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Research Article

Relational Capability and Strategic Alliances for Research and Development

Capacidade Relacional e Alianças Estratégicas de Pesquisa e Desenvolvimento

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ABSTRACT

Context: the Brazilian Agricultural Research Organization has played an important role in research and development to generate innovations. Many of these innovations are generated through research and development alliances with external partners. This stimulates the potential for relationship capability, i.e., a strategic management construct of alliances with procedural proposals that have not yet been verified empirically. **Objective:** the general aim of the study was to explore how relationship capability processes can help to generate innovations. **Methods:** qualitative research was conducted using the case study method, based on interviews, document analysis and observation. Three strategic research and development alliances involving the Brazilian Agricultural Research Organization and external partners constituted the analysis corpus. **Results:** the principal contribution to the advance of knowledge was an interorganizational model for generating innovations based on strategic research and development alliances, founded on the empirical evidence of the relationship capability processes of the Brazilian Agricultural Research Organization and its external partners. **Conclusion:** this new model provides greater clarity regarding how a public research company absorbs knowledge and unprecedented evidence of the processes of institutionalization and the overflow of relationship capability.

Keywords: agricultural innovation; strategic alliances for research and development; relational capability.

JEL Code: L1, L2, O32.

RESUMO

Contexto: a Empresa Brasileira de Pesquisa Agropecuária tem exercido importante papel em pesquisa e desenvolvimento para a geração de inovações. Grande parte dessas inovações é devida às alianças de pesquisa e desenvolvimento com parceiros externos, estimulando potencialmente a capacidade relacional, isto é, um construto de gestão estratégica de alianças, com proposições processuais ainda não verificadas empiricamente. **Objetivo:** o objetivo geral deste estudo foi explorar como os processos da capacidade relacional podem contribuir para a geração de inovações. **Métodos:** realizou-se uma pesquisa qualitativa, utilizando o método de estudo de caso, a partir de entrevistas, análise documental e observação. Três alianças estratégicas de pesquisa e desenvolvimento, envolvendo a Empresa Brasileira de Pesquisa Agropecuária e parceiros externos, constituíram o corpus de análise. **Resultados:** a principal contribuição para o avanço do conhecimento foi um modelo interorganizacional para geração de inovações, a partir de alianças estratégicas de pesquisa e desenvolvimento, fundamentado nas evidências empíricas dos processos da capacidade relacional da Empresa Brasileira de Pesquisa Agropecuária e dos seus parceiros externos. **Conclusão:** esse novo modelo fornece mais clareza sobre como uma empresa pública de pesquisa absorve conhecimento e evidencia, de forma inédita, os processos de institucionalização e de transbordamento da capacidade relacional.

Palavras-chave: inovação agropecuária; alianças estratégicas de pesquisa e desenvolvimento; capacidade relacional.

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INTRODUCTION

Agriculture is one of the most important sectors in the Brazilian economy, as its complete production chain is responsible for approximately 22.5% of Gross Domestic Product (GDP) and foreign trade figures, since one in four agricultural products in the world is of Brazilian origin (Empresa Brasileira de Pesquisa Agropecuária [EMBRAPA], 2017). In this respect, the Brazilian Agricultural Research Corporation (EMBRAPA) has played an important role in R&D to generate innovations, raising the productivity rate in agriculture, which helps to guarantee food safety (Nehring, 2016) and the development of a more sustainable farming system (Food and Agriculture Organization [FAO], 2016). Many of these innovations are developed through strategic alliances forged between EMBRAPA and external partners, including firms, institutes and research foundations, cooperatives and universities that, through this interaction, jointly succeed in facing challenges related to agriculture (Schut et. al., 2016).

Strategic alliances have been viewed as a structural alternative to innovation, given the possibility of complementing resources, accessing new markets and reducing costs (Almeida & Costa, 2017; Dyer & Singh, 1998). However, forming these alliances is not a simple process and their failure rate is very high. The chances of an alliance performing satisfactorily increase if the institutions involved develop the capability to continuously exchange knowledge and information with their partners (Shakeri & Radfar, 2017; Patterson & Ambrosini, 2015) and establish a governance structure to manage alliances (Heimeriks & Duysters, 2007; Milagres, Rezende, & Silva, 2017). It is also necessary to select suitable partners, managing conflicts and establishing mutual trust (Shakeri & Radfar, 2017), and create mechanisms to protect assets (Sorrentino & Garraffo, 2012; Costa & Porto, 2014) in order to ensure advantages for all the parties involved (Wang & Rajagopalan, 2015).

These strategic management processes of alliances combine the construct of relational capability (RC) (Schilke & Goerzen, 2010), the potential results of which are known as relational rents; in other words, benefits in terms of economic gains, scientific and technological outcomes that are only obtained through an interorganizational relationship (Zhang, Li, & Li, 2017). Despite the importance of RC, it should be noted that procedural propositions have yet to be empirically verified:

(a) RC can manifest differently in public research companies that form R&D alliances with external partners, including those connected (when the innovation is stimulated by the partner predominantly due to market demand) (Lhuillery & Pfister, 2009) and not connected to the market (when the innovation is developed by the partner predominantly through research) (Appio, Martini, Petruzzelli, Neirotti, & Van Looy, 2017);

(b) in a public research company, there is a possibility of systematizing strategic management processes for alliances (Crossan, Lane, & White, 1999), providing opportunities to adapt or replicate these processes in future alliances; thus, RC may be considered mature, i.e., institutionalized (Lorenzoni & Lipparini, 1999);

(c) in the strategic R&D alliances of a public research company, there is a possibility of overflows of relational processes between partners, culminating in internal improvements or even in the adoption of new R&D practices (Lin & Darnall, 2015; Walsh, Lee, & Nagaoka, 2016).

Given the need to verify these propositions with procedural empirical evidence, considering the important role that agricultural innovation plays in the country, and considering that the formation of strategic R&D alliances has been increasingly used to generate innovations, in this study an effort was made to explore how RC processes can aid the generation of innovations (Walsh et al., 2016).

With this objective in mind, RC is investigated here through the perspective of the dynamic capabilities (Schilke & Cook, 2015; Niesten & Jolink, 2015) of a company that, through organizational processes, seeks to create, expand or transform its resource base (Helfat et al., 2009), enabling companies to handle changes in the environment (Donada, Nogatchewsky, & Pezet, 2016).

Specifically, the model of Schilke and Goerzen (2010) was used to operationalize the study, as it is up-to-date and diffused at the international level (283 citations), the analysis categories being: interorganizational coordination, alliance transformation, learning, alliance proactiveness and alliance portfolio. The latter was not used, given that the focus was on dyad-level alliances rather than portfolios.

It should also be highlighted that this study considered the following antecedents of RC: experience in forming alliances and the governance structure of alliances (Schilke & Goerzen, 2010). Prior experience, accumulated through the formation of previous strategic alliances, enables organizations to develop the skill of choosing potential partners to complement resources, manage alliances (Heimeriks & Duysters, 2007; Almeida & Costa, 2017) and make adjustments when required (Heimeriks & Duysters, 2007). Companies with a structure that focuses on managing alliances can centralize information and facilitate communication between sectors (Hoang &

Rothaermel, 2005), developing means of managing alliances more efficiently (Heimeriks & Duysters, 2007). Regarding the governance structure of an alliance, its formalization should be highlighted, in other words, the different levels related to protecting assets (Sorrentino & Garraffo, 2012; Costa & Porto, 2014), considering the partners and goals involved in alliances.

Concerning its contribution to the advancement of knowledge, it should be emphasized that the study provided an opportunity to propose an interorganizational model for the generation of innovations through strategic R&D alliances, based on the empirical evidence of EMBRAPA and its external partners' relational capability processes. This new model sheds greater light on how a public research company absorbs knowledge and provides unprecedented evidence of the institutionalization and overflow processes of RC.

THEORETICAL FRAMEWORK

Schilke and Goerzen (2010) defined the dimensions of RC through interorganizational coordination and learning, alliance proactiveness and transformation. Interorganizational coordination is made up of a set of specific processes that are constructed consensually between partners to execute tasks and invest the resources of the alliance (Gulati, Lawrence, & Puranam, 2005). This coordination plays an important role, facilitating interaction to guarantee that individual alliances are governed efficiently, especially those with partners of a different nature, with differences in terms of objectives and expectations (such as industries and universities), assuaging and resolving interpretative conflicts (Estrada, Faems, Cruz, & Santana, 2016).

Organizational learning is related to processes and mechanisms to facilitate the articulation, coding, sharing and internalization of the know-how of partners in alliances and transferring knowledge within the company (Shakeri & Radfar, 2017). Also known as absorptive capacity, this dynamic capability allows companies to create new internal resources through seeking, acquiring, assimilating, transforming and exploiting external knowledge, developing an innovation process (Patterson & Ambrosini, 2015).

It should be highlighted that, through a routine of detection, proactiveness helps organizations to identify opportunities and potential partners in order to acquire external resources (Schilke & Goerzen, 2010). Proactive firms are able to respond and act in a preventive manner with regard to new opportunities (Schilke & Goerzen, 2010). This occurs because the transformation of an alliance is related to the partners' flexibility when it comes to reacting to conditions that change throughout the alliance. This is a natural and desirable phenomenon, since a perfect model cannot be expected from the outset (Reuer & Zollo, 2000). Therefore, alterations to contracts, governance mechanisms and staff are recurrent in approximately 40% of strategic alliances. Thus, if after an alliance is formed, partner institutions develop processes that modify it, managing to leverage complementary resources and learn from one another when facing challenges, conflicts, unexpected costs and moral risks, they succeed in leveraging value (Wang & Rajagopalan, 2015), aiding an efficient collaboration (Reuer & Zollo, 2000).

Therefore, when companies have established structures and specialized staff, the processes of strategic management of R&D alliances can be institutionalized (Crossan et al., 1999), thus creating an expectation that mature RC has been achieved. In this respect, proposition **P1** may be highlighted: as companies institutionalize processes of interorganizational coordination, proactiveness in alliances, organizational learning and transformation, the more mature their relational capability will be.

Research institutes (not connected to the market) are considered important R&D partners because they conduct research for the development of new knowledge and technologies in specific fields, aiding the promotion of innovations (Etzkowitz, 2017). On the other hand, it falls to institutions connected through practice to place these innovations on the market (Lundvall, 1988). Following this line of reasoning, the interorganizational overflow of processes is expected to occur between companies and their partners. In other words, these actors institutionalize and later transfer processes inherent to R&D, resulting in improved or new knowledge absorption practices. Thus, proposition **P2** may be outlined: in strategic R&D alliances, processes inherent to research overflow from the public research company to its partners (connected or unconnected). **P3** may also be stated: in strategic R&D alliances, processes inherent to development, overflow from the partners (connected or unconnected to the market) to the public research company.

METHODOLOGY

To achieve the general goal of this study, qualitative research was conducted, with the environment of the phenomenon used as a source of data, and the researcher as a fundamental instrument for the collection of these data and

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for the selection, verification and interpretation of the information (Creswell, 2017). The approach was exploratory, through a process of interaction between the researcher, the participants and the locations under study in order to modify or clarify concepts (Creswell, 2017). The method used was the case study, as there was no mastery of the phenomenon in question, and thus it was possible to verify, connect and compare the information obtained (practical knowledge) with the propositions of the study (theoretical knowledge) (Godoy, 1995).

To investigate the problem, the analysis unit was EMBRAPA, as it meets the following criteria: (a) it is recognized as one of the main actors in Brazilian agricultural research; (b) it has experience in forming alliances for the development of agricultural innovations; and (c) it has evidence of RC, as it promotes integration and interaction between the different actors in the National Agricultural Research System (SNPA), including for-profit organizations (companies, cooperatives and private research institutes) and non-profits (public universities, public research institutes and social organizations).

Considering the case of EMBRAPA, three alliances were selected for analysis based on the following conditions: strategic R&D alliances that generated socially, economically or environmentally relevant innovations; and strategic alliances formed in the last 15 years. The choice of period can be explained by the fact that EMBRAPA has a history of developing cultivars and this process lasts an average of 12 years. Therefore, this time frame was chosen so that R&D alliances with a long-term research focus could be included in the study.

A search was conducted on the EMBRAPA website, on the page for products, processes and services (https://www.embrapa.br/produtos-processos-e-servicos; retrieved January 10, 2017), regarding technological solutions developed by the company. With the results filtered for the years 2002 to 2017, the search identified a total of 1,794 technologies. This result includes technologies generated by EMBRAPA and also between the company and its external partners. Later, another search was conducted with regard to the cultivars registered in the company's name in the National Cultivar Register (RNC) at http://www.agricultura.gov.br/guia-de-servicos/registro-nacional-de-cultivares-rnc; retrieved in January 10, 2017. In January 2017, approximately 1,580 cultivars were registered under the name of EMBRAPA. Finally, a search was conducted on the website of the National Industrial Property Institute (http://www.inpi.gov.br/; retrieved in January 15, 2017) to identify the patents registered or applied for by EMBRAPA.

Considering the strategic alliances formed by EMBRAPA with external partners to develop technology, from the aforementioned criteria, three R&D alliances were intentionally selected for the purpose of this study: (a) anatomical packaging for fruit developed by the EMBRAPA Food Agroindustry unit and public research institutes (IMA and INT) – innovation with environmental, economic and social benefits that resulted in 39 patents; (b) BRS Quaranta barley cultivar, developed by EMBRAPA Wheat, a Research Foundation (FAPA) and a company (AmBev) – an innovation with economic and social benefits, highlighting that 90% of malting barley cultivars on the market are developed by EMBRAPA; and (c) INOVA-Bti – biological insecticide developed by the EMBRAPA Genetic Resources and Biotechnology unit, a private research institute (IMAmt) and a cooperative (COMDEAGRO). This innovation is of great social benefit as it reduces the proliferation of the *Aedes aegypti* mosquito, which spreads the Dengue, Chikungunya and Zika viruses.

Regarding data collection, 10 interviews were conducted: 3 with the heads of T&T of the selected units; 1 with the head of the Genetic Resources and Biotechnology unit (CENARGEN); and 6 with researchers who have directly participated in both R&D activities and the coordination of the selected alliances, 3 of whom were from EMBRAPA and 3 from the partner institutions that were directly involved in the alliances to develop technologies at the units. Except for the interview with the researcher from FAPA, which was conducted on Skype, all the other interviews were conducted in person. The coordinator of Support for Innovation and Intellectual Property at EMBRAPA was also interviewed by phone call in order to identify the characteristics related to the formation of the company's alliances and the evolution of their formalization. An attempt was also made to understand the issues of intellectual property and the duration of alliances with different goals. To conduct the interviews, a semi-structured script was used in accordance with the model of Schilke and Goerzen (2010), and all the interviews were recorded, totaling 6 hours and 48 minutes of recordings.

Zamberlan et al. (2014) suggest that the most suitable method is to seek other sources to ratify the data collected during an interview. Observation, in this respect, was also used in this study, as it allows the researcher to identify and obtain information registered in a field diary, documenting the environment, expressions, behaviors, facts and meanings of individuals collected during on site interviews (Zamberlan et al., 2014; Godoy, 1995).

Furthermore, secondary data were obtained from the websites of EMBRAPA and its partners: cultivars registered in the name of EMBRAPA were

consulted at the RNC; information on patents was gathered and confirmed in a search of the National Industrial Property Institute's website (http://www.inpi.gov.br/; retrieved in January 15, 2017); and documents such as contracts, pamphlets, files, reports, minutes of meetings, regulations, newspapers and magazines were analyzed.

With these data sources, the analysis categories of the study were defined: (1) institutionalization of RC; and (2) overflow of processes inherent to research and development from primary data (semi-structured interviews and non-participant observation) and secondary data (documents) (Table 1).

To operationalize each analysis category, the procedure known as triangulation (Zamberlan et al., 2014) was used, i.e., evidence from different sources was collected and used to answer the questions that guided the study to arrive at more consistent conclusions. The aggregate analysis of each category and its evidence, obtained from different sources, enabled an interpretation of the propositions that were drafted from the theoretical foundations (Table 1).

It should be emphasized that the primary and secondary data were submitted to content analysis (Creswell, 2017), involving organization and classification based on systematized categories, which in turn aided the reduction and triangulation of the data, guaranteeing the validity and robustness of the analyses (Table 1). A synthesis of the association matrix is shown in Table 1.

Table 1. Methodological association matrix.

Nature	Qualitative (Creswell, 2017).		
Approach	Exploratory (Creswell, 2017).		
Method	Case study (Godoy, 1995).		
Research context	EMBRAPA		
Analysis unit	Three strategic R&D alliances formed by EMBRAPA and external partners		
Guiding questions of the analysis category	**Analysis categories and propositions**	**Data collection procedures**	**Data analysis procedures**
In general, does the initiative to form R&D partnerships stem from your institution or the partner? Does the institution have a formal department, manuals, norms, guide, etc.? Is there a differentiation in the formalization of partnerships for research and partnerships for development? Does the institution adopt mechanisms to avoid opportunistic behavior, theft of information and unilateral knowledge? Is the level of formalizing partnerships standardized or are there differences according to the goals of the alliance or nature of the partner? How is each R&D partnership coordinated? How are activities synchronized? Is it common for there to be requests for "procedural" or "contractual" changes in partnerships? Is it common for conflicts of interest to emerge in partnerships?	Institutionalization of RC (P1)	Interview, document analysis (contracts and projects) and non-participant observation (field diary).	Content analysis and triangulation
What is the institution's perception with regard to forming partnerships to conduct R&D? What knowledge, resources or assets were sought for this partnership? Did your institution succeed in learning from its partners? Are there any transfer processes for this knowledge? Which activities were developed by each partner? What is the partner's main expertise? What are the main impacts that this innovation generated?	Overflow of processes inherent to research and development (P2 and P3)	Interview, document analysis (contracts and projects) and non-participant observation (field diary).	Content analysis and triangulation

Note. Source: Prepared by the authors based on research data.

RESULTS

Considering the characteristics of the alliances in question, the description of the partners involved and the innovations that were generated, a summary of the cases is presented in Table 2.

Table 2. Intra-case synthesis of the strategic R&D alliances under study.

Characteristics	Brief description		
	Alliance (1) **Anatomical packaging for fruit**	**Alliance (2)** **Barley cultivar - BRS Quaranta**	**Alliance (3)** **INOVA-Bti – biological insecticide**
Type of innovation	Agroindustrial process	Product (eco-innovation)	Product
Associated theme	Agroindustry, food safety, health and nutrition.	Family farming, agroindustry, genetic improvement and vegetable production.	Bioproducts, formulations and similar.
Year of launch	2011	2002	2016
Year of conclusion	2015	2015	2016
Main applications	Transport and storage of fruit	Winter culture	Reservoirs of water for consumption, appropriate locations for proliferation or linked to other means of mosquito control.
Main impacts	Reduced loss and waste of fruit; greater efficiency at work; faster decomposition in nature.	Higher productivity; partial or total dispensation of fungicide applications.	Control of the larvae of the *Aedes aegypti* mosquito, which spreads the Dengue, Chikungunya and Zika viruses; does not harm the environment.
Patent deposits	39	1	Not applicable (industrial secret).
Publications	4 articles and 2 book chapters	1 pamphlet	1 pamphlet
R&D activities	blems farmers experience regarding the transport and storage of fruit and vegetables; selection of the most suitable fiber to form composites. Development: include fiber in the composite, modeling and design of packaging.	Development: genetic improvement of barley. Research: experiments to evaluate the agronomic performance of the strains.	Identification of strains (bacteria); optimization of the production process of the strains; development of high quality formulations and evaluation of the toxicity of products.
Main partners	IMA (not connected to the market) and INT (not connected to the market).	AmBev (connected to the market) and FAPA (not connected to the market).	IMAmt (not connected) and COMDEAGRO (connected to the market).
Alliance begun	2010	2002	2016
Duration of alliance	5 years (medium term)	12 years (long term)	1 year (short term)
Formalization instrument	Term of agreement	Contract of technical and financial cooperation	Technical cooperation contract
Purpose of the alliance	Development of recoverable packaging for fruit and vegetables.	Establishment of conditions for technical and financial cooperation between EMBRAPA, AmBev and FAPA to achieve new barley cultivars.	Development of products based on *Bacillus thuringiensis var. israelenses* and *Bacillus sphaericus*, to control *Simulium spp, Culex quinquefasciatua, Anopheles spp* and *Aedes aegypti.*
Composition of funding	BNDES: R$ 7,500,217; IMA, INT and EMBRAPA: R$ 4,179,000 (contribution)	R$ 4,199,195.30, with R$ 1,568,972.30 being the share of EMBRAPA; R$ 1,362,612 from AmBev; and R$ 1,267,611 from FAPA.	Without the transfer of funds between the institutions. Sums contributed: EMBRAPA R$ 120,000; IMAmt R$ 60,000; COMDEAGRO R$ 60,000.
Role of EMBRAPA	Identification of the needs for each product, appropriate characteristics of the packaging.	Crossing activities; advancement of generations and selection of progenies and evaluation tests and value of cultivation and use (VCU) tests.	Obtaining the necessary authorizations to comply with legislation on access to genetic heritage; being responsible for the Work Plan; and providing the strains to be used in the contract.
Role of Partner 1	IMA: selecting, handling and characterizing agricultural rejects that could be used in polymer composites; selecting the most suitable polymer materials to prepare the composites.	AmBev: conducting evaluations of the quality of malt and beer and validating the agronomic performance of cultivars registered under the name of EMBRAPA.	IMAmt: providing human resources to execute the contract, being responsible for the payment of expenses; hiring researchers; making purchases (consumables and equipment) and engaging services.
Role of Partner 2	INT: development of projects for primary, secondary and tertiary packaging in the field of design.	FAPA: conducting evaluation tests of the quality of malt and beer; validating agronomic performance of cultivars registered in the name of EMBRAPA; evaluation tests and VCU tests of strains developed by EMBRAPA.	COMDEAGRO: obtaining the authorization required to regulate compliance with legislation and access to genetic heritage; responsible for managing the process of registering products with the competent authorities and producing the bioinsecticide.

Note. Source: Prepared by the authors based on research data.

Strategic alliances have to do with links between institutions (Kale, Dyer, & Singh, 2002), which united to gain access to or develop resources, knowledge, know-how etc. (Ortiz-de-Urbina-Criado, Montoro-Sánchez, & Mora-Valentín, 2014; Bleeke & Ernst, 1991; Powell, 1987) to achieve different goals through the joint development of R&D activities, by means of bilateral contracts (Powell, Koput, & Smith-Doerr, 1996; Klotzle, 2002).

The types of packaging that were studied were developed through a strategic R&D alliance (Alliance 1, described in Table 2) that is in keeping with the theory of the Resource Based View (RBV), as it provided a way of accessing each partner's unique resources (Barney, 1991). The institutions that formally participated in this alliance were: EMBRAPA Food Agroindustry; the National Technology Institute (INT); the Macromolecule Institute (IMA) of the Federal University of Rio de Janeiro (UFRJ); and the Foundation for the Coordination of Technological Projects, Research and Studies (COPPETEC). The Brazilian Development Bank (BNDES) was the funding agency, and the Rio de Janeiro Fruit Farmers' Association participated informally in the project.

The research activities in Alliance 1 (anatomical packaging for fruit) included farmers identifying problems, the shape and size of fruit, harvest time, etc. Another part of the research was related to the use of the most suitable type of fiber for the composite. This activity was coordinated by IMA. EMBRAPA acted in Alliance 1 as an intermediary of the primary production sector, providing farming residuals to be used as raw material. Furthermore, it fell to EMBRAPA to identify the needs for each product and the appropriate characteristics of the packaging due to the company's direct contact with the production sector. It also provided information on the properties of products with regard to their post-harvest physiology, shelf life, dimensions, temperature and relative humidity in storage.

The Quaranta barley cultivar was also developed through a strategic R&D alliance (Alliance 2, described in Table 2), in which three institutions participated: EMBRAPA Wheat, the Agricultural Research Foundation (FAPA) and the Americas' Beverage Company (AmBev). It fell to EMBRAPA to conduct the entire research process for the genetic improvement of barley, which included grossing, advancement of generations and the selection of progenies and tests to evaluate the value of cultivation and use (VCU). The partners (AmBev and FAPA) were assigned the testing to assess the quality of malt and beer, the validation of the agronomic performance of cultivars registered in the name of EMBRAPA and the evaluation VCU tests on strains developed by EMBRAPA. Therefore, the partners worked more intensely in the development phase in Alliance 2.

The INOVA-Bti product was also developed through a strategic R&D alliance (Alliance 3, described in Table 2) between EMBRAPA Genetic Resources and Biotechnology (CENARGEN), in partnership with the Mato Grosso Cotton Institute (IMAmt) and the Mixed Cooperative for the Development of Agribusiness (COMDEAGRO) (EMBRAPA, 2017). The R&D activities of Alliance 3 included the identification of strains (bacteria), optimization of the production process of the strains, development of high quality formulations and evaluating the toxicity of products. It fell to EMBRAPA to obtain the necessary authorizations for compliance with legislation regarding access to genetic heritage, be responsible for the activities outlined in the Work Plan and make available the strains to be used in the execution of the contract. IMAmt's activities included providing human resources for the execution of the contract, being responsible for paying expenses, hiring researchers, making purchases (consumables and equipment) and engaging services. The activities for which COMDEAGRO was responsible were obtaining the necessary authorization to regulate compliance with legislation regarding access to genetic heritage and being responsible for managing the registration of products that would be developed with the competent authorities, especially the National Sanitary Surveillance Agency, including the resulting expenses.

Institutionalization of RC processes

Based on the analysis of RC, it was possible to identify in the alliances in question the presence of processes of interorganizational coordination, alliance transformation, learning and proactiveness, as established by the relational capability model of Schilke and Goerzen (2010).

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Regarding the coordination processes, the use of work plans should be highlighted, in which the R&D activities of each of the partners, the work methodology, the forecasting of resources to be invested by each party and a schedule were described. These work plans were drafted through the prior sharing of information regarding the resources and knowledge of each actor in the alliance and the later division of activities and responsibilities of each. Furthermore, each actor designated a researcher to coordinate the activities, making efforts to comply with these plans.

In addition to the aforementioned processes, in Alliance 1 (anatomical packaging for fruit) a committee was set up, composed of a (designated) researcher from each institution, who coordinated the activities of his or her institution, and a set with the others that gauged the progress of the R&D activities of the other institutions, insuring the synchrony of activities. For this purpose, monthly meetings were held, e-mails were exchanged (always copied to everyone) and technical and financial reports were forwarded every six months to the funding agency. The representatives from the committee also made regular visits to the research laboratories, suppliers of raw materials and the farmers. The Alliance 1 partner was responsible for financial controls, authorization of purchases and travel and the accountability of the alliance.

The formation of committees to evaluate the alliance, meetings for planning, the evaluation of results and shared strategy discussions are therefore considered processes that aided the coordination of the alliances. It is important to have synchronization mechanisms to reconcile the individual interests of each institution and to align information (Gofredo & Bataglia, 2015) and practices (Lorenzoni & Lipparini, 1999) between the partners in order to harmonize them in their drive to achieve the goals of the alliance, aiding more efficient coordination (Gofredo & Bataglia, 2015) and the co-creation of knowledge (Silva & Rossi, 2018).

In Alliance 2 (barley cultivar), the processes of the coordination of activities and management of the alliance were conducted through telephone conversations and constant exchanges of e-mails. Furthermore, the partners met once a year to synchronize information. On those occasions, reports were given on executed activities and plans of the next activities. Visits were also made to the experiments, with representatives from each partner institution attending. EMBRAPA was responsible for initiating processes to renew the alliances, with the voicing of interests and suggestions from the parties.

In Alliance 3 (biological insecticide), in addition to the technical manager (researcher), an administrative manager was appointed to evaluate the progress of the activities and another manager to monitor the enforcement of the contract. The synchrony of the activities was monitored through technical meetings, assessments and reports. The researcher from the partner company in the alliance was responsible for requesting the purchase of materials and equipment, hiring staff for R&D activities and accountability to his or her institution (partner). It was found that there was engagement in terms of coordination efforts through explicit actions to adjust the partners' activities to meet determined goals jointly, increasing relational quality and cooperation in the alliance, aiding the results (Estrada et al., 2016) and the co-creation of knowledge (Silva & Rossi, 2018).

EMBRAPA showed signs of proactiveness only in Alliance 1, seeking potential partners to complement its expertise. In Alliances 2 and 3, EMBRAPA was sought out by partners due to the company's scientific knowledge, experience in R&D and its resources (laboratories and genetic materials). These partners (Alliances 2 and 3) constantly acted proactively, always seeking help to solve problems and in terms of market demand. Proactiveness is related to the ability to recognize the context of the environment by identifying customers' needs, target market segments, a new technological or market opportunity (Teece, 2007) and then take the initiative to seek potential partners to acquire external resources (Schilke & Goerzen, 2010).

Learning processes are related to the ability to transfer knowledge from the partner in the alliance to the institution (Teece, 2007; Patterson & Ambrosini, 2015). An exchange of scientific and/or market knowledge between the partner institutions was identified. In Alliance 1 (EMBRAPA and IMA - not connected), EMBRAPA absorbed specific knowledge from this partner, which had expertise in the field of polymers, and

then transferred this learning to other researchers and research teams through discussions, meetings, and technical presentations to allow this knowledge to be used in other EMBRAPA projects. On the other hand, IMA absorbed technical and scientific knowledge in the post-harvest field, passing it on to students through teaching and to the laboratory team. This alliance also resulted in patents, the publication of scientific articles and book chapters, which are means of transferring knowledge to society.

In Alliance 2 (EMBRAPA, FAPA and AmBev), EMBRAPA absorbed knowledge related to market demands regarding the quality of beer and malt, understanding the needs and production in certain regions of Paraná State. This knowledge was transferred to the team through seminars and lectures. The partner institution, in turn, acquired technical knowledge from EMBRAPA regarding cultures, disease control, direct plantation and conservation of the soil, as well as general knowledge through field days and Barley Meetings. This knowledge transfer occurred internally through training for technicians.

In Alliance 3, EMBRAPA acquired knowledge of the formulation and production of the product. The knowledge transfer occurred internally through fortnightly seminars on the progress of the projects and their results. The partner in this alliance acquired knowledge related to research processes with microorganisms and biological control. Many of the resources sought in alliances are tacit knowledge or access to the partner's know-how (Dyer & Singh, 1998). Having developed learning means that institutions are capable of acquiring, assimilating, transforming and exploiting this knowledge, thereby improving their performance (Zahra & George, 2002).

It was found that, throughout the alliances, changes were necessary, requiring interaction and adaptation by the partners. In this respect, it is important to develop processes to aid change during alliances (Wang & Rajagopalan, 2015). In Alliance 1, there was a change in responsibility for the submission of patents. Furthermore, it was necessary to increase the number of molds to be developed, leading to financial adjustments and changes in the production order of the packaging.

In Alliance 2, adjustments to contractual clauses and the number of experiments were made when the contract was renewed. The alteration in Alliance 3 was related to adjustments in the schedule due to delays in the installation of equipment purchased overseas. A change in alliances is considered a natural phenomenon. Therefore, it is important for the parties to make changes jointly to increase the chances of satisfactory performance (Reuer & Zollo, 2000).

The development of a capability depends on improved processes (Winter, 2003). Thus, when institutions have established organizational structures and specialized employees that can produce favorable results, the managerial processes of strategic R&D alliance are institutionalized (Crossan et al., 1999).

An analysis of the three alliances showed that they all had institutionalized RC processes. Institutions adopt formalized and replicable processes and mechanisms to coordinate R&D alliances (manuals, directives, legal advice, departments and staff who specialize in the formalization and management of alliances, software for monitoring internal activities, activity plans, a sector to provide accountability, purchases and hiring of staff). They also showed learning capacity through specific knowledge of the partner institutions or knowledge generated by the alliance and transferred. Flexibility (transformation) to handle changes and the existence of processes of proactiveness were identified at EMBRAPA Food Agroindustry, FAPA and IMAmt. However, these processes did not prove to be systematized at EMBRAPA Wheat, EMBRAPA CENARGEN and IMA, as highlighted in Table 3 (non-compliant with the proposition).

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Table 3. Analysis of the propositions linked to the institutionalization of RC processes.

Propositions linked to the institutionalization of RC processes		Compliance with the propositions		
		Alliance (1) Anatomical packaging for fruit	**Alliance (2) BRS Quaranta Barley Cultivar**	**Alliance (3) INOVA-Bti – biological insecticide**
(P1) The organizations institutionalize inter-organizational coordination processes, proactiveness in alliances, organizational learning and alliance transformation, the more mature relational capacity will be	Interorganizational coordination	**COMPLIANT** Establishment of a Work Plan with R&D activities, work methodology, resource forecasting, and activity schedule. A researcher was allocated from each institution to coordinate activities. Committee created to monitor activities; monthly meetings; exchange of e-mails; drafting of technical and financial reports; visits to research laboratories, suppliers of raw materials and farmers.	**COMPLIANT** Establishment of a Work Plan with R&D activities, work methodology, resource forecasting, and activity schedule. A researcher was assigned from each institution to coordinate activities. Coordination was by telephone, exchange of e-mails, annual meeting with the drafting of a report and technical visit to experiments; an EMBRAPA employee was responsible for the renewal of the alliance.	**COMPLIANT** Establishment of a Work Plan with R&D activities, work methodology, resource forecasting, and activity schedule. A researcher was assigned from each institution to coordinate activities. An administrative manager of the contract to evaluate the progress of activities; and a manager to monitor the enforcement of the contract. There were meetings, technical evaluations and reports, and a partner was designated to be responsible for the purchase of materials and equipment and the hiring of staff for R&D activities.
	Alliance proactiveness	**COMPLIANT** EMBRAPA sought potential partners to complement expertise.	**NON COMPLIANT** EMBRAPA was sought by partners because of its scientific knowledge, experience in R&D and resources (laboratories, genetic materials).	**NON COMPLIANT** EMBRAPA was sought by partners because of its scientific knowledge, experience in R&D and resources (laboratories, genetic materials).
	Learning resulting from knowledge exchange in the alliance	**COMPLIANT** Absorption of technical and scientific knowledge in the field of polymers and post-harvest; knowledge transfer to research teams through discussions, meetings and technical presentations to students through teaching; and to the laboratory team; publication of scientific articles, book chapters and patent registration	**COMPLIANT** Absorption of market knowledge regarding the quality of beer and malt; understanding the demand and need of the market; acquisition of knowledge regarding the needs and production in specific regions; technical and scientific knowledge regarding the development of cultivars, disease control, direct plantation, soil conservation; knowledge transferred through lectures, seminars, field days, training and barley meetings.	**COMPLIANT** Absorption of knowledge regarding formulation and production; knowledge related to research processes with biological microorganisms and biological control; knowledge transfer through seminars.
	Transformation of the alliance	**COMPLIANT** Alterations in responsibility for submitting patents; alterations to the number of molds for packaging; financial and chronological adaptations.	**COMPLIANT** Adjustments to research activities; updating contractual clauses and financial values upon renewal of the contract.	**COMPLIANT** Adjustments to the schedule due to delays in the installation of equipment.

Note. Source: Prepared by the authors based on research data.

Relational capability overflow

Competence-oriented alliances are motivated by the desire of institutions to improve their internal resources (via access to complementary resources) and internal knowledge (through organizational learning and knowledge creation) (Lin & Darnall, 2015). Therefore, institutions are more likely to seek diverse and inter-sector partners (firms, universities, research institutes, suppliers, clients, etc.) (Walsh et al., 2016).

In the three alliances under study, every institution was found to have specific knowledge and resources and were motivated to form alliances to gather different and complementary assets, capabilities and skills to achieve their goals. At the EMBRAPA units in question and their partners not

connected to the market (IMA and IMAmt), expertise was identified in the conducting of research, as in the partner in Alliance 1 (anatomical packaging), IMA, an institute specializing in polymer research. On the other hand, the partners connected to the market (AmBev and COMDEAGRO) had greater knowledge of it, as they are always seeking to develop innovations to meet demand. Through these alliances, an overflow of processes was identified from one institution to another (from the public research company to partners connected and not connected to the market) and of development (from the partners connected or not connected to the market to the public research company), resulting in improvement or new practices.

In Alliance 1, from the knowledge acquired from EMBRAPA Food Agroindustry concerning processes inherent to post-harvest research, the partner institution (IMA) developed a line of research of packaging with the establishment of the flow of the process (overflow of processes from institutions not connected to the market to their unconnected partners – EMBRAPA and IMA).

In Alliance 2, from the knowledge inherent to FAPA's research activities and the market institution of AmBev, EMBRAPA adapted an R&D methodology for the development of barley and other cereals resulting from knowledge of industrial demand such as the quality of malt (AmBev) and the climate, and of farmers from regions of Paraná State obtained from FAPA. According to FAPA, in Alliance 2, at the beginning of the partnership with EMBRAPA, 100% of the barley cultivars used were the result of alliances with that company. Today, the institution uses 50% of them, which are developed in alliances with other institutions. Furthermore, it was found that the institution adapted the clauses of the contract in accordance with models adopted in research conducted by EMBRAPA. Therefore, it can be inferred that, from this alliance, the institution began to use EMBRAPA processes in R&D (overflow of processes of the public research company to the non-connected partner: EMBRAPA-FAPA).

In Alliance 3, owing to the difficulties in dealing with the regulatory agencies to produce this type of product, EMBRAPA developed a regulatory document of the essential requirements for forming alliances to develop similar products. As the partner had expertise in formulation and production, EMBRAPA incorporated, adapted and began to use formulation and production processes of similar products (overflow of processes from institutions connected to the market to those not connected – COMDEAGRO and EMBRAPA). COMDEAGRO, in turn, built the factory to produce the bioinsecticide based on past knowledge and processes due to the expertise gained at EMBRAPA CENARGEN in biotechnology. Furthermore, the partner's employees received training at EMBRAPA (overflow of processes from institutions not connected to the market to those that are connected – EMBRAPA and COMDEAGRO).

An analysis of the overflow of R&D processes according to the partner is shown in Table 4. It should be emphasized that the relational capability model of Schilke and Goerzen (2010) establishes the processes of interorganizational coordination, alliance transformation, learning and proactiveness.

Table 4. Analysis of the propositions linked to RC overflow.

Propositions linked to RC overflows	Compliance with the propositions		
	Alliance (1) **Anatomical packaging for fruit: a process innovation**	**Alliance (2)** **BRS Quaranta barley cultivar: a product innovation**	**Alliance (3)** **INOVA-Bti – biological insecticide: a product innovation**
(P2) In strategic R&D alliances, processes inherent to research overflow from the public research company to the partners (connected or not connected to the market).	**COMPLIANT** Development at IMA of a line of research on packaging with the adoption of EMBRAPA research processes.	**COMPLIANT** FAPA diversified the research and the source of barley cultivars and adapted the contractual clauses in accordance with the models adopted in research conducted by EMBRAPA.	**COMPLIANT** COMDEAGRO constructed a factory to produce the insecticide based on the orientation in research and training by EMBRAPA.
(P3) In strategic R&D alliances, processes inherent to development overflow from the partners (connected or not connected to the market) to the public research company.	**NOT APPLICABLE** Alliance formed with an institution not connected to the market with expertise in polymers.	**COMPLIANT** Adaptation at EMBRAPA of the R&D methodology for the development of barley resulting from knowledge of the demand of the industry (AmBev) and climate and producers from regions of Paraná State, obtained from FAPA.	**COMPLIANT** Use at EMBRAPA of similar formulation and production processes that were the expertise of the partner COMDEAGRO.

Note. Source: Prepared by the authors based on research data.

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PROPOSITIONAL INTERORGANIZATIONAL MODEL

Based on an in-depth study of the alliances to generate agricultural innovations (such as the development of anatomical packaging for fruit, the BR Quaranta barley cultivar and INOVA-Bti insecticide), it was possible to develop a propositional interorganizational model from a theoretical and empirical comparison involving a public research company and its partners connected and not connected with the market (Figure 1).

The model is divided into four blocks, which represent the empirically evidenced analysis categories of RC, including: (Block 1) RC Maturity; (Block 2) RC overflow; (Block 3) Results; and (Block 4) Facilitator (Figure 1).

Block 1, based on the empirical evidence, indicates that the more institutionalized a given set of strategic management processes of R&D alliances is in a public research company, the more mature (institutionalized) the RC will be, as its constitutive processes can be replicated and adapted in future alliances (Figure 1).

Specifically, a set of processes capable of conferring maturity on RC can be seen, as listed below.

(a) Interorganizational coordination processes: establishment of an R&D work plan with details of the method, resource forecasting and an activity schedule; formal designation of collaborators from partner institutions to coordinate activities; creation of a committee to monitor activities; drafting of technical and financial reports of projects for the evaluation of results; and visits to research laboratories, suppliers of raw materials and farmers.

(b) Processes of proactiveness in the alliance: search for potential partners to complement expertise in R&D and to provide resources, including laboratories and genetic materials.

(c) Learning: absorption of technical and scientific knowledge**;** understanding the demand and needs of the market in specific regions; and the dissemination of knowledge through lectures, seminars, field days, training, meetings, technical and scientific publications, book chapters and patent registrations.

(d) Transformation: making adjustments to research activities throughout projects; updating contractual clauses and financial values when renewing R&D contracts; changes in responsibility for submitting patents; and adaptations in the activity schedule.

When an institution manages to develop and consequently institutionalize this set of strategic management processes of R&D alliances, conferring maturity on RC, there is an overflow of research and development processes between the public research companies and partners connected and not connected to the market (Figure 1).

With particular regard to overflow processes (Block 2), in alliances with both scopes (research and development), there is an overflow of research processes from the public research company (due to its scientific expertise) to the partner (whether connected or not connected to the market). On the other hand, in the case of development processes, there are overflows from both partners (connected or not connected) to the public research company, resulting in improved processes or the adoption of new development practices (Figure 1). Thus, there was evidence of the overflow of the following R&D processes:

(a) Overflow of development processes: (1) diversification of existing products and processes at the public company, which is a benchmark in research following the establishment of the alliance with the partner most closely connected to regional needs; (2) adoption of new patterns of development of quality in the public company, which is a benchmark in research, following the formation of an alliance with the partner most closely connected to industrial needs; (3) implementation of a regulatory document of the essential requirement for collaborative R&D at the public company, which is a benchmark in research, following the formation of an alliance with a partner with great expertise in contractual safeguards.

(b) Overflow of research processes: (1) implementation of a new line of research by the partner after the formation of alliances with the public company that is a benchmark in research; (2) after the formation of alliances with the public company that is a benchmark in research, the partner incorporates research processes that consequently enable the implementation of a factory to produce the innovative product; (3) after the alliances, the employees of the partner company continue to undergo training in research at the public company that is a benchmark in research.

It may be concluded, from Blocks 1 and 2 of the propositional interdisciplinary model, that RC creates a potential for development of products, processes, patents, etc., and later innovations for the market. The model (Figure 1) also shows that if products, processes and patents are developed in alliances with at least one partner that is active in the market (e.g., a company or industry), they will be traded on the market more quickly, becoming innovations, because these partners have greater expertise in terms of commercialization, i.e., the generation of innovations.

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Figure 1. Interorganizational model for the generation of innovation from strategic R&D alliances, based on the empirical evidence of the RC processes of EMBRAPA and its external partners.
Source: Prepared by the authors based on the research data.

Finally, it should be emphasized that the RC model by Schilke and Goerzen (2010), used as the theoretical basis for this study, is founded on the following analysis categories: interorganizational coordination, alliance transformation, learning, alliance proactiveness and alliance portfolio. The latter was not considered given that the focus of the study was on dyad-level alliances rather than portfolios. In turn, the proposed interorganizational model (Figure 1) provides unprecedent evidence of the processes of institutionalization and overflow of RC. In other words, it generates a distinctive and broader contribution to the field of relational capability in strategic R&D alliances compared to the model by Schilke and Goerzen (2010), as it provides greater clarity on how a public research company institutionalizes and overflows relational capability processes in interorganizational R&D alliances not considered in the model of Schilke and Goerzen (2010).

FINAL CONSIDERATIONS

It was found that when the institutions had and developed dimensions and factors with a potential for RC, an overflow of processes inherent to research and development occurred between EMBRAPA and its external partners in strategic R&D alliances. More specifically, in alliances with both scopes (research and development) there was an overflow of research processes from EMBRAPA (due to its scientific expertise) to the partner (whether connected or not connected to the market), and from the partner (whether connected or not connected to the market) to EMBRAPA, in the case of development processes, resulting in the improvement of these processes or the adoption of new practices.

Finally, it was found that the EMBRAPA units and external partners have institutionalized dimensions of coordination, learning and transformation of RC (formalized and replicable in future alliances). With regard to proactiveness, which is also part of the RC construct, it was identified at an EMBRAPA unit (Food Agroindustry) and two partners (FAPA and IMAmt). These institutions can be considered as having matured these dimensions in general, i.e., they are formalized and replicable in future alliances.

As for the economic aspect of innovation, the anatomical packaging for fruit still needs to be potentiated concerning its launch on the market and commercialization. The main motive for this not having occurred yet was found to be the lack of a marketing partner since the early phases of R&D. When institutions connected to the market (companies, industries or cooperatives) do not participate from the outset, it is more difficult to convince others later on that this product or process will be welcomed by the market or that the percentage of royalties to be paid is adequate in relation to the investment. In the other alliances that were analyzed (malt barley cultivar and biological insecticide), a link was found with the market resulting from the alliance with partners that operate in the market, such as cooperatives and industries, justifying the fact that the innovations resulting from these alliances have already made a social, economic and environmental impact.

This study contributes to the advancement of knowledge related to R&D alliances, especially regarding the institutionalization and overflow of processes, culminating in a propositional framework. In R&D alliances, when the partners have developed RC, they are able to overflow knowledge and research processes (public research institute to the partner) and development (partner to the public research institute), improving their own processes or adopting new practices. Likewise, the more institutionalized the RC processes are, the more mature the RC will be and it will be possible to replicate it in other alliances.

For managers of R&D institutions, whether connected or not to the market, the study indicates that when R&D alliances are formed with emphasis on the development of innovations, repeat partners from other alliances can create the potential for RC, leading to the more agile development of the innovation. On the other hand, when institutions not connected to the market seek partners for R&D alliances with an emphasis on the development of innovations, it is important that at last one of the partners should be connected with the market with potential capacity for future production. Therefore, it is important for managers to participate actively in the choice of partners according to the focus of the alliance in order for the alliance to achieve goals and better results.

Although signs were found that prove the efficient coordination of these alliances, a suggestion (practice already demonstrated in the literature) for managers is that all the partners should adopt mechanisms for more integrated management, with the use of software and the intranet, for the joint planning and management (Hoang & Rothaermel, 2005) of alliances. Institutions can also form internal teams and/or committees to aid the formalized management of

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alliances (administrative and for coordination) so as to centralize information and experience, allowing them to be used in future alliances, and for monitoring in the early, intermediate and final stages of activities.

As the research is qualitative, the selection of the number of cases is restricted and limiting, and it was not possible to generalize them in terms of other R&D alliances for the development of innovations; nor could their results be generalized in relation to other EMBRAPA units and their partners.

It was also possible to identify that in R&D alliances for the development of agricultural innovations, the researchers from EMBRAPA and their partners are directly involved in R&D activities and play an important role in the coordination of activities and interorganizational relationships. They are channels through which alliances are formed because they emerge from their contact network and because of individual experience in alliances, which contributes to their success. Thus, future studies could analyze the influence of individual RC on the RC of the institution in strategic R&D alliances that aim to generate agricultural innovations. Another suggestion for future research would be to broaden the analysis with a larger number of institutions that form strategic R&D alliances in agriculture.

REFERENCES

Almeida, J. M. S. de, & Costa, P. R. da (2017). Development of relational capability in technology-based companies in the information and communication technology sector. *International Journal of Managerial Studies and Research, 5*(4), 119-126. https://doi.org/10.20431/2349-0349.0504015

Appio, F. P., Martini, A., Petruzzelli, A. M., Neirotti, P., & Van Looy, B. (2017). Search mechanisms and innovation: An analysis across multiple perspectives. *Technological Forecasting And Social Change*, *120*, 103-116. https://doi.org/10.1016/j.techfore.2017.04.008

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. http://dx.doi.org/10.1177/014920639101700108

Bleeke, J., & Ernst, D. (1991). The way to win in cross-border alliances. *Harvard Business Review*, *69*(6), 127–135. Retrieved from https://hbr.org/1991/11/the-way-to-win-in-cross-border-alliances

Costa, P. R., & Porto, G. S. (2014). Governança tecnológica e cooperabilidade nas multinacionais brasileiras. *Revista de Administração de Empresas*, *54*(2), 201-221. Retrieved from https://rae.fgv.br/rae/vol54-num2-2014/governanca-tecnologica-cooperabilidade-nas-multinacionais-brasileiras

Creswell, J. W. (2017). *Research design*: *Qualitative, quantitative, and mixed methods approaches*. London: SAGE publications.

Crossan, M. M., Lane, H. W., & White, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of Management Review*, *24*(3), 522-537. http://dx.doi.org/10.2307/259140

Donada, C., Nogatchewsky, G., & Pezet, A. (2016). Understanding the relational dynamic capability-building process. *Strategic Organization*, *14*(2), 93–117. https://doi.org/10.1177/1476127015615286

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, *23*(4), 660–679. https://doi.org/10.2307/259056

Empresa Brasileira de Pesquisa Agropecuária (2017). *Embrapa em números*. Retrieved from https://www.embrapa.br/embrapa-em-numeros.

Estrada, I., Faems, D., Cruz, N. M., & Santana, P. P. (2016). The role of interpartner dissimilarities in industry-university alliances: Insights from a comparative case study. *Research Policy*, *45*(10), 2008-2022. https://doi.org/10.1016/j.respol.2016.07.005

Etzkowitz, H. (2017). Innovation Lodestar: The entrepreneurial university in a stellar knowledge firmament. *Technological Forecasting and Social Change*, *123*, 122-129. https://doi.org/10.1016/j.techfore.2016.04.026

Food and Agriculture Organization (2016). *The state of food and agriculture 2016 (SOFA): Climate change, agriculture and food security*. Food and agriculture organization of the United Nations. Retrieved from http://www.fao.org/3/a-i6030e.pdf.

Godoy, A. S. (1995). Introdução à pesquisa qualitativa e suas possibilidades. *Revista de Administração de Empresas*, *35*(2), 57–63. Retrieved from https://rae.fgv.br/rae/vol35-num2-1995/introducao-pesquisa-qualitativa-suas-possibilidades

Gofredo, T. R., & Bataglia, W. (2015). Os mecanismos de sincronização em alianças estratégicas. *Revista de Administração da Universidade Federal de Santa Maria*, *8*(4), 633-649. https://doi.org/10.5902/1983465911111110648

Gulati, R., Lawrence, P. R., & Puranam, P. (2005). Adaptation in vertical relationships: Beyond incentive conflict. *Strategic Management Journal*, *26*(5), 415–440. https://doi.org/10.1002/smj.458

Heimeriks, K. H., & Duysters, G. (2007). Alliance capability as a mediator between experience and alliance performance: An empirical investigation into the alliance capability development process. *Journal of Management Studies*, *44*(1), 25–49. https://doi.org/10.1111/j.1467-6486.2006.00639.x

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2009). *Dynamic capabilities: Understanding strategic change in organizations*. New York: John Wiley & Sons.

Hoang, H., & Rothaermel, F. T. (2005). The effect of general and partner-specific alliance experience on joint R&D project performance. *Academy of Management Journal, 48*(2), 332–345. https://doi.org/10.5465/amj.2005.16928417

Kale, P., Dyer, J. H., & Singh, H. (2002). Alliance capability, stock market response, and long-term alliance success: The role of the alliance function. *Strategic Management Journal*, *23*(8), 747–767. https://doi.org/10.1002/smj.248

Klotzle, M. C. (2002). Alianças estratégicas: Conceito e teoria. *Revista de Administração Contemporânea*, *6*(1), 85–104. http://dx.doi.org/10.1590/S1415-65552002000100006

Lhuillery, S., & Pfister, E. (2009). R&D cooperation and failures in innovation projects: Empirical evidence from French CIS data. *Research Policy, 38*(1), 45–57. https://doi.org/10.1016/j.respol.2008.09.002

Lin, H., & Darnall, N. (2015). Strategic alliance formation and structural configuration. *Journal of Business Ethics*, *127*(3), 549–564. http://dx.doi.org/10.1007/s10551-014-2053-7

Lorenzoni, G., & Lipparini, A. (1999). The leveraging of interfirm relationships as a distinctive organizational capability: A longitudinal study. *Strategic Management Journal*, *20*(4), 317–338. https://doi.org/10.1002/(SICI)1097-0266(199904)20:4<317::AID-SMJ28>3.0.CO;2-3

Lundvall, B. A. (1988). Innovation as an interactive process: From user-producer interaction to the National System of Innovation. In G. Dosi, C. Freeman, R. Nelson, G. Silverberg & L. Soete (Eds.), *Technical change and economic theory* (Chapter 11, pp. 349–369). London: Pinter Publishers.

Milagres, R., Rezende, O., & Silva, S. A. G. da (2017). Papel e posição do departamento de alianças: Caso Embrapa. *Revista de Administração Pública*, *51*(3), 431-450. http://dx.doi.org/10.1590/0034-7612160046

Nehring, R. (2016). Yield of dreams: Marching west and the politics of scientific knowledge in the Brazilian Agricultural Research Corporation (Embrapa). *Geoforum, 77*, 206-217. https://doi.org/10.1016/j.geoforum.2016.11.006

Niesten, E., & Jolink, A. (2015). The impact of alliance management capabilities on alliance attributes and performance: A literature review. *International Journal of Management Reviews*, *17*(1), 69–100. https://doi.org/10.1111/ijmr.12037

Ortiz-de-Urbina-Criado, M., Montoro-Sánchez, Á., & Mora-Valentín, E.-M. (2014). Impact of growth strategy on mode of governance in alliances. *International Business Review*, *23*(4), 838–848. https://doi.org/10.1016/j.ibusrev.2014.01.002

Patterson, W., & Ambrosini, V. (2015). Configuring absorptive capacity as a key process for research intensive firms. *Technovation*, *36-37*, 77-89. https://doi.org/10.1016/j.technovation.2014.10.003

Powell, W. W. (1987). Hybrid organizational arrangements: New form or transitional development? *California Management Review*, *30*(1), 67–87. https://doi.org/10.2307/41165267

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, *41*(1), 116–145. https://doi.org/10.2307/2393988

Reuer, J., & Zollo, M. (2000). Managing governance adaptations in strategic alliances. *European Management Journal*, *18*(2), 164–172. https://doi.org/10.1016/S0263-2373(99)00088-2

Schilke, O., & Cook, K. S. (2015). Sources of alliance partner trustworthiness: Integrating calculative and relational perspectives. *Strategic Management Journal*, *36*(2), 276-297. https://doi.org/10.1002/smj.2208

Schilke, O., & Goerzen, A. (2010). Alliance management capability: An investigation of the construct and its measurement. *Journal of Management*, *36*(5), 1192–1219. https://doi.org/10.1177/0149206310362102

Schut, M., Klerkx, L., Sartas, M., Lamers, D., Mc Campbell, M., Ogbonna, I., Kaushik, P., Atta-Krah, K., & Leeuwis, C. (2016). Innovation platforms: Experiences with their institutional embedding in agricultural research for development. *Experimental Agriculture*, 52(4), 537–561. https://doi.org/10.1017/S001447971500023X

Shakeri, R., & Radfar, R. (2017). Antecedents of strategic alliances performance in biopharmaceutical industry: A comprehensive model. *Technological Forecasting and Social Change*, *122*, 289-302. https://doi.org/10.1016/j.techfore.2016.01.003

Silva, M. de, & Rossi, F. (2018). The effect of firms' relational capabilities on knowledge acquisition and co-creation with universities. *Technological Forecasting and Social Change*, *133*, 72-84. https://doi.org/10.1016/j.techfore.2018.03.004

Sorrentino, F., & Garraffo, F. (2012). Explaining performing R&D through alliances: Implications for the business model of Italian dedicated biotech firms. *Journal of Management & Governance*, *16*(3), 449-475. https://doi.org/10.1007/s10997-010-9159-9

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Walsh, J. P., Lee, Y.-N., & Nagaoka, S. (2016). Openness and innovation in the US: Collaboration form, idea generation and implementation. *Research Policy*, *45*(8), 1660-1671. https://doi.org/10.1016/j.respol.2016.04.013

Wang, Y., & Rajagopalan, N. (2015). Alliance capabilities review and research agenda. *Journal of Management*, *41*(1), 236–260. https://doi.org/10.1177/0149206314557157

Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, *24*(10), 991–995. http://dx.doi.org/10.1002/smj.318

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, *27*(2), 185–203. http://dx.doi.org/10.2307/4134351

Zamberlan, L., Rasia, P. C., Souza, J. D. S. de, Grison, A. J., Gagliardi, A. de O., Teixeira, E. B., Drews, G. A., Vieira, E. P., Brizolla, M. M. B., & Allebrandt, S. L. (2014). *Pesquisa em ciências sociais aplicadas*. Ijuí, RS, Brasil: Unijuí.

Zhang, S., Li, N., & Li, J. (2017). Redefining relational rent. *Technological Forecasting and Social Change*, *117*, 315-326. https://doi.org/10.1016/j.techfore.2016.10.072

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1st author: Lead researcher of the study, reviewed the literature, collected and analyzed the data. Main writer of the article.

2nd author: Advisor of the study, assisted in the construction of literature review, methodological path, supervision and validation. First reviewer of the article, responsible for article submission and correspondence with the scientific journal.

3rd author: Final revision of the article, including new references and bringing complementary perspectives to the discussion of results.

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