The 4.0 revolution in meat industries and the impacts on transaction cost savings

A revolução 4.0 nas indústrias de carne e os impactos na economia dos custos de transação

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Abstract
The article brings a reflection on what is happening in industry 4.0, in the agribusiness environment, more specifically in the meat processing industries, and the relationship of these movements with transaction cost savings, which occur within the food chain, between suppliers, producers, distributors, customers, among others.


Resumo
O artigo traz uma reflexão sobre o que está ocorrendo na Indústria 4.0 no ambiente do agronegócio, mais especificamente, nas indústrias processadoras de carnes e a relação destes movimentos com a Economia de Custos de Transação, que ocorrem dentro da cadeia alimentar, entre fornecedores, produtores, distribuidores, clientes, entre outros.

Introduction

New technologies, such as Big Data, IoT (Internet of Things), Artificial Intelligence, Cloud Computing, Automation, Robotization, Block Chain, among others, have been contributing significantly in this fourth industrial revolution, also present in the immense universe of agribusiness.

Intelligent factories, where equipment and sensors interact with each other, building more predictable scenarios and of action and more instantaneous response in the processes, provide greater effectiveness, productivity and competitiveness, so as to meet a growing demand, on the part of the consumers. This movement also has an impact not only on employees, who will need different skills to adapt to this new reality, but also provoke a reorganization in the productive chains.

In this context, it is also important to understand the relationship of this 4.0 movement with transaction costs. The Transaction Cost Theory is not new and emerged on the world economic scene in 1936 through Ronal Coase, who defined this concept in the book "The Nature of the Firm" (COASE, 1995).

Transaction costs, by definition, are expenses that the company has to plan, prepare and negotiate transactions of its activities or to obtain resources necessary for its operation. These disbursements occur, along with other types of costs an organization has, when it is necessary to turn to the market to obtain raw materials, equipment and services in general.

Although the concept is old, in the early 1970s, this concept gained more relevance, thanks to the American economist Williamson (2010), who went on to address transaction costs in his works.

In this concept, competitive strategies tend to be modified and depend on appropriate governance structures. In this scenario 4.0, so-called vertical transactions bring important instruments, such as the use of signed contracts that will certainly contribute to a more rigorous compliance with the requirements specified in the negotiations between the different links of the chain, directly impacting on transaction, measurement costs and helping to reference the influences of the institutional environment.

Case Description

In the Institutional Economy, the activities carried out by firms and markets are numerous, and serve as a basis for conducting economic transactions. The attributes and
specificity of the assets involved in these transactions determine the most appropriate organizational structure to coordinate the industrial organization in turn.

According to Filho (1995), the Coaseana view points out that the institutional forms of organization of production are not directed solely by the price mechanism and the firm, in its administrative role, can determine a different means of carrying out various tasks and differentiate itself in the market. According to the author, the firm and the market are part of the extremes of the organization of production and there are various ways in which production can be organized, mediated by contractual relations or otherwise. The industrial organization depends on the comparison between the cost of carrying out certain operations through the market versus the cost of carrying them out internally. The author also mentions the concept of the economics of transaction costs (ECT), linked to the New Institutional Economy of the 1930s, which contrasts the Neoclassical structure and which, according to Arrow and Hurwicz (1977), represent the expense with the "general functioning of the economic system". That is, transaction costs are the costs that make the economic system work, through the coordination and motivation/incentives employed, under the assumption that the organizational structure is determined by minimizing these costs. In this way, the transaction cost savings can be related to the links of the Agro-Industrial System (SAG).

**Key Results**

For Colombo (2014), it is crucial to regulate the actions of firms and institutions play an important role in imposing the rules on the economic game. The institutional environment is the basis for developing the organizations and tracing the ways for them to develop. The author also mentions the economy of measurement costs (ECM) which, unlike the economics of transaction costs, focuses on the specificities of assets. In ECM, the focus is on the measurable dimensions secured by ownership rights and the use of information by agents; that is, the greater the information obtained in a given transaction, the less likely a future problem will be. Dimensions that are easier to measure will require governance mechanisms that are easier to adjust and, on the contrary, where these measurements are more difficult, they will provide more complex governance mechanisms.

According to Guimarães and Maringá (2020), even with all efforts looking for differentiation and better cost x benefit in terms of competitiveness, failures in the measurement criteria still persist. The issue is evident in relation to the variability in relation to the quality offered and the lack of adoption of adequate measurement mechanisms and forms of governance, which end up threatening producers who seek quality as a differential
fatora. The article also mentions the functioning of the coffee agro-industrial system in Brazil, as an example of the savings in measurement costs, justifying the results obtained for the commodity type product, without differentiation, to gains in scale, different from the special coffees, which are measured in different sensorial attributes, such as taste, the type of roast, the quantity of caffeine, color, acidity, sweetness and aroma, among others. Thus, it is noticeable the existence of different mechanisms of operation of the chain, depending on the requirements of the internal or external market, with different factors coexisting (higher level of quality x greater attention to scale).

According to Morales, Caleman and Sproesser (2008), the Measurement Cost Theory (TCM) as well as the Transaction Cost Economics (ECT) are the primary support axes for studying economic transactions in any sector. The measurement of attributes is key to understanding the efficient ways in which transactions are coordinated. According to the authors, ECT is better coordinated according to the increase in the specificity of the asset, "starting from the extreme spot market, exemplified by the meat commodity subsystem and reaching vertical integration, exemplified by the organic meat subsystem". The same gradient can be observed with variables that have measurability of the attributes, thus concluding that the MCE is a "theoretical framework" inherent to the understanding of agro-industrial systems, aiming at a convergence to the ECT, however, more flexible and operational.

In this context, the importance of the Agroindustrial System Organization lies in the ability to conclude contracts. According to Milgrom and Roberts (1992), this is one of the main approaches to the economic analysis of organizations, in which the organizations themselves are regarded as a nexus of contracts, treaties and understandings among the individual members of the organization. The company, in turn, is regarded as a set of contracts between its suppliers, employees, investors, managers and customers. On the one hand, in these contracts, the transactions will be defined, which must take place between all interested parties and, if they are imperfect, may affect the competitiveness of the organizations. On the other hand, if the contract is done well, there can be good efficiency in competitiveness. All transaction costs will vary according to their nature and should always be minimized for their good performance.

The article published by Souza (2014) reports on a study carried out in the pig industry, in which they were addressed "the aspects that may justify the adoption of structure by contracts to conduct the supply of raw material, by the producer segment and for the pork processing segment in the state of Paraná". In this context, the article describes the understanding of the factors and conditions that explain the choices in the form of the arrangements, as well as the preference for integration contracts that have provided superior
performances in the industrial pig farming chain over the past decades. The study based on
the theories of ECT and ECM, brings to the surface the importance of contracts, and "the
perception that transactions are characterized not only by greater levels of coordination and
specificity, but also by higher control, considering the asymmetry of power in the
relationship". The possibility of measuring the attributes and their insertion into a contract,
make the contractual arrangement possible in relation to vertical integration. In this way,
"contractual formalization seems to indicate an appropriate governance structure for the
processor, providing standardization, reducing transaction costs and guaranteeing the right of
ownership of the end product."

The article published by Vinholis (1999) comments on how the lack of coordination
of the beef agro-industrial chain affects product differentiation and market segmentation. In
other words, beef, which is marketed as a commodity, from the cattle raiser to the supermarket
gondola, shows transactions in which the identity of the players has little relevance.
Meanwhile, this scenario is beginning to change, with some initiatives for vertical
coordination of the segments of this chain, with the objective of adding more value to the
product, as is to be seen in the market alliances between the agents involved in the production
and marketing of beef. In order to offer better quality meat of known origin and provenance,
the existence of the slaughter of early bulls under special supervision would be a way of adding
value to the product. In this sense, "products with higher quality attributes require specific
mechanisms of coordination, once the assets become more specific".

This context can be better explained by Guimarães et al. (2020), when, in his
dissertation, he reports how an agro-food system of beef in Paraná manages to
"decommoditize" the product, through differentiated products or processes or even through
differentiated distribution channels. The authors also comment that, on the one hand, the
differentiations directly involve innovations, on the other, the continuity of these subsystems
depends on the return by these efforts. Thus, they conclude that "since they involve greater
specificity of assets and quality attributes that may not be easily measurable, more complex
governance structures are necessary".

Without a shadow of doubt, a major factor that can contribute to the attempt to justify
the theoretical approach of the Economy of Transaction Costs, in the System of Industrial
Agribusiness (SAG), is the industrial revolution 4.0. This is a disruptive landmark and a
potential factor in breaking product commoditization, price regulation and obtaining new
niche markets. In this context, smart factories are beginning to gain space in SAG, bringing
the market closer to what is being produced and in such a way as to provide a better
understanding of the needs of customers, and also a much more dynamic and instantaneous
action within the industrial processes. Efficiency gains, process monitoring, productivity, quality and costs are a reality. Technologies such as IoT, Big Data, Artificial Intelligence, Automation, Robotization, Cloud Storage have been transforming the lives of organizations in the industry. All this, obviously, makes a great change in all transactions, from employee training, supplier development, product distribution, technology involved, in short, it is a huge transformation in the beef segment, which is beginning to happen at this moment.

An example of this movement can be better observed in the dissertation by Duarte e Rocha (2018), which presents a Big Data approach in Brazilian agriculture and livestock. In it, he seeks to analyze the impact of this revolution and to understand how the new technologies make possible an increase in the profitability of cattle raisers, by simply analyzing data in a massive manner that makes it possible to take decisions based on the inherent variables of the industrial processes. The author comments on how the new technologies were able to "generate immense value to the different stakeholders and create a new market environment in Brazilian agribusiness".

**Final Considerations**

The readings taken as the basis for the elaboration of this article, together with the debates held in the classroom, brought much wealth to the understanding of the mechanisms applied to the Economy of Transaction Costs, Economy of Measurement Costs and also the influence of the Institutional Environment.

Interesting as Coase's contribution, he managed to establish a watershed between Neoclassical Theory and the New Institutional Economy (NIS), in which he indicated the bases for understanding the vertical growth of organizations at the expense of horizontal growth based on coordination by prices, supported by Neoclassical Theory. His view that the efforts involved between organizations would lead to higher costs than simply manufacturing and distributing the products gave the basis for this new approach, later called Cost Transaction Economics, by Williamson.

The focus on this conceptual break with Neoclassical Theory, brings to the surface the importance of contracts and the relevance of institutions for the development of organizations and markets. It is very clear how important it is for those who enforce the rules to ensure that contracts are fulfilled.

The mechanisms and concepts of the NIS, applied to the Industrial Agribusiness System (SAG) and, in particular, to the beef segment, show a sector that is difficult to coordinate, in spite of Brazil having one of the largest herds in the world. The challenge of
creating new niches in the market, to escape commoditization and price regulation, and to create a greater link with more specific niches in the market, still has many opportunities for more effective development.

This is the moment of transition to the 4th industrial revolution within the Industrial Agribusiness System. The emergence of countless technological innovations not only allows for greater symbiosis between man and machine, but also brings enormous benefits to the whole food chain, because this movement makes the links of the chains have greater friction to the point of promoting a self-development and new forms of transactions between them, providing a better reorganization and further development of the sector.

In this sense, the industrial revolution 4.0 that is already occurring in a good part of the meat processing industries, as for example, at JBS, will certainly change completely the current cost transactions and all their mechanisms, favoring a more vertical integration, with greater coordination by contracts, stipulating new standards to be followed by the links of the chain, generating a more complex governance and a market with more niches to be explored.

The 4.0 universe is here to stay, and is already a big reality in many environments, agribusiness being a potential consumer of these new technologies. Technologies are those that consider drones that fly over crops to the intelligent factories that are part of the meat processing industry, connecting the data from their processes, through artificial intelligence mechanisms, in which software, cameras and other devices, integrate and generate online responses. With this, processes are more responsive, to changes that occur at every moment, either within the process itself, or outside it, through big data and all associated tools that seek to understand customer behaviors in real time.

This level of connection certainly brings a change in the form of relationship between customer and supplier, which affects transactions within the chain and their costs. For example, the meat processing company, with all the available technology, has the condition not only to automate and robotize its processes, and with this, to leave them leaner and quicker, in order to eliminate process losses. With the help of scanners and the use of block chain systems, the impact on costs is certainly immediate, in addition to the greater guarantee to ensure the quality of the final product to the consumer.

In conclusion, technological and management developments are constantly evolving and so many other tools are being created, and with this, the dynamics of transactions within food chains, has to be reviewed. Models of contracts and relationships between suppliers, intermediaries, distributors, producers, in general, and consumers, tend to evolve together, in a win-win relationship, between technology and the market.
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Referências


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