics of systems which are used in the trades as a competitive advantage. Thus, this paper was done according to the following steps [16]:

- **First**, the study was limited to the soybean production chain, analyzing specifically the industry trading companies. Six operating companies were identified: Cargill, Bunge, Amaggi, Adm Brazil, Louis Dreyfus, Monsanto.
- **Second**, we sought to identify which information systems were used by these companies. Information systems are vital to take decisions, given the complexity of the chain, the presence of several players and soybean production volume. Such information was collected through information traceability of these companies’ websites, management reports and official documents.
- **Finally**, Using the gathered information, we grouped together tools with features in common, as the technique employed and technologies.

This paper also used the Embrapa database, which has a sample of answers of 162 companies on the use of softwares and its segmentation in agribusiness in Brazil.

4 Results and Discussion

4.1 Research Summary

Information systems represent an evolution of IT (Information Technology) in agribusiness as a strategic support. Figure 1 shows a representation of the Soybean Agribusiness System in Brazil, with several players of the chain and its complexity [17]. Deepening the cereal trading companies, which are characterized by large corporations that have an influence on trade relations in Brazil and abroad.

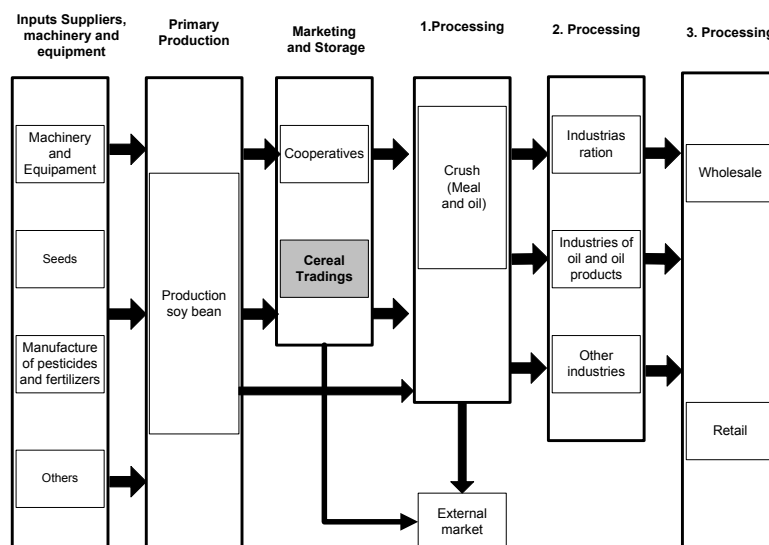


Fig. 1: Representation of the Soybean Agribusiness System in Brazil.

The target audience, which may benefit from IT in agribusiness, are many, such as farmers, agricultural cooperatives, agribusiness companies and industry, distribution companies, agricultural extension organizations, among others. [7]. And its use ranging from inventory control and people management to more technically elaborated softwares that assists in handling the best mix of agricultural inputs for certain cultures [7].

In Brazil, the Embrapa (Brazilian Agricultural Research Corporation) agency extends the knowledge in the area of information systems in agribusiness, in addition to conducting agricultural research. According to data collected in 2010 the percentage of software offered for agribusiness are: i) Administration / management: 40.9%; ii) Animal management: 20.6%; iii) Farming: 13.6%; Control of rural processes and/or activities: 25.0% [7]. As noted, farm management systems have been standing out in the market.

The software features offered as a niche market for enhancement of farm management, acting in a vertical way, encouraging farmers to seek control over their processes influencing its results.

Large corporations with bigger organizational structures look for tools that are more associated to its business and in line with its other units around the globe. A survey was carried out in the websites of the larger trading companies in the soybean segment (which buys and sells soybeans in Brazil). Analyzing the information systems used by the trading companies, it was possible to identify their characteristics and strategies: Cargill, Bunge, Amaggi, Adm Brazil, Louis Dreyfus, Monsanto.

The Cargill company uses the procurement with its suppliers, who must go through a selection process with criterias such as sustainability processes, financial condition, quality system, technology and innovation capacity [18].

Cargill adopted ERP (Enterprise Resource Planning) solution to improve efficiency and reduce costs, choosing SAP technology. With a robust and scalable platform to support the growth, it reduced IT costs from US\$ 42 million to US\$ 13 million. Cargill uses this solution to manage everything from contracts with farmers for inventory control to support the negotiation of commodity future options [19]. Although for many experts the area of IT ERP is an outdated issue, we should note the adherence of the information system with business and strategic competitive factor.

In 2011, Bunge Brazil company also innovated its management system to capture synergies between business units, increasing efficiency and expanding opportunities and the overall quality of operations, by promoting trainings to the use of ERP/SAP management system [20].

Furthermore, Amaggi Company establishes partnerships with technology companies, having IT services to tax solutions. It is integrated into the entire group management system that controls the electronic invoice and electronic transportation document [21].

The company ADM with the EADM system allows customers to have flexibility and convenience of online service of account management, EDI transactions (Electronic Data Interchange) and XML (Extensible Markup Language), online inventory and logistics management, also using other technologies such as [22]:

- **Electronic Data Interchange:** service of ADM (EDI) make it easier and faster to do business. Use it to send and receive documents by electronic means, including purchase orders, invoices, advanced shipping notifications, purchase order changes, and more.
- **Retrieval Documents:** Save time and eliminate delays with Document Retrieval. This service allows you to receive appropriate contracts and invoices by electronic means, saving storage space, providing electronic storage of documents.
- **Online Inventory Services:** more efficient inventory monitoring. It offers real-time monitoring through the tank sensors and can even send alerts of low inventories by email. The inventory data are available online at all times, and the system provides customized inventory reports and forecasting.
- **PayADM:** online service gives you the freedom to make payments or pay shipments in advance 24 hours a day, seven days a week. The system also maintains a complete payment history, including invoices and statements. The service is free with no installation costs, operation, or service.
- **Rail Car Tracking:** Rail Car Tracking allows you to track shipments at your convenience from anywhere with an Internet connection. It offers real-time information on rail shipments to help to plan order shipments and production cycles.
- **ADM FarmerView:** is a gateway to real-time news and information for the origination partners. Allows personalizing the page and to have access to news about commodity and grain market.

The challenge of trading companies is not only manage their data and saves them, but manage their information as a factor of support for decision making, working with information online and how much the internet environment can add value in their processes.

Louis Dreyfus company employs the e-procurement that automates certain purchasing processes [23]. We cannot overlook the role of the Internet in rural areas, because it is the mainspring of the services provided. Monsanto Company applies the company management system SAP R/3. Monsanto has a global process model and, therefore, set up a strategy to work in a standardized way, mainly in manufacturing and finance in a global context [24].

What drove the choice of SAP in the Monsanto Company [25]:

- Ability to meet business needs in a single instance.
- Improved inventory control, with better quality of management and tracking.
- Global manufacturing visibility and control to leverage the full capacity and the different cost structures.
- Uniformity in the employee records and in the management processes of performance.

Based on the issues identified in the trades, it was possible to make a comparison as shown in table 1.

Table 1: Compare Technologies.

Organization	Embedded technologies
Cargill	ERP SAP
Bunge Brasil	ERP SAP
Amaggi	Integrated Systems
Adm	EDI, XML
Louis Dreyfus	E-procurement
Monsanto Company	ERP SAP

ERP management systems stand out for modularization as financial, inventory or even adhering modules to agribusiness.

The ERP serves as a strategic tool in an uncertain environment, performing synchronization, integrating data and organization of the processes in a single system [26].

SAP stands out as a leader in the enterprise resource planning software market. In order to meet the needs of infrastructure of large enterprises or organizations system, the software must contain logic for all business functions [27].

SAP holds 24% of the world market according to Gartner, Oracle 12% and Sage, Infor and Microsoft we represent 17% of the remaining market. As Fortune 500 data almost 80% of companies use SAP software and 63% of financial transactions are at least partially processed with SAP software [27].

Through an analysis, we could trace a profile of the trading companies that use solutions on the web as e-procurement, standing out in the use of EDI and electronic documents. In organizations that there is no need to use different systems, the presence of XML acts as a basic element.

The presence of the consolidated ERP on the market that support the organization's needs and that meets several branches around the world is as common factor among the surveyed trading.

5 Conclusions

The present paper allows the view of information about the systems applied by trading companies specialized in grains in Brazil, mapping out what kinds of technologies are employed with greater emphasis. ERP stands out as a key factor for business, with the support e-procurement as a tool in the business relationship with suppliers. Embrapa Statistical data also reveal that the systems for agribusiness have a promising market in Brazil.

For future work, we can explore the impact of information system of soybean supply chain focused on the farmers' use.

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