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**Business Networks: Technology Transference to the Agribusiness – Embrapa Case**

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## **ABSTRACT**

Competition and the factors which contribute to a company's success in a volatile global and economic environment depend on many different aspects. One of them pertains to the relationship established between companies, with the goal of attaining a uniform level of development with effective integration and coordination. A relationship between companies creates a network and a positive integration can be attained with the removal of obstacles so as to facilitate the flow of information, goods and services. This study seeks to understand how the relationship of technology transfers from the external environment with Embrapa. We analyzed the evolution and subsequent transformation of vision that the company has undergone since its creation until today. At the end you can see the network cohesion and the convergence of the interests of its participants require the achievement of a balanced relationship and the establishment of governance principles.

**KEYWORDS:** Technology Transfer, Innovation, Agribusiness, networks of business

## **1. INTRODUCTION**

A recent analysis of the actual trajectory indicates that the intensive use of technology and innovation provided by the technological revolution that agribusiness has had in the past 38 years, still bearing fruit, visible in the highly competitive and dynamic sector registered. However, recent developments in the Research, Development and Innovation - R, D & I and its macro environment of action also signals that Brazil still has a long way to go before we reach the level where the most developed nations like the U.S. and

member countries European Union, and even emerging countries like China, India and South Korea (Cruvinel et al., 2008).

Conceptually, agribusiness should be understood as a network that involves input from manufacturing through to production in the agricultural establishments and processing to consumption. This network incorporates all support services: research and technical assistance, processing, transportation, marketing, credit, export, port services, distributors, handbags and the final consumer. The aggregate value of agro-industrial complex is, necessarily, in five markets: the supply, the actual production, processing, distribution and end user. (CONTINI et al, 2005).

In numbers, the Brazilian agribusiness highlights its importance, represents a third of GDP, 40% of the value of exports and jobs for more than half of the economically active population. In 2010 the sector's exports hit record, hit the historical figure of \$ 76.4 billion, representing an increase of 18% compared to 2009. According Bolson (2005) the most important are not the actual numbers, but the enormous growth potential of the sector. The area planted to grains can be tripled. There is available land, technology, tropical sun and plenty of water.

The production of food, fiber and biofuels experience rapid and revolutionary technological developments that lead to radical changes in the traditional way to produce, processing and preserve food. More and more agribusiness agents will require technologies generated by research and development institutions seeking to improve the performance in the supply chain and thus the governance of the network of agribusiness is the big difference for companies that operate in the sector to survive. This article aims to address issues related to the process of articulation of networks of seed producers who have adopted technologies generated by the Brazilian Agricultural Research

Corporation - Embrapa, the critical success factors and provides a reflection on entrepreneurship in these companies.

The hypothesis guiding the study is that changes in world market globalization and the internal market arising from public policies and legislation have led to Embrapa, a public company, to broaden its focus to survive in the agricultural market. These factors were responsible for identifying and seeking a partnership that culminated in the formatting of networks of small companies producing seeds. The theoretical selected to support the cognitive structure for the study supported the company in this dual approach. First, we took as reference the historical approach on the development of Brazilian Agribusiness and the role played by Embrapa. Second, the analysis relies on data on technology transfer to the seed segment. From the methodological point of view, the study can be considered exploratory and qualitative. The research involved the analysis of documents and data from Embrapa and official sources, such as the Ministry of Agriculture, Livestock and Supply. Understanding the productive development / management of the Company occurred over time and organized by period analysis was based on the history and development of Brazilian agribusiness, interference in the company network and formatting. This paper is organized into five sections, starting with this introduction. In the second section is a brief description of the Embrapa. In the third section presents the cultural change of a time when the company was diffusing technology to a technology transfer process, then the unfolding of the concept of transfer of technology and its suitability for the company. In the fourth section presents the formatting of the corporate networks for the transfer of technology. And in the fifth section a brief conclusion.

## **2. EMBRAPA**

The Brazilian Agricultural Research Corporation (Embrapa) under the Ministry of Agriculture, Livestock and Supply, was created on April 26, 1973. Its mission is to facilitate solutions to research, development and innovation for sustainable agriculture for the benefit of Brazilian society (EMBRAPA, 2008). Embrapa operates through Research Units and Units and Services Administration, found in almost all states of the federation, in many different biomes. Their coordination is under the National Agricultural Research - SNPA, consisting of federal public institutions, state universities, private companies and foundations that so cooperative, performing research in different geographical areas and fields of scientific knowledge. The feasibility of the solutions contained in the company's mission is accomplished through the coordination and execution of projects in R & D and development, adaptation and transfer of technology and knowledge. According to Oliveira (2002) innovation is a major challenge for R & D institutions such as Embrapa. As a consequence, the lapse of time between the generation and adoption by the segments interested in technological innovations is pretty long. Embrapa, as a generator of technology to agribusinesses, has sought solutions to this problem and thus has been striving to streamline the process and adoption of new technologies and technological services.

### **2.1 The Diffusion and technology transfer in the EMBRAPA**

The vision, objectives and strategies of technology transfer has been undergoing changes since the creation of Embrapa in 1974, and can be characterized in three very different times. At first, between 1974 and 1988, Embrapa has established itself as a

major duty-oriented institution for applied research. His philosophy of action was that the research began and ended the farmer, by identifying their problems.

This view was part of the culture of Embrapa's mission and focused on the development of agriculture, with the main beneficiaries farmers. This initial period, given the stage of development of Brazilian agriculture, almost all that was available for research, outbreaks caused gain and impact on producers. This period was characterized by intense actions of technology diffusion, especially in the 70's, through the formulation of so-called "technological packages". The diffusion of technology was defined as a broad process of actions that presupposed the interaction between researchers, extension workers, farmers and agricultural policy organs with a view to greater flexibility in the process of generation, diffusion and adoption of agricultural technology, with an interdisciplinary character.

Despite the fertile time of interaction between the Company and its partners and producers, the activity of dissemination had the connotation of "business", even in cases involving the sale of products and services. It was also not very common to speak of "technology transfer", an expression more commonly used at the time, to characterize the appropriation of a technology of a country, on the other.

In the second phase, between 1989 and 1998, Embrapa tried to adjust to changing political contexts and agribusiness, which resulted in a political-institutional framework much more complex in the country. Trade liberalization and the formation of economic blocs, along with the reduction policies of the state, deregulation, consolidation and environmental awareness of consumer rights, were landmarks in determining new forms of work organizations.

The reduction of state intervention in the rural sector - with implications for the allocation of public resources devoted to agricultural modernization, rural credit, agricultural research and technical assistance and rural extension - the trend of privatization of technology by multinational companies, especially in the field advanced biotechnology and organization of production chains in networks, gave rise to a new spectrum of challenges and opportunities for governmental and private. That is when the breakdown occurs by the Brazilian Technical Assistance and Rural Extension (SIBRATER), leading even to extinction of its coordinator, the Brazilian Enterprise for Technical Assistance and Rural Extension (EMBRATER). In the States, there were increasing difficulties imposed on both the extension, as the state research companies, and many of them become extinct, altered or rendered (research and extension).

Taken together, these changes produced drastic changes in the Brazilian agribusiness, there was no longer to seek technological solutions for incremental productivity gains, but to master new knowledge about activities/ products, sometimes unknown, and to advance in management, to try new ways to organize. All this movement demanded the implementation of compensatory public policies to enable the restructuring of production. Given this situation, Embrapa has become increasingly demanded, including playing the role of state research organizations, technical assistance and rural extension, being highlighted the need to change the way the Company operates. It took more than an outline profile of the new technological solutions has become crucial, too, understand the new context, analyze alternatives through actions of technological forecasting, articulate new partnerships, strengthen the promotion of technology transfer actions resulting (validated) and act, supporting the formulation and implementation of public policies. However, the views of these two moments proved ineffective in ensuring a fair distribution of benefits generated and maintenance of public investment

in research and development and technology transfer, as the most organized and capitalized segments of society have been quicker to take ownership of public assets and use them to their advantage. On the other hand, fulfilled the purpose of consolidating technology as one of the main factors of production and agricultural development, and helped create new business networks, particularly in the area of seeds, inputs, and equipment and communication services.

## **2.2 The Introduction of Technology Transfer in the Process**

In the third phase, from 1999, the vision of business as a means to facilitate the process of technology transfer from Embrapa began to emphasize a broad concept, highlighting the complementarity of roles between researchers, producers, extension agents, government agencies, associations civilian and agricultural industries. Embrapa sought to streamline the process of technology transfer with the business vision though timidly, forging new links and strengthening existing ones throughout the Brazilian agribusiness. The stock transfer, however, were seen as an inherent part of the R & D, thus becoming one of its stages. During this period, Embrapa has adopted a stance based on the context of major economic and social transformations that affect Brazil and the world. In this sense instituted a new arrangement with the company in order to improve the efficiency and effectiveness of this process as well as to contribute greater amounts of financial resources to strengthen research and providing access to innovations through partnerships of various kinds. The structure of social networks, as described by Lazzarini (2008), was consolidated by the relationships already exist in some segments, thus the company started to work on the centrality of the network, as the mediator of the relationship between agents and agribusiness it organized with other institutions to act

in a network so dense that the second Fusco (2005) aims to facilitate the flow of information and resources, through trust and sharing activities.

The greatest advances occurred with the negotiation of the results of plant breeding through partnerships with public and private sector. However, the technology transfer processes, products, knowledge and service delivery, speed, efficiency and the process suffered few changes within the company due to its complexity, little experience and lack of adequate tools and procedures.

### **3. TECHNOLOGY TRANSFER**

The process begins with the demand of society, determines the product resulting from the R & D activities and culminates with the transfer and technology adoption. The protocol includes the full realization of various sub-processes such as product development and technological processes, technical feasibility studies of production, study the competition with the competitors and the economic result, intellectual property protection of inventions and of copyright, registration cultivars, and registration of trademarks, publications, event information, distribution and marketing.

#### **3.1 The Training Network for Business Technology Transfer**

Nonaka and Takeuchi (1997), Bogenrieder and Nooteboom (2003) and Boschma and Lambooy (2002) believe that knowledge is and will increasingly be the means to gain competitive advantage through innovation networks. Kodama (2005) showed that generate knowledge and technology transfer is possible, however, Mody (1993), Brown and Duguid (1996), Boisot (1995) stressed the importance of systematic coordination.

This means that the focus of knowledge is not only learning, characterized by Kogut and Zander (2003) explicit knowledge. The knowledge that produces innovation, according to Kogut and Zander (2003), is tacit and networks able to transfer and develop this kind, ie, networks capable of converting skills, experiences, models and techniques will be responsible for innovations. Thus, the ability to make good use of inter-organizational relationships and exploit them in order to gain competitive advantage, and to Gemunden Ritter (2003) competence network branches into two main parts that are in the same hierarchical level. The first part includes the tasks for network management that can be for specific relationships or inter-relationships in the organization. The second part is the qualifications for network management that translate into social or experts.

#### **4. EMBRAPA FOR NETWORKING**

In markets for products with high technological content, companies like Embrapa need of permanent interaction with their customers and their sources of information to streamline and optimize the process of innovation and delivery of knowledge and technologies with a view to effective implementation. Often certain factors considered critical, become real barriers to the process of technology transfer, making the knowledge and technology generated are not actually adopted by society.

##### **4.1 Technology Transfer for the Seed Sector**

The plant breeding was, and remains, one of the pillars of the expansion of Brazilian agriculture, both in acreage as productivity and quality of production. Genetic

researches crosses and select plants for five or ten years to generate a few grams or a few pounds of seeds called "genetic." These seeds need to get new cultivars to farmers, keeping unchanged the superior genetic characteristics acquired in the process of improvement. The seeds of the base class are generated from the genetic and planting those seeds are used by businesses for commercial seed production. In the 1970s, EMBRAPA has created the Office of Basic Seed Production - SPSB with several production units and marketing all over Brazil. This service was implemented in order to centralize the network between the results of the genetic improvement of EMBRAPA and the private sector seed, consisting of over 500 companies. In this initial form, the technology transfer is achieved through the offer and sale of basic seeds of EMBRAPA for the private sector. Revenue from the sale of basic seeds reverted to the maintenance of service activities.

The contributions of service to the network of agribusiness seed, second behind et al (2006), can be summarized thus: a) continuing source of innovation for companies via the release of new cultivars and differentiated b) Ensuring the maintenance, commercial seed , superior genetic characteristics obtained by breeders c) Use of the fields of basic seed multiplication for validation, development and dissemination of new releases from companies and farmers d) Reduction of time required for a new cultivar to be adopted by farmers and large reach planted areas; e) Use of the basic seed production technologies to generate or improve field production, processing, analysis and storage of seeds of new varieties; f) the maintenance of basic seed stocks allowing control of supply and enabling the private sector better plan their production goals; h) Use of new cultivars with the technical support the brand and reputation genetic BRS (exclusive of EMBRAPA).

In the 1990s, a combination of factors created conditions that Embrapa revise his role with the seed production sector. The establishment of a new intellectual property laws applied to agriculture favored the work of plant breeding and strengthened the position of breeders of plant varieties before the other players in the sector seed production and agriculture in general. The opening of international trade, globalization and the breakdown of trade barriers have exposed the seed industry to difficulties that arose with the easy entry of large companies.

Brazilian companies were exposed to an environment of fierce competition and felt the need to invest in technology to track the highest rate of release of new cultivars that have come to represent new options for farmers and resulted in effective gains in productivity and quality Brazilian agriculture (Prado, 2002).

During this period, the public sector faced a number of needs of financial, human and logistical became unsustainable for the budget and the structure of EMBRAPA. The establishment of partnerships has become essential for the Company to fulfill its role as breeders of plant varieties for agriculture that expanded its borders and modernized.

The partnership initially limited to public institutions increased involvement with the group of private producers that gave momentum, capillarity and agility to work in research and development of cultivars. In a dynamic process, the partnership system gradually evolves according to the needs of agriculture, changes in legislation on the subject and it molds itself to the characteristics and especially the expertise of partners (Miranda, 2005).

With this we can say that started the process of establishing inter-organizational networks, as quoted by Piore and Sabel (1984) and Powell (1996) in order to preserve their expertise, and at the same time, reduce contractual risks that occur in market

transactions in order to develop new cultivars with state companies, universities and research foundations established by seed producers and farmers. Also entered into several licensing agreements which delegated the production and marketing of basic seed of cultivars developed together with foundations of research. The flexibility in management, technical assistance and outreach provided by foundations and the private sector led seed cultivars EMBRAPA occupying more than 75% of the area planted with soybeans in Brazil in the late 1990s.

In 1997, the enactment of the Plant Variety Protection Act completely changed the landscape planting with regard to intellectual property protection and control over genetic materials developed by the research. Some contracts which assumed co-ownership for some soybean cultivars had to be revised to EMBRAPA to the ownership of exclusive new cultivars to be generated by the joint research. In this new scenario and stage of evolution of the seed business in Brazil, EMBRAPA tends to reduce its participation in the production of basic seed. The company tends to focus its action on technology transfer through partnership agreements with companies and private organizations.

The Office of Basic Seed Production - SPSB was later integrated into the Service Business Technology Transfer - SNT, seeking to act more broadly on technology transfer. The SNT's mission is to "formulate, propose, coordinate and implement the policy, strategies and management actions on the transfer of technology (products and services) that can be enabled by EMBRAPA and for the sustainable development of agribusiness in benefit of society."

## 4.2 Vision Seed Entrepreneurial Firms

In today's competitive agribusiness seeds stand out more and more enterprises with the so-called "entrepreneurial vision". In this view, according to Schumpeter, quoted by Nooteboom (1999), an entrepreneur builds a business on top of an innovation that consists of novel compounds, causing creative destruction and practices, showing a balance of power away from the market. And, complemented by analysis Bolson (2006), is the cultivation of the spirit of observation opportunities, imagination, creativity, innovative spirit, the habit of planning and taking risks. Have entrepreneurial vision means breaking paradigms, do differently, and plan to seek competitive advantages. The opportunities to undertake often arise through technological innovations or close observation of changes in consumption habits of potential customers. Technological innovations mean opportunities for small businesses with entrepreneurial vision. These innovations enable, for example, turning quickly, saw the sole intellectual property, small business of seeds and seedlings in powerful companies. In the burgeoning agribusiness there are many opportunities to engage in the sector of seeds and seedlings. For example: new varieties of plants with undoubted advantages. Revolutionary new methods of seed treatment may be the opportunist to start or expand a business in the seed sector.

Insufficient entrepreneurs endowed with entrepreneurial vision and management tools necessary to start or expand a business seed. Here are some examples of opportunities available to seed companies endowed with entrepreneurial vision: a) Entry of new species in cultivation in certain areas, b) Expansion and diversification of cattle pasture, c) improving the technological level of farmers, d) Decrease in manpower in the field, e) Installation of agricultural industries in certain regions; f) Valuation of biofuels; g) Valuation of environmental awareness; h) Ability to sell along with technical assistance;

i) The growth of organic food production j) New legal facilities, logistics and communications for exports.

Another striking feature of the seed companies with entrepreneurial vision is the long-term thinking. Companies that plan to prospect the future and anticipate trends. They can predict the most likely of several possible alternatives. They clearly define objectives, goals, actions, targets, resources and methods for monitoring and management plans. When planning law, different scenarios are simulated and future decisions are discussed with calmness and reason. The planning is not a sophisticated stuff, just within reach of large and medium-sized enterprises. He is an intelligent and cost compatible with the size of any business.

#### **4.3 Governance Network**

According VILLAS BOAS (2008) to be inserted in the chain of Research, Development and Innovation with the competitive challenge of developing cultivars that meet the diverse demands of the productive sector of Brazil, Embrapa is vital to establishing partnerships with the segments of biotechnology, plant breeding and regional adaptation to perform its mission. In early partnerships were limited to contracts for the provision of services to facilitate technology transfer. Gradually become more comprehensive, going from exploration to consider demand, through research and development to technology transfer, sharing risks, costs and benefits.

Agricultural expansion into new regions of the country stressed the need for breeding programs rely on the support of other organizations for testing regional adaptation of their materials, which at first had only the participation of several public research institutions statewide and Universities. Given the growing demand of the production

chain in different regions of the country, there was a need to intensify regional tests, seeking greater flexibility and capillarity. At this time groups of private producers, predominantly seed producer organizations formed to establish partnerships with Embrapa, in order to provide the support necessary for regional research and development of cultivars. This network produced effective results, contributing to the development of cultivars and production of soybeans, corn and others. It is essential to the commercial success of the partnership and consolidation of the joint planning of the various steps related to licensing, it is at this stage they are exploring the possibilities of mutual cooperation, discussed the needs of the parties and defined responsibilities. Thanks to partnerships, Embrapa began to experience a series of experiments very heterogeneous, with separate contracts, various partners and the involvement of different units of the company itself. Although the partner organizations have a common interest in the generation of cultivars and technologies that enable the development of agriculture, they are distinct in structure, objectives, composition, methods and resources available. This distinguished gathering constituted a new experience for a public research institution which now has an increasing involvement in negotiations, contracts, joint work plans, and business transactions that have become essential to his performance, leverage your results and generate additional resources for the company. To Embrapa consolidate as manager of the network is necessary to develop their negotiation skills in order to improve the partnerships and their management, enhancing the interaction with partners and adopting a monitoring system able to identify, prevent and resolve problems that can hinder the achievement of expected results.

## 5. CONCLUSION

The policy of Brazilian S & T, determined from the 80's, brought in its wake several new factors for research institutions, which led to threats or at least as factors causing disorder and inducing changes. In order to meet these new challenges and strengthen its contribution to economic and social development of the country, the institutes have been implementing organizational changes and modernizing its management practices. This is an arduous task, which involves embedding cultural change difficult and requires patience on your driving and clarity in the definition and correction of institutional direction. In seeking to understand how the relationship between Embrapa and the external environment is, we analyzed the evolution and the consequent transformation of vision that.

This study considered only the last segment of the PD & R process that deals with the transfer of technology but raised some interesting information about the realization of the research network for the generation of new genetic material. Regarding the governance of the network, we can consider that Embrapa has been for a period of 26 years and remains the main supplier of basic public seed cultivars important, as the key input to the seed business (Wetzel, 2002). Bolson (2005), in his study of entrepreneurship in agribusiness suggests that a powerful wave of change is close to the seed production chain and promises to destroy the old way of doing business, it is essential that entrepreneurs seed accompany technological innovations and changes in customer behavior, ie, it is necessary to tune the seed business with the demands and future requirements, for it will have to use strategic planning and business plans aimed at the professional segment the company has since its inception to the present day. Success in this respect will come with the consolidation of inter-organizational networks, mainly formed by the public-private partnerships, requiring, in addition to

offering good products and services, cooperation with the sectors in order to implement a fair and equitable distribution and promotion of its results. Overcoming this challenge requires greater integration with the actors involved in this network and the market demands and complementary skills, which often lie outside the company itself. This implies recognizing that the joint intra-and inter-institutional coordination capacity of network projects with institutions representing the various segments of the Brazilian agribusiness should be prioritized. This integration will be made in order to organize and integrate the actions of research and development and communications, focused on technology transfer to society.

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