

Evidences of Open Innovation in Brazilian Agrifood Chain

Evidências de Inovação Aberta na Cadeia Agroalimentar Brasileira

Giovanna I. B. de MEDEIROS [1](#); Thiago J. FLORINDO [2](#); Erlaine BINOTTO [3](#); Silvia M. Q. CALEMAN [4](#)

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ABSTRACT:

Brazil is an important player in the global agribusiness but this favorable position contrasts with its high dependence on foreign source inputs. Investments in Research and Development (R&D) and an open organizational attitude are crucial to the success of innovations. Based on a theoretical framework elaborated from the literature review, this study aimed to identify and analyze open innovation practices in the Brazilian agribusiness Innovation System. It was found that organizations from this sector adopted open innovation strategy to complement internal R&D activities and perceived its positive impacts.

Keywords: Agriculture; national innovation system; new product development; public policy; university.

RESUMO:

O Brasil é um importante ator no agronegócio global, mas essa posição favorável contrasta com sua alta dependência de insumos de fontes estrangeiras. Investimentos em Pesquisa e Desenvolvimento (P & D) e uma atitude organizacional aberta são cruciais para o sucesso das inovações. Com base em um arcabouço teórico elaborado a partir da revisão da literatura, este estudo teve como objetivo identificar e analisar práticas de inovação aberta no Sistema de Inovação do agronegócio brasileiro. Verificou-se que as organizações deste setor adotaram uma estratégia de inovação aberta para complementar as atividades internas de I & D e perceberam os seus impactos positivos.

Palavras-chave: Agricultura; Sistema nacional de inovação; desenvolvimento de novos produtos; políticas públicas; universidade.

1. Introduction

The National Innovation System (NIS) is the group of agents – individuals, organizations and institutions – that contribute to the development, dissemination and use of new technologies that directly or indirectly influence the process of technological change in a particular industry (Temel, Janssen & Karimov, 2003). It represents a break with the conventional and linear understanding of innovation in favor of a new conception of research as part of an increasingly complex and interactive system based on learning (Sumberg, 2005).

The interactions among different actors reflect the national innovation capacity, which directly affects the performance of the country in the international market (Furman, Porter & Stern, 2002). Thus, the analysis of the Innovation System and the knowledge of its trajectory allow directing future developments leading to the increased competitiveness of a nation (Dewes, 2012).

Among developing countries, Brazil, China and India stand out in the agricultural sector as the largest investors in R&D (Beintema, Stads, Fuglie, & Heisey, 2012). Brazil traditionally has one of the most well established research systems, but investment levels have fluctuated over the past two decades (Beintema *et al.*, 2012).

As a result, it is observed that from 143 countries analyzed in the Global Innovation Index 2014, Brazil occupies the 61st position in the overall innovation index, with a higher position (25th) in knowledge absorbing and a lower position (65th) in production of knowledge and technology (Dutta, Lanvin & Wunsch-Vincent, 2014). These data may suggest that greater investments are necessary to encourage research and innovation policies together with appropriate coordination mechanisms so that the results of these investments are more effective.

Admittedly, the generation or adoption of new technologies pass through the deliberate decision-making of managers, but

it is also affected by the institutional environment. The challenge is to obtain an optimal combination of public and private efforts. Therefore, studies that broaden the understanding of complex processes of innovation, learning and adoption of technologies are fundamental (Sunding & Zilberman, 2001).

Understanding the critical aspects of these processes, such as incentives, barriers, activities, interactions among actors and knowledge flows, is essential to support the development of incentive policies (Organisation For Economic Co-Operation And Development [OECD], 2005). For this purpose, the theoretical framework of open innovation appears to be useful for analyzing the behavior of organizations within the National Innovation System. This is also justified by the literature, which considers as gaps the perspectives of open innovation analyses at different levels, in addition to the organizational level, such as the NIS itself (Chesbrough & Bogers, 2014).

While the agri-food sector considers open innovation as a promising approach to support competitiveness, the transition from a close model to an open model is challenging because it requires specific resources and capabilities, as well as a favorable institutional environment (OECD, 2014). As for the latter, examples of public policy management focusing on its implementation are still scarce (Dong, Yang, Bai, Wang & Zhang, 2013). However, a Brazilian initiative, the Inova Agro Plan ("Agricultural Innovation Plan"), was intended to encourage and finance partnerships for projects in the country.

Therefore, a comprehensive analysis of inter-organizational relations aiming to support the co-production of innovations in the sector is essential to evaluate which initiatives produce better results. Thus, how open innovation is adopted by organizations that have innovative projects selected by the Inova Agro Plan? The aim of this study is to identify, describe and analyze open innovation practices in the National Innovation System of Brazilian agribusiness.

2. National Innovation Systems

Innovation can be understood as the production, adoption, assimilation and exploitation of a novelty with **value added** in the economic and social spheres by either new or improved products, services and markets, the development of new methods of production, or the establishment of new management systems. Thus, it is both a process and an outcome (Crossan & Apaydin, 2010).

Innovation capacity is the most important determinant of organizational performance because it is considered as a critical source of competitive advantage in a growing environment of changes (Tushman, Reilly & Charles, 1996).

According to Schumpeter (1939), to innovate means doing something in the economic environment in a way different from what has already been done, not necessarily meaning an invention. While it arises from the inventor's ability, innovation comes from the entrepreneurial skill of the entrepreneur, which results in leaps towards economic development (Schumpeter, 1939).

Admittedly, innovation plays a central role in the process of economic growth in the long term (Furman et al., 2002). In this sense, post-Schumpeter authors envisioned the existence of National Innovation Systems (NIS) by recognizing the interaction between public and private sectors with an interactive learning towards the production of knowledge and elucidating the role of networks and institutions and the multiplicity of factors influencing them (Figure 1).

Concept	Author(s)
"the network of institutions in the public - and private - sectors whose activities and interactions initiate, import, modify and diffuse new technologies"	Freeman (1987, p.1)
"the elements and relationships which interact in the production, diffusion and use of new, and economically useful knowledge [...] and are either located within or rooted inside the borders of a nation state"	Lundvall (1992, p.12)
"the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, in as much as the goal of the interaction is the development, protection, financing or regulation of new science and technology"	Niosi, Saviotti, Bellon & Crow (1993, p. 212)
"the set of institutions whose interactions determine the innovative performance of national firms".	Nelson & Rosenberg (1993, p. 4)
"all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion, and use of innovations"	Edquist (1997, p. 14)

Figure 1. National Innovation Systems concepts.

The major contributions of this concept are associated to how economists and policymakers have come to think international competitiveness. However, it mostly relates to the transition of research, innovation and industrial development policies from a linear thinking to a more interactive and dynamic thinking (Lundvall, 2007).

The associations to the National Innovation System are determined by the way knowledge and resources move among different levels and among institutions and organizations, whether by formal or informal channels (OECD, 1999). This set of actors is influenced by several factors specific to the context of each country, and determine the national innovation capacity. In other words, it is the ability of a country to produce and market an innovative, long-term technology flow (Furman et al., 2002).

The national innovation capacity is directly related to the common innovation infrastructure, i.e., transverse conditions that contribute broadly to innovation throughout the economy (Furman et al., 2002). The financial system, corporate governance, market conditions, regulatory and legal frameworks, level of education, labor qualification and labor relations, among others, affect the quality and intensity of interactions between different actors (OECD, 1999).

One of the forms of government action is through public policies, which play an important role in the formation of the innovation capacity of a country, particularly when they are associated with investments in human capital, financial incentives to innovation projects, the conditions of clusters and the quality of associations among actors (Furman et al., 2002).

Thus, it is noted that public policies, in order to promote innovation, should focus not only on R&D but also on infrastructure in order to eliminate barriers that hinder the complementary quality of assets (Teece, 1986). This is because innovations depend on a partially codified and tacit know-how, whose implementation requires specific assets related to production, distribution, services, technologies, and others (Teece, 1986).

From the perspective of organizations, dynamic capabilities to integrate, build and reconfigure internal and external powers are essential to respond quickly to changes in the environment, and reflect the ability to achieve new forms of competitive advantage (Leonard-Barton, 1992). The search for complementary assets and the ability to integrate them internally relate to an organizational approach that can be easily related to the concept of open innovation.

Although both consider innovation as an interactive process, the literature on NIS analyzes industries and countries, but tends to ignore the behavior of organizations, which are the focus of the studies on open innovation (De Jong, Vanhaverbeke, Kalvet & Chesbrough, 2008). It is understood that the action of the other agents of the national system may reflect positively or negatively on the position of the organization regarding the adoption of open innovation. Therefore, the contribution of both prospects is considered relevant to a more coherent analysis of the agribusiness context, as well as of other sectors.

3. Open innovation

By definition, it is a distributed innovation process based on the purposeful management of knowledge inputs and outputs within organization boundaries, through financial incentives or not, aligned with the organization's business model (Chesbrough & Bogers, 2014).

The literature on open innovation arises mainly from the observation of innovation management practices in companies that are changing (Chesbrough, 2006). Research in the area has not been substantiated nor sufficiently linked to existing theories, representing a point from which it must advance (Vanhaverbeke & Cloudt, 2014).

Supporting the success of open innovation means understanding how companies adopt this model and determine which approaches work and which do not. This is mainly because this practice is an innovation in itself for many companies (Christensen, 2006). In this sense, Mortara and Minshall (2014) sought to relate the elements that characterize the implementation, from broader aspects to the internal dynamics of the phenomenon. In addition to the perspective of the authors, based on literature review, other factors able to describe and influence this practice were identified (appendix).

The starting point is the decision regarding the internal change in favor of the opening of innovation activities. The stimulus for this may be originated at the most senior levels or from R&D needs (Mortara & Minshall, 2014). The responsibility of implementing it is commonly assigned to professionals of these two levels or specific departments and functions can be created within the organization for this purpose (Mortara & Minshall, 2014).

Social interactions, whether internal or external, are an aspect that may be influenced by this process. First, the implementation of open innovation directly reflects in its communication and public relations activities, as they are important tools to attract potential partners and exchange information (Mortara & Minshall, 2014). It also significantly changes the way that people management activities are carried out (Petroni; Venturini; Verbano, 2012). This because it requires a new professional profile able to gather scientific and managerial competences to select and integrate external knowledge based on its perceived value and its potential regarding a new technology in face of organizational needs (Dogson, Gann & Salter, 2006). As a result, recruitment, selection, retention, training and communication processes need to be rethought (Mortara & Minshall, 2014).

It is important to note that the adoption of open innovation may be incremental, as a complement to other innovation strategies or radical, becoming the main strategy of the organization (Mortara & Minshall, 2014). To put it into practice, there is a range of different partners that may become a source of external knowledge: individuals (consumers, users, scientists), companies (suppliers, clients, competitors) and other organizations such as public and private research institutes and government agencies (Mortara & Minshall, 2014).

Organizations can benefit in several ways from these partnerships through different processes characterized by the direction of knowledge flows across organizational boundaries (Gassman & Enkel, 2004). Through processes called "outside-in", companies are able to access relevant external resources to supplement domestic R&D efforts (Von Hippel, 2005). This will in turn improve the performance of innovation internally (Chiaroni, Chiesa & Frattini, 2010).

Conversely, investments in R&D may result in knowledge and technologies which the organization does not have the necessary skills to benefit from, or are not compatible with its business model (Chesbrough & Bogers, 2014). In this case, it could allow that useless ideas or ideas that would be underutilized be shared with other organizations to compose their

business models and generate value for all involved (Maarse & Bogers, 2012). This alternative can be made possible by sale or donation of licenses, corporate incubators, joint ventures and alliances (Chesbrough & Garman, 2009).

Partners may also share resources by both processes simultaneously. The acquisition and delivery of knowledge assets can be combined to develop and/or commercialize an innovative cooperative way (Enkel, Gassmann & Chesbrough, 2009; Chesbrough & Bogers, 2014). Regardless of the type of procedure involved, the configuration of these relations may vary according to the degree of openness and the depth of the connections between partners.

The degree of openness is the diversity of sources of external knowledge, usually defined by the number of different types of external actors involved in the innovation process (Amara & Landry, 2005). However, the depth level refers to the number of external partners that are deeply integrated into innovation activities (Laursen & Salter, 2006).

The coordination of the partnership can be centralized or decentralized in an organization (Mortara & Minshall, 2014). As a support to this function, a R&D infrastructure can be installed close to potential partners or created near the organization itself in order to attract these partners (Mortara & Minshall, 2014).

The impact of open innovation on business models is evident, since it may bring the organization to a new value proposition, change the set of activities that it performs, and affect its structure by integrating external sources that may require changes in governance (Saebi & Foss, 2015). The concept of business models is presented in the literature in several ways. However, the central idea representing the logic by which the organization creates value for customers and capture it as profit and revenue streams over time through the network of involved partners predominates (Osterwalder, Pigneur & Tucci, 2005).

However, the business model includes not only the current strategy regarding how the company does its business, but also a reflection on the company itself. In other words, it is possible to relate four main elements: value proposition relates to the value that is embedded in the product or service offered by the company; the interface with suppliers and customers relates to how the relations with these actors are structured and managed; and the financial model relates to covering costs and benefits as well as to their distribution to stakeholders (Doganova & Eyquem-Renault, 2009).

Just as open innovation is only one of the possible innovation strategy, it is not necessarily accompanied by an open business model. The organization can generate innovations together with external partners, but it can market it entirely through their own channels (Vanhaverbeke & Chesbrough, 2014). However, it is common that, upon opening their innovation activities, they also create value together with these partners. This is done by connecting their business models and training a team throughout the product life cycle based on agreements signed at the beginning of the cooperation (Vanhaverbeke & Chesbrough, 2014).

The type of strategy adopted will designate the business model by which the value of innovation is generated and captured. This motivated Saebi and Foss (2015) to identify some open strategies and business models suited to its implementation. Complementarily, Felin and Zenger (2014) sought to integrate the Transaction Cost Theory relating it to governance mechanisms corresponding to different ways of acquiring knowledge assets.

A first possible alternative is to acquire external knowledge through the market, obtaining innovations that are ready to be released or complementary resources and capabilities that reduce the development time and introduce a product (Saebi & Foss, 2015). Governance is based on financial compensation, in which the incentives are high, but the communication channels are limited (Felin & Zenger, 2014). The business model, and specifically the value proposition, are centered on efficiency (Saebi & Foss, 2015). They are suitable for cases in which assets are unspecific, and complexity, uncertainty and information asymmetry are limited, thus providing lower transaction costs (Williamson, 1975).

Another option is to outsource the solution of a problem to specific user groups or scientists through contests or tournaments, for example, in which knowledge comes from a large number of actors (Saebi & Foss, 2015). In these situations, incentives can be low or moderate, property rights may vary and can even be null (Felin & Zenger, 2014). Generally used in the innovation idealization phase, the business model is focused on the user, who is often encouraged by financial awards in order to engage them and manage them as if they were employees of the organization (Saebi & Foss, 2015).

As necessary complementary assets become more specific, the organization may establish partnerships along the value chain. Collaborative agreements with few partners (but knowledge-intensive) involve close and frequent interactions and the development of mutual trust, facilitating the transfer of tacit knowledge (Saebi & Foss, 2015). Usually related to radical innovations and to the opening of a new market segment, they require a collaborative business model in which governance is based on contracts and sharing of rewards with external partners (Saebi & Foss, 2015).

In situations with a greater complexity and a need to deeply integrate external partners, the organization may also engage in creating and maintaining a network of relations with various agents, becoming part of an innovation ecosystem composed of individuals, communities and organizations (Saebi & Foss, 2015). The business model acts as an open innovation platform for multiple stakeholders. This requires incentives for employee engagement with multiple partners and the redistribution of risks and rewards (Saebi & Foss, 2015). In the latter two strategies, governance can be translated by partnerships, alliances and corporate venture capitals (startups), in which a bilateral and socially established communication with high and cooperative incentives and negotiated property rights are established (Felin & Zenger, 2014).

During the implementation of open innovation, some factors may facilitate the process or pose serious barriers that may compromise it. Culture, institutional environment, adaptability of the internal R&D area, and practices and tools for knowledge management and innovation are some moderating factors of this process (Mortara & Minshall, 2014). Therefore, it is essential to monitor them and adjust them in order to support the partnerships established by the organization, allowing it to benefit from this strategy.

4. Research methodology

In 2013, the Brazilian government launched a policy for the coordination of development of innovation actions in agribusiness that allows and seeks to encourage projects carried out by national companies in partnership with other companies and/or scientific and technological institutions (Banco Nacional de Desenvolvimento [BNDES], 2015). In 2014, 49 projects designed by medium and large companies in the area of raw materials, processing, and machinery and equipment were selected.

The population of the survey was composed of 49 leading companies that had their projects selected. The questionnaire was based on the variables identified in the literature (appendix) and was sent electronically to managers responsible for R&D. In addition, some issues were clarified to the respondents by telephone or email.

Twelve companies agreed to participate, among which eleven admitted that they had partnerships for innovation in the project selected by Inova Agro and/or in other situations. Of these, one company is a food industry and ten are suppliers of raw materials (pesticides, fertilizers, machinery, equipment and agricultural implements and animal and plant genetic breeding). Additional information about the policy was requested to Finep (Financier of Studies and Projects) and to BNDES (National Bank for Economic and Social Development), government institutions responsible for contracting projects.

5. Implementation model adopted by Brazilian companies

According to the theoretical framework, a survey was conducted with the companies selected by the government policy, and characteristics of open innovation adoption process and some factors influencing this practice were identified in the context of Brazilian agribusiness (Figure 2).

MICRO CHARACTERISTICS	Process	Inbound and interactive couple
	External Actors	Companies, universities and other organizations
	Open innovation strategy	Collaborative
	Governance	Partnerships and alliances
	Property Rights	Negotiated
	Business model	Closed
MACRO CHARACTERISTICS	Implementation stimulus	Top-down
	Approach to locations	"Come to me"

Figure 2. Open innovation implementation characteristics adopted by Brazilian agrifood companies.

It was observed that the stimulus for the adoption of open innovation was top-down, i.e., from the top management and the R&D area, whose professionals were also appointed to coordinate the activities necessary for its implementation. This occurs predominantly in order to complement other innovative strategies. To attract external partners, companies opted for a come-to-me localization strategy by using any existing infrastructure or by installing infrastructure near their own units.

Organizations have partnerships with more than one type of external actor at the same time, characterizing the amplitude of the associations and establishing networks and innovation communities. Its main partners conduct activities directly related to R&D, especially public universities and Embrapa (Brazilian Agricultural Research Corporation), a government research institution under the Ministry of Agriculture, Livestock and Supply.

Other important partners are private foundations, with a social and research objective, and also public universities. Unlike several experiments reported in other countries (Malik, Georghiou & Grieve, 2011; Grieve, B., Bushell, M., Lant, M., Georghiou, L. & Malik, 2009; Saguy, 2011), the partnership between companies and universities is still a challenge in Brazil. The time granted to teachers for involvement in partnership activities and the financial resources involved in their execution are issues that often make that kind of partnership impossible and that could be more easily controlled by the foundations established by the public universities.

In general, partners exchange knowledge through two-way interactive processes, acquiring and providing knowledge for each other and exerting an active role in the design and development of innovation. However, some companies also admitted that they established partnerships solely for acquiring knowledge from an external source.

Just as in the scientific literature, there was no evidence of outbound processes. This suggests that the concept of open innovation in agribusiness is still limited or that managers do not recognize possible benefits in outsourcing knowledge incompatible to their organization's business model.

Open innovation has been established by partnerships and alliances with other organizations, as well as by the acquisition of knowledge from user groups, consumers and communities. Known as collaborative innovation strategies, these relationships are characterized by close and frequent interactions and by the development of mutual trust, facilitating the transfer of tacit knowledge across organizational boundaries (Saebi & Foss, 2015).

In a great number of partnerships of the companies surveyed, the coordination of interactions is centered on one of the

partners. The mechanisms used include technology transfer and/or confidentiality agreements, meetings, partnership agreements, implementation schedules, work plans, seminars and lectures. These instruments are essential to enable a bilateral and socially established communication with high incentives for the cooperation between agents (Felin & Zenger, 2014).

Another key feature of the open innovation strategy adopted by organizations, the collaborative strategy, refers to property rights, which are traded, according to Felin and Zenger (2014). This attitude could be verified as the majority of participants stated that property rights will be shared or that they are still negotiating this issue in the partnership agreement.

Despite the innovation process be open, most companies stated that the innovations generated in partnership would be introduced and sold in the market only by their organization, turning it into a closed business model. Therefore, it is noted that, in general, companies would share the design and the implementation of innovation, but only one partner would capture its value. This may be explained by the involvement of research institutions as a major partner. They can benefit from the exchange of knowledge and property rights arising from innovation without participating in marketing activities, which are not their scope of action.

The institutional environment proved to be the main supporter and the main barrier for the adoption of open innovation. The Brazilian government policy was important to enable domestic companies' projects, to stimulate higher risk projects and to encourage the participation of small and medium companies in innovation activities through partnerships with other companies and research institutions. It is clear that funding programs are especially important for smaller companies, whose resources are scarcer (Khan, Grigor, Winger & Win, 2013), and that partnerships are the main mechanism to enable their participation.

However, companies that had their projects selected mentioned some points that could be improved, such as the volume of released funds, the deadlines for the effective procurement of projects, restrictions on high-risk projects and the exclusion of participation of cooperatives. A significant part of the negative criticism regards the efficiency of administrative processes involving selecting and contracting of projects. However, because it is the first experience of this policy, it is believed that these issues can be easily addressed to best meet the expectations of its target public.

On the other hand, conditions related to the volume of financial resources available to the program and project risk assessment may be subject to the country's current economic situation and to the willingness of institutions in investing in projects whose results, in most cases, are noticeable in long term.

The companies presented some suggestions that indicate some barriers to which they are subject. General issues include the need for less bureaucratic procedures for regulatory innovations; the improvement of security mechanisms for intellectual property; tax incentives for the development of more sustainable products; and agility of environmental agencies responsible for issuing the necessary permits to start the projects.

Still, some actions related to specific needs were mentioned: together with the final consumer, as to the awareness regarding some controversial issues in the sector, such as genetically modified products; and public policy, focused on fish production and consumption, and the use of biomass.

These issues require a greater effort of the relevant public bodies to provide an appropriate institutional environment in order to encourage and support the activities inherent to the processes of design, development and commercialization of innovations in agribusiness. Despite these difficulties, all the effort is justified in order to solve them, since the Inova Agro policy proved to be an important initiative to encourage, support and direct innovation projects in a strategic sector for the growth of Brazil.

6. Managerial and market advantages of open innovation strategy

The managers surveyed took into account the practice of rewarding open innovation because it enables the development and the launch of several products, and due to the possibility of exchanging knowledge, gaining experience, reducing technical risks, optimizing the use of resources and facilitating obtaining external financial resources.

It was observed that open innovation may be focused on food industry companies, open innovation is widely adopted by suppliers of raw materials. This reality runs counter to what was observed in studies conducted in other countries, in which empirical evidence is mostly related to the food and beverage industry (Bröring, 2013; Khan et al., 2013; Siedlok, Smart & Gupta, 2010; Pellegrini, Lazzarotti & Manzini, 2014).

Companies that had projects selected by Inova Agro proposed to develop pesticides to control pests, diseases and weeds; machinery, equipment and agricultural implements; technologies, products and processes from new sources (mineral, organic and industrial by-products); and genetics and animal and plant genetic breeding.

There is a degree of radicalism in the level of innovation of the companies' proposals. While some companies limited to improving a product already marketed by the organization, most wanted to create a new product in its market.

Despite the radicalism level be a good indicator, it is not possible to relate this attribute of innovations to partnerships generated for this purpose, since it was not possible to compare it with companies that individually developed them. Regardless of this, the types of innovations proposed may significantly contribute to overcoming some difficulties of the Brazilian agribusiness.

Although Brazil is an important player in the global agribusiness, the country is still highly dependent on foreign-source inputs. Besides the impact on trade balance, this situation leaves it vulnerable to exchange rate and price fluctuations, and also other external events, exposing it to several risks and jeopardizing the sector's competitiveness (Amaral, Guimarães & Bellizzi, 2014).

Thus, it appears that the innovations proposed in partnerships between Brazilian organizations seek to contribute to the

availability of inputs and, in some cases, to the mitigation of environmental impacts related to the production and consumption of these products. Because they are strategic resources, meaningful participation in production costs and directly dependent on non-renewable resources, these initiatives may positively influence the sector's competitiveness.

7. Conclusions

Brazil is an important player in the global agribusiness and yet this favorable position contrasts with its high dependence on external inputs, since markets regarding plant protection, machinery, equipment and agricultural implements, fertilizers and genetically modified seeds are dominated by foreign companies. Besides the impact on trade balance, this situation leaves the country vulnerable to exchange rate and price fluctuations, and also other external events, exposing it to several risks and jeopardizing the sector's competitiveness.

Consequently, it is essential to encourage and support investments in research and development, in which one of the alternatives is a public policy, such as Inova Agro. This proved to be relevant to implement projects mainly related to raw materials, in which the country is still dependent on external knowledge and technologies. It may contribute to the reduction of costs of activities, and the growth of Brazilian companies and consequently the nation's. Similarly, it was also a crucial factor for the insertion in the market of small and medium companies, which often have less access to financial resources, by encouraging inter-organizational partnerships.

However, other actions are demanded from the institutional environment as a whole regarding the guarantee of intellectual property, especially in the case of seeds; tax incentives especially to support the development of more sustainable products; less bureaucracy in the Inova Agro selection process and in innovation regulatory processes; agility of public bodies responsible for the certification and the release of licenses for new products; consumer awareness policies related to the clarification of genetically modified products; and incentives to fish consumption habits.

In order to extend the possibilities of success of development activities of new products, Brazilian agribusiness organizations have adopted a strategy alternative to the traditional model. Although practiced in a manner complementary to internal research and development processes, open innovation has been an advantageous practice. However, the receptivity of organizations in relation to partnerships for innovation is still limited to the interest of appropriating external knowledge. Managers still do not know the benefits of creating value from knowledge that is unused or underused within their organization. Perhaps this attitude is due also to the inherent fear of sharing considered strategic resources.

This fear was confirmed by the difficulty of adherence of companies to this research. Some companies that refused to participate claimed that open innovation activities and processes are a strategic issue for the organization. In this regard, the survey instrument and the non-identification of the respondents were useful for a greater participation of respondents.

The proposed categories of analysis sought to contemplate the range of factors that could characterize or influence the phenomenon in question. However, macro and microelements were easier to be identified than moderator elements due to the search technique used. For this reason, it would be interesting to examine some issues in more detail through case studies and other research strategies allowing a greater interaction with organizations.

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References

- Amara, N., & Landry, R. (2005). Sources of information as determinants of novelty of innovation in manufacturing firms: evidence from the 1999 statistics Canada innovation survey. *Technovation*, 25(3), 245-259. [http://dx.doi.org/10.1016/S0166-4972\(03\)00113-5](http://dx.doi.org/10.1016/S0166-4972(03)00113-5)
- Amaral, G. F., Guimarães, D. D., & Bellizzi, F. M. (2014). A experiência do edital Inova Agro: dificuldades e oportunidades do plano de fomento conjunto à inovação no agronegócio. *BNDES Setorial*, Rio de Janeiro, (40), 163-203.
- Banco Nacional de Desenvolvimento. (2015). Inova Agro. Retrieved Aug 7, 2015, from <http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Plano_inova_empresa/inovaAgro.html>
- Beintema, N., Stads, G. J., Fuglie, K., & Heisey, P. (2012). ASTI Global Assessment of Agriculture R&D Spending: Developing Countries Accelerate Spending. *Agricultural Science and Technology Indicators Project, International Food Policy Research Institute, Washington DC*.
- Bröring, S. (2013). The role of open innovation in the industry convergence between foods and pharmaceuticals. In M. G. Martinez (Ed), *Open Innovation in the Food and Beverage Industry* (pp. 39-62). Cambridge, UK: Woodhead Publishing.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm*. Berkeley, USA: Oxford University Press.
- Chesbrough, H. W., & Garman, A. R. (2009). How open innovation can help you cope in lean times. *Harvard business review*, 87(12), 68-76.
- Chesbrough, H. W., & Bogers, M. (2014). Explicating open innovation: clarifying an emerging paradigm for understanding innovation. In H. Chesbrough, W. Vanhaverbeke & J. West (Eds.), *New frontiers in open innovation* (pp. 3-28). Oxford, England: Oxford University Press.
- Chiaroni, D., Chiesa, V., & Frattini, F. (2010). Unravelling the process from Closed to Open Innovation: evidence from mature, asset-intensive industries. *R&d Management*, 40(3), 222-245. <http://dx.doi.org/10.1111/j.1467-9310.2010.00589>
- Christensen, J. F. (2006). Wither core competency for the large corporation in an open innovation world. Chesbrough, H.,

- Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm* (pp. 35-61). Berkeley, USA: Oxford University Press.
- Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of management studies*, 47(6), 1154-1191. <http://dx.doi.org/10.1111/j.1467-6486.2009.00880>
- De Jong, J. P., Vanhaverbeke, W., Kalvet, T., & Chesbrough, H. (2008). *Policies for open innovation: Theory, framework and cases*. Tarmo Kalvet.
- Dewes, M. D. F. (2012). Projetos nacionais de inovação: práticas do setor espacial brasileiro.
- Dodgson, M., Gann, D., & Salter, A. (2006). The role of technology in the shift towards open innovation: the case of Procter & Gamble. *R&D Management*, 36(3), 333-346. <http://dx.doi.org/10.1111/j.1467-9310.2006.00429>
- Doganova, L., & Eyquem-Renault, M. (2009). What do business models do?: Innovation devices in technology entrepreneurship. *Research Policy*, 38(10), 1559-1570. <http://dx.doi.org/10.1016/j.respol.2009.08.002>
- Dong, G., Yang, S., Bai, J., Wang, Z., & Zhang, Y. (2013). Open innovation in the Sanjiang Plain: a new paradigm for developing agriculture in China. *International journal of food, agriculture and environment*, 11(3-4), 1108-1113.
- Dutta, S. (2014). Global Innovation Index 2012. *Stronger Innovation Linkages for Global*.
- Edquist, C. (1997). *Systems of innovation: technologies, institutions, and organizations*. Abingdon, UK: Psychology Press.
- Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management*, 39(4), 311-316. <http://dx.doi.org/10.1111/j.1467-9310.2009.00570.x>
- Felin, T., & Zenger, T. R. (2014). Closed or open innovation? Problem solving and the governance choice. *Research Policy*, 43(5), 914-925. <http://dx.doi.org/10.1016/j.respol.2013.09.006>
- Freeman, C. (1987). Changes in the national system of innovation. *Science policy research unit. University of Sussex*.
- Furman, J. L., Porter, M. E., & Stern, S. (2002). The determinants of national innovative capacity. *Research policy*, 31(6), 899-933. [http://dx.doi.org/10.1016/S0048-7333\(01\)00152-4](http://dx.doi.org/10.1016/S0048-7333(01)00152-4)
- Gassmann, O., & Enkel, E. (2004). Towards a Theory of Open Innovation: Three Core Process Archetypes. In *Proceedings of the R&D Management Conference (RADMA)*. Sessimbra, Portugal.
- Grieve, B., Bushell, M., Lant, M., Georghiou, L., & Malik, K. (2009). Changing the rules of the game for future agriculture, The University Innovation Centre (UIC) model. In *Management of Engineering & Technology, 2009. PICMET 2009. Portland International Conference on* (pp. 288-298). IEEE.
- Khan, R. S., Grigor, J., Winger, R., & Win, A. (2013). Functional food product development—Opportunities and challenges for food manufacturers. *Trends in food science & technology*, 30(1), 27-37.
- Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic management journal*, 27(2), 131-150. <http://dx.doi.org/10.1002/smj.507>
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic management journal*, 13(S1), 111-125. <http://dx.doi.org/10.1002/smj.4250131009>
- Lundvall, B. A. (1992). National innovation system: towards a theory of innovation and interactive learning. Pinter, London.
- Lundvall, B. A. (2007). National innovation systems—analytical concept and development tool. *Industry and innovation*, 14(1), 95-119. <http://dx.doi.org/10.1080/13662710601130863>
- Maarse, J. H., & Bogers, M. (2012). An integrative model for technology-driven innovation and external technology commercialization. In C. Pablos Heredero & D. López (Eds), *Open innovation at Firms and Public Administrations: Technologies for Value Creation* (pp. 59-78). Hershey, PA: IGI Global.
- Malik, K., Georghiou, L., & Grieve, B. (2011). Developing new technology platforms for new business models: Syngenta's partnership with the university of Manchester. *Research-Technology Management*, 54(1), 24-31.
- Mortara, L.; Minshall, T. (2014). Patterns of Implementation of OI in MNCs. In H. Chesbrough, W. Vanhaverbeke & J. West (Eds.), *New frontiers in open innovation* (pp. 223-241). Oxford, England: Oxford University Press.
- Nelson, R. R., & Rosenberg, N. (1993). Technical innovation and national systems. *National innovation systems: a comparative analysis*. Oxford, UK: Oxford University Press.
- Niosi, J., Saviotti, P., Bellon, B., & Crow, M. (1993). National systems of innovation: in search of a workable concept. *Technology in society*, 15(2), 207-227. [http://dx.doi.org/10.1016/0160-791X\(93\)90003-7](http://dx.doi.org/10.1016/0160-791X(93)90003-7)
- OECD (1999). *Managing National Innovation Systems*. OECD publishing.
- OECD (2005), *The measurement of scientific and technological activities. Proposed guidelines for collecting and interpreting innovation data*, Paris.
- OECD (2014). *Global Value Chains: challenges, opportunities, and implications for policy*. OECD publishing.
- Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the association for Information Systems*, 16(1), 1-25.
- Pellegrini, L., Lazzarotti, V., & Manzini, R. (2014). Open innovation in the food and drink industry. *Journal of Agricultural & Food Industrial Organization*, 12(1), 75-94.
- Petroni, G., Venturini, K., & Verbano, C. (2012). Open innovation and new issues in R&D organization and personnel management. *The International Journal of Human Resource Management*, 23(1), 147-173. <http://dx.doi.org/10.1080/09585192.2011.561250>

- Saebi, T., & Foss, N. J. (2015). Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions. *European Management Journal*, 33(3), 201-213. <http://dx.doi.org/10.1016/j.emj.2014.11.002>
- Saguy, I. S. (2011). Paradigm shifts in academia and the food industry required to meet innovation challenges. *Trends in food science & technology*, 22(9), 467-475. <http://dx.doi.org/10.1016/j.tifs.2011.04.003>
- Schumpeter, J. A. (1939). *Business cycles*. New York, USA: McGraw-Hill.
- Siedlok, F., Smart, P., & Gupta, A. (2010). Convergence and reorientation via open innovation: the emergence of nutraceuticals. *Technology Analysis & Strategic Management*, 22(5), 571-592. <http://dx.doi.org/10.1080/09537325.2010.488062>
- Sumberg, J. (2005). Systems of innovation theory and the changing architecture of agricultural research in Africa. *Food policy*, 30(1), 21-41. <http://dx.doi.org/10.1016/j.foodpol.2004.11.001>
- Sunding, D., & Zilberman, D. (2001). The agricultural innovation process: research and technology adoption in a changing agricultural sector. *Handbook of agricultural economics*, 1, 207-261. [http://dx.doi.org/10.1016/S1574-0072\(01\)10007-1](http://dx.doi.org/10.1016/S1574-0072(01)10007-1)
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research policy*, 15(6), 285-305. [http://dx.doi.org/10.1016/0048-7333\(86\)90027-2](http://dx.doi.org/10.1016/0048-7333(86)90027-2)
- Temel, T., Janssen, W., & Karimov, F. (2003). Systems analysis by graph theoretical techniques: assessment of the agricultural innovation system of Azerbaijan. *Agricultural Systems*, 77(2), 91-116. [http://dx.doi.org/10.1016/S0308-521X\(02\)00087-2](http://dx.doi.org/10.1016/S0308-521X(02)00087-2)
- Tushman, M. L., & O'Reilly, C. A. (1996). The ambidextrous organizations: managing evolutionary and revolutionary change. *California management review*, 38(4), 8-30. <http://dx.doi.org/10.2307/41165852>
- Vanhaverbeke, W.; Cloudt, M. (2014). Theories of the firm and open innovation. In H. Chesbrough, W. Vanhaverbeke & J. West (Eds.), *New frontiers in open innovation* (pp. 256-278). Oxford, England: Oxford University Press.
- Von Hippel, E. (2005). Democratizing innovation: The evolving phenomenon of user innovation. *Journal für Betriebswirtschaft*, 55(1), 63-78. <http://dx.doi.org/10.1007/s11301-004-0002-8>
- Williamson, O. E. (1975). *Markets and hierarchies*. New York, USA: FreePress.

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1. Administradora, mestre em Agronegócios e doutoranda em Agronegócios pela U
 2. Administrador, mestre em Agronegócios, doutorando em Agronegócios pela UFRGS e docente da faculdade de Administração da UFMS. Email: tjflorindo@gmail.com
 3. Administradora, mestre e doutora em Agronegócios e docente da faculdade de Administração da UFGD
 4. Engenheira Agrônoma, mestre em Agronegócios, Doutora em Administração, Pós-doutora em Economics of Organization e docente da faculdade de Administração da UFMS.

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