
COLLECTIVE ORGANIZATIONS AND THE CHALLENGE OF PLANT BREEDING ON COTTON

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Abstract

This paper aims to investigate the emergence of farmers funding organizations, specialized in cotton breeding. Improved varieties of plants are important since they increase crop quality and production regardless of any other technological change. Considering the important role of collective breeding organizations on the market share of cotton seeds, the present study seeks to identify the incentives for the emergence of collective organizations for cotton breeding. Applying the concepts of institutional change, transaction costs and the logic of collective action, the genesis and the behavior of three organizations were investigated, as well as its performance amongst competitors. Discussions were addressed considering two basic premises: (a) by joining a collective action, individuals expect to gain higher than they could get acting alone; and (b) there is a tendency to internalize transactions when they occur under uncertainty, through the adoption of strategies that reduce the costs of these transactions. Chandler (1962) states that organization structure is the result of strategy designed according to the institutional environment and available resources, meaning that structure follows strategy. This logic can be applied to the emergence of collective action driven by farmers to work with technology generation in Brazil in the late 1990s, when the government had made significant interventions on both levels of the cotton sector: market and production.

Key words: Collective action, Plant breeding, Cotton

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1. Introduction

Plant breeding constitutes the first segment of agribusiness chains. This kind of research is responsible for create new varieties of crops to the farmers. The key challenge for plant breeding is the adaptation of species into diverse environmental conditions and suitable to field practices. Though, new plant varieties, disseminated by seeds are necessary to supply, in quantity and quality, the demand of the world population for grains, cereals, fibers, fruits, vegetables, as well as for energy and forestry species.

New plant varieties are obtained by breeding programs focused on incremental innovation, as they are dedicated to improve the performance of plant varieties already in use by farmers. Thus, by making use of genetic recombination – through conventional methods or using biotechnology – the breeders create new varieties able to withstand environmental stress, optimize productive factors, facilitate the handling and increase yield. Such improvements impact not only on the production costs, but also reflect on the price of products to the consumers.

Much of the success of Brazilian agriculture is linked to favorable conditions of soil and climate, as well as the confluence of economic, institutional factors and the entrepreneurial capacity of groups and individuals. In equal measure, its evolution can be credited to the active participation by research-generating technology, whether performed by the public sector or by private agents.

The agents responsible for the sponsorship and development of breeding programs are known as breeders. In Brazil, traditionally, breeder activities are carried out by governmental organizations. However, in the recent decades, trade liberalization in conjunction with the potential of Brazilian agribusiness has attracted investments from private companies, both national and foreign.

Among the breeding companies one can note that transnational companies are the most competitive and characterized by the diversity of products and services offered to the farmers. Among the nationals we can highlight the performance of farmers collective organizations. With a high capacity to invest and compete with foreign specialized companies these research organizations stand out among other farmers collective actions¹ – traditionally dedicated to provide services related to technical assistance and technology diffusion for their members, or even, for collective purchase of input or group commercialization of their products.

We take, as a context for the study the initial links of the agro-industrial chain of cotton, with the aim of observing the mechanisms that motivate farmers to get together in collective actions to invest in research to obtain new cotton varieties. Therefore, through an analysis focused on plant breeding activity, we have sought to understand how groups of

¹ For the purpose of this study, collective organizations will be considered synonymous with collective actions. In one ample sense, collective action can be understood as being a voluntary association of people sharing common interests, able to represent the possibility of working on the solution of problems on a local, national or global scale. The concept collective action transcends formal organizations, generally represented by associations and cooperatives, able to assume the informal groups engaged in collective efforts, such as realizing a mutiny or political lobby (SANGLARD; SANTOS, 2013).

farmers have become strong competitors in the Brazilian seed market.

Observing the incentives for emergence of private collective organization such as COODETEC, Fundação Mato Grosso (FMT) (*Mato Grosso State Foundation*) and the Instituto Matogrossense do Algodão (IMAMT) (*Mato Grosso State Institute of Cotton*), could show up strategies affecting governance structures, as well as the relationship between the agents of the agribusiness chain. It also brings out the possibility to study the dynamic and the coordination within agro-industrial systems. Addressing such discussions, we take as basic premises that, first, entering into a collective action, individuals expect to obtain superior gains compared to what they could achieve alone and, secondly, that there is a tendency for the internalization of transactions when these occur under uncertainty, through the adoption of mitigating strategies to reduce the cost of these transactions. The resulting analyses can be useful to improve institutional mechanisms for strengthening the collective actions of public interest, which, from the strategic point of view, is important for the agribusiness in the country.

Therefore, the general objective of the present study is the identification of the factors that stimulate collective actions by Brazilian farmers, turned into shareholders of companies specialized in plant breeding. Specifically, we seek: (a) to report institutional and economic changes that can unleash collective actions for plant breeding; (b) to analyze the influence of market structure for the emergence of collective organizations for plant breeding; (c) to describe common strategies adopted for the establishment of such organizations; and (d) to point out the challenges and opportunities resulting from the process of creation of such organizations.

This investigation, of qualitative nature, applies economic concepts of strategy of organizations to discuss multiple cases, seeking for clarifications about the behavior of cotton chain agents, acting specifically on plant breeding. In this context, secondary sources of statistical and marketing data will be used, as well as academic-scientific papers and information from official documents of the Government, other entities and the organizations themselves.

The article is divided into six parts, including this introduction. After presenting the theoretical basis, there follows the third part, dedicated to a report the recent history and institutional context of the cotton in Brazil. Under the section number four we present a description of cotton chain, focusing the segment responsible for plant breeding. The fifth section proceeds with an analysis of the agents relationship based on theoretical literature review. This study concludes with the final considerations and perspectives for future investigations.

2. Theoretical Basis

Alfred Chandler (1962) states that the organizational structure reflects the strategy shaped by institutional environment and available resources, meaning that structure follows strategy. This logic can be applied to the emergence of collective actions conceived by farmers in order to develop innovation in Brazil in the late 90's, a period with remarkable changes in the role of the State and in the competitive environment of the market (ZYLBERSZTAJN; MACHADO FILHO, 1998).

For Douglass North (2011, p. 3-5) institutions are the rules of the society, more specifically, formal apparatus – such as the norms – and informal – such as the codes of behavior – conceived to restrict and design the interaction among people. The evolution of

these rules reflects the belief of men, which, in turn, acting as a group, create organizations that somehow, will affect the institutions. The cooperation among farmers address their interests to obtain support to the development of their activities. This behavior and its effects on the institutions can be analyzed by the optic of North, who uses the theory of collective action advocated by Mancur Olson associated to the theory of transaction costs proposed by Ronald Coase and defended by Oliver Williamson.

According to North's concept, the organizations focused in this study were subject to the effects of institutional change, when restrictions create opportunities (KNIGHT, 1964). According to Coase (1960) the firms internalize some productive phases in the attempt of reduce the costs of market transactions and which concretization depended on the "contracts". Organizations were, therefore, a nexus of contracts.

Giving the existence of transaction costs it is also necessary to understand how they contribute to set resource coordination and how this can impact over economic performance, to create institutional arrangements. With this view, Coase inaugurated the Transaction Costs of Economics (TCE) by considering the economy of the organizations a matter of contract, which unit for analysis was the transaction (WILLIAMSON, 1985).

Williamson (op.cit.) links some behavior premises to TCE. The first assumption is the limited rationality, in which in spite of the desire of the economic agent to optimize the resources, it cannot be achieve (ZYLBERSZTAJN, 1996). The other assumption treated by the author is opportunism, meaning that agents can act in their own interests, against the other contract party before the transaction occurs, or even during the lifetime of contracts.

Given these assumptions, Williamson (op.cit.) describes the dimensions of each transaction and their relation to the elected coordination form, or governance. The first dimension of transactions is the "frequency", which enables the creation of reputation between agents and dilutes the costs of adopting a complex mechanism in the presence of many transactions. Another dimension is the "uncertainty" which concept is applied to the non-predictable contingencies that can appear in a transaction.

The dimension that has motivated the largest number of studies is the assets specificity². Specific investments can induce value appropriation of one contract party, a situation known as "hold up". This problem occurs when one party of the contractual relationship behaves in an opportunistic manner in the face of the other party. Once the one who made the specific investment cannot convert his asset to another application without a loss of value, the other party forces the renegotiation trying to appropriate of the income of the first party.

Williamson (op.cit.) associates the choice for governance type to the degree of specificity of the assets involved in the transactions. When the asset is not very specific, the market is the form of coordination that presents the lowest cost. As the specificity increases, reaching the mid level, the hybrid form (for example, outsourcing contracts) is the best form of coordination to minimize costs. However, when the asset specificity is very high, the internalization of the activity is a good way to lower the costs to the firm. This hierarchy situation, or vertical integration, is the best alternative to avoid opportunistic behaviors of appropriation of income and to minimize costs.

The institutional environment was also described by Williamson (op.cit.) as a group of

² The concept of specific asset can be applied when a certain asset cannot be re-used in another activity without the loss of value. Therefore, the value depends on the continuity of the transaction; the greater the degree of specificity the greater the need to safeguard the investments, in order to avoid opportunistic behavior from the other party.

basic social and cultural rules that define individual and collective behavioral characteristics. This also includes the legal systems to solve disputes and the adopted macroeconomic policies, tariffs, taxes, whose bases for production, exchange and distribution were established by the government, partners and competitors.

The institutional arrangements in progress can either facilitate or make economic development more difficult for certain sectors of the population affecting the way in which organizations operate in a competitive environment. According to Coase (op.cit.), the coordination process was not only based on the rationality of the agents, but also in the contracts between them and, above all else, taking into consideration the perceived transaction costs and information constraints.

Under uncertainty, organizational strategies seek for creating favorable market conditions for their agents. In the context of agribusiness, the cooperation occur, as a rule, in order to facilitate access to production factors – land, inputs, credit – or even, as a way to add advantage in the marketing of products at the other extreme of the chain. In agriculture, associations with productive aims also appear to enable or reduce the cost of adopting new technologies. For example, it is common that less capitalized producers that would like to access modern equipment do this through joint purchasing and shared use. Therefore, in the process of incorporating innovations, the relationships are more intense and, consequently, the productive chain is strength (SZAFIR-GOLDSTEIN & TOLEDO, 2004).

At the current stage of agriculture, seeds are the main vectors of technology. Whether through conventional breeding or by the use of genetic engineering, as mentioned before, plant breeding is the most effective way to increase crop yields, to adapt crops to different climatic conditions, to improve the management system, to create resistance to pests and diseases and to comply with market requirements. Develop plant breeding, however, requires high specific investments. This is one of the main reasons why this activity is usually performed by the government. Few private companies can afford the operation cost of plant breeding activities, because there are risks and long-term return.

In this sense, the implementation of Plant Variety Protection Law, in 1997, has contributed to attract private investments to the breeding of agricultural crops – especially for species of high economic interest, such as soybean, rice, wheat, sugar cane and cotton. The formal recognition of property rights by the state ensure exclusivity rights over seeds resulting protected varieties, allowing the royalty collection by breeder companies (FUCK & BONACELLI, 2008).

3. Cotton in Brazil

Cotton produces the most important fiber for the international textile industry. It is also the second largest source of vegetable oil (ABRAPA, 2011). However, the value of this commodity for the industrial sector was not enough to guarantee stability in its primary production. The trajectory of cotton in Brazil has alternated between favorable moments and failures³, and its production reflects the dichotomy of our agriculture, to the extent that it is possible to observe two distinct groups situated on different levels of income, of technologies and system management. The first, constituted by smallholders farmers use rustic practices of production, whose low efficiency of economic revenue entails attempts at compensation for

³ The performance of the Brazilian Cotton-culture cannot be measured only in function of the productive aspects. The sector is historically affected by international prices, by the world economic situation and by protectionist policies.

product differentiation, for example, the organic or colored, and promoted by socially fair trade. The other group is comprised by large professionalized producers who realize large investments and make use of specific expertise and the latest technology in order to maintain a high rate of return (BRASIL, 2007).

Until the middle of the 80's, Brazil was self-sufficient in the production of cotton and was known as a notorious exporter, supplying almost 10% on the international market. The commercialized cotton was the arboreal type, which was perennial and predominantly on the Northeastern region of Brazil. Despite not result on high incomes to the producers, this type has a good quotation on international market because its long fibers and high resistance. The destabilization of this production system began in the 80's, with State interventions on the market: on one hand restricting the export of raw material such as cotton fibers and on the other, allowed the purchase of cotton in the foreign market with subsidized credit, provoking the fall in domestic prices.

Another factor that contributed for the decline of cotton was the boll weevil⁴. It is estimated that the Brazilian cotton-culture crisis between the mid-80's and the mid-90's had caused an unemployment rate of approximately 800 thousand direct workers, leading to the one of the greatest (in number) and quickest rural exodus registered in the history of the country (BRASIL, op.cit.). The public institutions, until then the responsible for finding solutions for agriculture, did not react in the expected manner due to the budgetary cuts to which they were submitted. Other obstacles to the timely actuation of the governmental research system were the geographical limitations to the experimental centers and the bureaucracy.

The domestic production of cotton has been recovered in 1999 stimulated by the currency devaluation, the prohibition of long-term purchase on international market, the incentives to acquiring machinery and equipment, the rising of the international prices and the improvement of fiber quality. The latest aspect resulted from cotton breeding, which even with the suppression of federal research financing, got the support from state governments – as for an example, through the implementation of the Facual Fund⁵ which will be discussed later in this paper. Such support maintained the main research programs responsible for supply the farmers with new varieties, keeping the crops tolerant to pests and diseases, which caused great damage during this period. One of the consequences of cotton breeding was the influence on the predominant type of cotton. The arboreal was replaced by the herbaceous type, which demanded a considerable adjustment on cropping system and caused an impact on all productive chain.

The damage caused by the *boll weevil*, as well as the changes in the production system – requiring advanced knowledge and higher investments – demotivate farmers of Paraná and São Paulo states (at that time, the most important area for cotton production), who began to dedicate to other crops. Along the 90's the cotton crop gradually expanded to the Center-West region driven by favorable weather and soil conditions. Another important factor was the

⁴ The *boll weevil* (*Antonomus grandis* Hohenan) is a small beetle, considered the most serious of Brazilian cotton due to the damage it provokes and the difficulty of keeping it in check. It was first detected in Brazil in February of 1983, in the region of Campinas-SP (Braga Sobrinho & Lukefhar, 1983). Currently, the *boll weevil* is spread throughout every Brazilian states where cotton is grown. The use of varieties tolerant to its attack, and handling practices are fundamental to maintain this pest under control in levels that are less damaging.

⁵ Facual Fund - *Fundo de Apoio à Cultura do Algodão*, is formed by the resources from waive tax of the state government of Mato Grosso, Goiás and Bahia, from part of sales tax paid by farmers and used to sponsor cotton breeding, labor training and to promote the cotton crop.

presence of more capitalized farmers with appropriate machinery structure and modern practices compatible with the needs of the “new cotton” – learned from soybean management - besides the interest to diversify the crops in the region (FAVERET FILHO; THIBAU, 2002).

Despite the migration of cotton to new areas, the public research centers persisted in the search for solutions, especially for the Northeastern region, obtaining results that gradually made it possible to overcome the local crisis. Even though they were far from achieve the volumes produced in the past, during the 2000 decade, the Northeastern states kept up the yields compatible with the large producers of the country. Given the social role of cotton growers, the crop has always received financial support from federal government. Subsidies for small holders work as incentives to improve income of rural population and also contributes to the generation of jobs.

In the new cotton frontier, located in the central region of Brazil, two factors were determinant to production and consequently to the establishment of the crop. These are: availability of equipment and know-how to grow cotton on large extensions of land. The income generated by cotton was converted on large investments to install processing units and to achieve specialized machinery. Such assets are highly specific, if we consider they can't be used for other crops. Under the increased pace of development, we verified the strength of the relationship between farmers and researchers. The former were avid for technology and were aware to the difficulties research institutions were going through in terms of financial resources and infrastructure. The public institutions in turn saw possibilities of obtaining resources and speed the breeding programs. We see here a combination of aspects considered fundamental for the consolidation of the agricultural activity and for the construction of relationships that gave origin to the collective organizations. We register as a precursor to this movement, *Coodetec*, which resulted in the collaboration among various Cooperatives of Paraná and *OCEPAR*. In this same line, we see partners in the central region of the country involving rural producers and public institutions such as *IAC* and *EMBRAPA* and *IAPAR* which culminated in the creation of the organizations, which became independent with the passing of time and evolved into their own research programs.

In the year of 2010 Mato Grosso sown 723 thousand hectares of cotton, the Brazilian largest area, surpassed the 2.5 million tons of pitted cotton. Bahia state, with more than 400 thousand hectares, had the second major yield, 1.6 million tons, contrasting the 145 thousand total tons produced by the rest of the Northeastern states. Other relevant states are Goiás, Mato Grosso do Sul and Minas Gerais, reaching almost 5.2 million tons of pitted cotton, harvested from 1.39 million hectares sown in 2011 (CONAB, 2012).

Approximately 80% of the production is sold directly by the farmers to domestic spinning and the rest is exported. The trade negotiations, being domestic or international, exclusive or in a group – depending on the volume sold -, count with the support of organized associations, on the state level as well as on the national level.

Besides being well-tuned one to one another, the associations administrative staff are comprised of farmers, experts and executives who combine their capabilities to other professionals specialized in agriculture, economy, foreign trade, marketing as well as to other institutions with agribusiness know-how. The actions are coordinated by the Brazilian Association of Cotton Producers (ABRAPA) headquartered in Brasilia through a team that constantly monitors the international and domestic markets and interacts with public and private organizations, as well as conducting some important negotiations with other agents of the supply chain. Cotton producers have 18% of the gross production value (GPV) of the

chain, which is estimated on 37 billion dollars, they also generate more than 19 billion dollars of aggregate GNP (ABRAPA, 2011).

4. The Cotton Chain

Simplifying the cotton supply chain, it can be described as shown on Figure 1. The first agents are the input suppliers, followed by the farmers that produce the pitted cotton and deliver to the processing units, or mills. Then, the fiber is processed by the weavers and forwarded to the clothing industry in charge of supply the consumer at the retail market.

Figure 1. Cotton supply chain in Brazil (simplified diagram)



Source: The authors

The chain is designed according to the role and technological processes used by the agents. As previously mentioned, the substitution of arboreal for herbaceous type of cotton implies in the radical transformation in the handling of the crop and in the placement of the lands for production which, in turn, demand the incorporation of innovations to maintain the supply of the product to the chain. Although the success of the activity is also owed to the convergence of economic and institutional factors as well as the entrepreneurial spirit of groups and individuals, the evolution of the processes depend on the active participation of research, whether they are done by the private sector, by public agents or even by collective actions with specific interest in developing techniques and products. Especially, genetic improvement programs for plants result on innovations in the form of new varieties, which are able to minimize costs, tolerate environmental stresses, optimize production factors, facilitate crop management, increase yield and, consequently, the income of agents involved in the agribusiness chain.

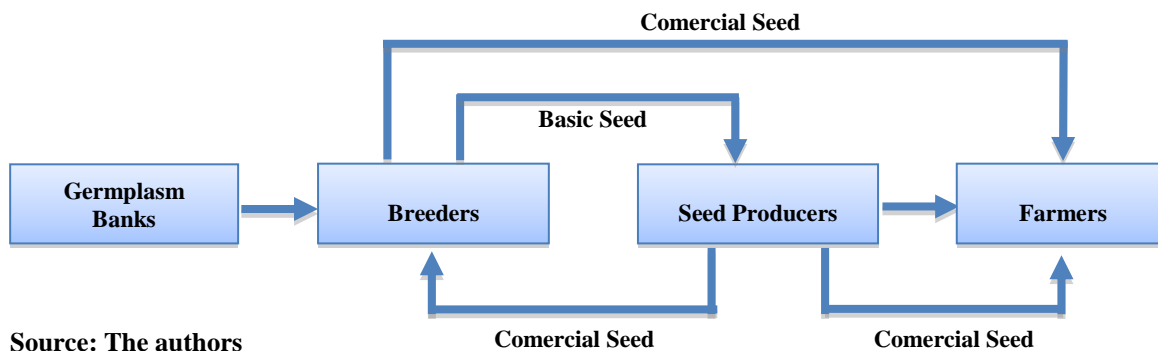
To support further discussions it must be considered the economic value of the genetics of the seeds for agriculture as a whole. In this sense, the renovation of the cotton varieties used by the farmers, has shown to be also important for the industry sector once it can lower the price of the fiber and meet the requirements of apparel industry.

On Figure 2 one can better understand the transactions among the agents involved on cotton seed production. The creation of new varieties begins with access to the germplasm banks – collections of varieties used by breeders to access genetic variability. More than dispose the plants that will be used in the crossings, the banks and collections are libraries of traits or features of the species, with fundamental information to drive breeding programs. The breeders lead the programs, the expert team, own the infrastructure composed of fields in the countryside (or contracts to run the trials in different locations), greenhouses, laboratories and other facilities to run the necessary research and test involved on the creation of new varieties. They employ genetic techniques, plant science, entomology, plant pathology, biology and other specialties in conjunction with contracted experts.

Once elected for being used by the productive system, the varieties have their seeds multiplied in commercial scale. Depending on the amount and the recommended location of

the variety, the breeders realize licensing contracts with specialized producers for multiplication on large scale. The farmers normally purchase the seeds from breeders commercial representatives or from seed producers licensed by the breeders.

Figure 2. Cotton seed production chain



Source: The authors

5. Analysis of the Dynamic of Breeder Segment

Notwithstanding the breeding importance, it is deeply linked to the various agents of the agribusiness chain. Goldberg (1968) considered that the agents individually cannot work with effectiveness if they do not take into consideration the global behavior of the system in which they take part. Therefore, the phases in the chain are inter-dependent to the point that it is possible to identify along the production process the influence of agents not always directly involved in specific transactions. In cotton chain, for example, the demand of the weaving industry naturally affects the price of different types of fiber, which can reflect on the choice of consumers of clothes. On the other hand, weaving industry also affect the choice of farmers on selecting a variety with specific genetic characteristics to produce the fibers valued by the industry.

Among the changes in the productions system which have taken place during the decades of the 90's and 2000, one can highlight the emergence of farmers fund organizations in the sector of cotton breeding taking up the place of public organizations in charge of this type of research until then.

Decentralization and Organization

The government for numerous decades was the only agent investing in cotton breeding research. A network for breeding and other sort of researches was established during the 1930's, when cotton reached the top product in the Brazilian economy. Integrated by public institutions the network lasted until the late 80's, when their principal units were deactivated, due to the devastating effect on the arboreal cotton crop caused by the boll weevil (FREIRE; MORELLO; FARIAS, 2011). The remaining active programs were those run by Embrapa (extensive to the Northeastern region) and by the Agronomic Institute of Campinas (IAC). These two institutions, jointly with the Agronomic Institute of Paraná State (IAPAR), during the 80's performed the first evaluations for adaptation of cotton varieties on the Center-West region. But only in 1988, after the government cancel its own monopoly over seed production, the private organizations finally began to demonstrate interest on cotton breeding.

In 1990 the Organization of Cooperative of Paraná State (Ocepar) through its department of plant breeding – which later gave rise to Coodetec -, was the first entity in Brazil to implement a private program for cotton breeding, jointly with Cirad, a French research institution. Together with other partners located in the Center-West region – such as Unicotton, a cooperative of cotton producers of Mato Grosso – and being sponsored by Facual Fund, Coodetec, had released the first new varieties for the central region of Brazil in 2002. However, years later, given the change of interest of farmers from Paraná, Coodetec negotiated the transference of their cotton breeding program to the Mato Grosso Institute of Cotton (IMAMT).

The IMAMT was founded in 2007 by the Mato Grosso Association of Cotton Producers to support the research for the development and the strength of cotton crop on that state (IMAMT, 2013). The Fundação MT is also a result of a collective action of the farmers and began the cotton breeding in 1995 in a partnership with Embrapa, IAC and IAPAR counting as well on the financial support of Facual (FUNDAÇÃO MT, 2013).

Other breeding companies worth be mentioned are Bayer Cotton Seed International and Delta & Pine Land Technology Holding Company (owned by Monsanto), then counting four private breeders, being two transnationals and two farmer organizations.

Applying the Theory

The motivation for the emergence of collective organizations represent an important phenomenon that also reveals the influence of institutional changes in the seed innovation sector. The change on the economic scenario transforms the conventional governance structures and affects the relationships and market strategies while shows up a third force – constituted by grouping of farmers –in an environment where the main agents are traditionally the state-owned companies and the transnationals.

The growing demand for new technologies came up with agriculture expansion and the raise of specialization in this sector. However such demand could not be supported exclusively by the public sector and the government adopted the strategy of encouraging the entrance of companies on plant breeding business allowing the royalty collection over new varieties protected by Plant Variety Protection Law. As an additional consequence the plant breeding research in Brazil would sped up and the government could address the budget to other priorities.

The Figure 2 presents a situation where cotton seeds are multiplied by specialized producers. The seed producers are farmers who, besides dedicating themselves to the production of pitted cotton for the industry, they also detain a higher level of technology to produce seeds. On that regard, they differentiate themselves by expanding their business scope and by improving their production system to higher levels, therefore increasing the level of investments. However, as seen in the previous section, the breeders keep controlling the kind of produces varieties and the amount of the seed multiplied by the licensee seed producers⁶. From this point of view, seed producers are in the same situation of access to new varieties as the rest of the non-specialized farmers, with the choice limited to those varieties elected by the breeder. This situation is of great concern on the part of cotton producers, once can affect the quality and the quantity of the seed available for planting.

⁶ The picture described here are suitable to varieties formally protected by property rights. For varieties under public domain the relationship between seed producers and breeders, if exists, covers objects other than the variety. However, this situation is unusual in sectors with intense technology generation, if we consider the duration property rights tend to be greater than the useful life of the variety.

Aware of the importance of seeds for the survival of their activities, the farmers mobilized through class associations, of which they were members, and created new organizations to take the control over the research in plant breeding, aiming to fulfill their own needs. This attitude is coherent with the model developed by Zylbersztajn and Farina (2010) for cooperation networks where they verified the effects of externalities in the choice of strategies by the agents, suggesting that the integration between them would be structured as a way to protect themselves from risks after the transactions, especially in the presence of specific investments.

According to Williamson (1985), the specific assets have their value compromised in the case of relocation provoked by a premature rupture or interruption of the contract. The existence of specific assets in a transaction entails costs to manage and conserve in order to preserve the continuity of the links established between the parties. The specificity of the assets is the most important inducer of the type of governance once it implies in bilateral dependence. The farmer that realizes investments seeks for the guarantee that, at the moment of sowing, the inputs will be available. The lack of options by the farmers side causes, as consequence, dissatisfaction with suppliers and leads to the search of new sources of inputs.

This context can be analyzed under the influence of uncertainty and frequency, two other elements that, according to Williamson (op.cit.), shape the transactions and influence the relationship between farmers and breeders. In other words, these aspects interfere on the choice of the governance structure adopted by farmers. For Williamson, the uncertainty can be calculated as losses arising from contract break can affect the adopted governance structure. The uncertainty about the behavior of the parties involved in the transaction - which can tend to opportunism - permeates transactions between farmers and breeders. From the observation of Zylbersztajn (1996) frequent transactions allow the recovery of costs related to investments and make possible the emergence of firms as unified forms of governance. On that regard it can be suggested that there is a perception of an extreme dependence from one party, that can decide for internalize transactions threatened of discontinuity. It is important to note that the "party" that is actually a collective organization whose members have in common interests related to a situation of uncertainty in transactions between farmers and breeders.

For North (2011) the institutional environment is the reference for individuals to understand the current circumstances. Nonetheless, the individual choices will be based upon subjective perceptions coming from the asymmetry or the incompleteness of the information, thus, not having the ability to foresee behavior. According to the author, is hard to sustain cooperation under uncertainty, once the game is not repeated; when there is a lack of information about other players; or when there are many players. The existence of institutions mitigates this situation. Therefore, new institutional arrangements, such as the cooperation under the form of a new organization can work as reducers of the uncertainties involved in human interactions.

In this context, collective actions are considered by the farmers as a safe alternative that, at least, could generate return in the form of individual benefits (OLSON, 2011). The author uses the Theory of the Logic of Collective Action to discuss about the reasons why individuals act together. He focuses on organizations that supposedly promote the interests of its members and includes the concept of collective assets as a factor of stimulus for the constitution of groups. Therefore, the individuals join together to reach a common objective that they couldn't achieve individually. Collective assets in this case refer to the goods that are at the service of the members of the organization, such as for example, the varieties, the

technologies for production, technical assistance, among others.

Another empirically perspective was tested by Willer (2009). It is based on the social rewards collected by the individual members when they dedicate themselves to the strengthening of the collective action. Such gains would be linked to the hierarchical ascension in the group and the influence over the other members, without having any negative connotation. On the opposite, the group is benefitted by the elevated contribution provided by the leadership of individuals, once it is converted to the collective good or works as a feedback to the motivation of the group as a whole.

6. Final Conclusion and Considerations

This report analyzed the aspects that contributed to the emergence of farmers collective organization dedicated to cotton breeding. The phenomenon was discussed under theoretical perspectives of New Institutional Economics and the theory of collective actions. The findings suggest that collective organizations reflect a tendency for the protection of specific investments, the reduction of uncertainty and the transaction costs, besides the appropriation of value over the protected cultivars. The observed cases reflect, however, the classical idea of Chandler (1962) that the implementation of new strategic arrangements require compatible structures, otherwise, they can result inefficient.

The history of cotton crop in Brazil, the know-how learned from soybean experience and the recent trajectory with paths interlaced with the research, confirm the successful strategy adopted by farmers. It also allows to apply the Williamson (1991, p. 83) model which compares the costs of governance structure, considering the safeguards and the specificity of the assets as variable, as well as his conclusion which refers to the choice for the internalization of the breeding activity: *“Vertical integration is the organization form not of first but of last resort – to be adopted when all else fails. Try markets, try long-term contracts and other hybrid models, and revert to hierarchy only for compelling reasons.”*

Valle (2002, p. 9) when analyzing the cooperation on research environment aiming the innovation, also used the Williamson model to presume that *“the formation of institutional arrangements aimed at obtaining research and innovation can be a virtuous strategy, as long as the resulting transaction costs do not surpass the costs of implement hierarchy on the innovated activity.”*

The success of farmers fund organizations to develop plant breeding raise incomes for the institution through the collection of royalties when new varieties are used in the production system. On the other hand, the advantages revert to the very members of the association who can count on the genetic improvement of the seeds used for planting and the guarantee of their supply. There are estimations that breeding programs have increased yield on 1.0 to 1.3% per year, in numerous countries in the world, including Brazil (MORELLO; FREIRE, 2005). Other benefit is the privilege of access, allowed to the members of the organization by exclusive licenses for multiply the commercial seeds of the new varieties.

The leaders of the farmer organizations declare that besides plant breeding being a hard and complex job, this as a way of avoiding dependence of the private seed companies specially the foreign ones, noting the previous experience with soy. Behind this conduct it is possible to perceive other types of rewards that go beyond monetary values. On the other hand, the appropriation of benefits of a conjoined action is complex, demanding the development of management models able to conciliate the individual interests with the collective ones.

With this study we have verified the opportunity to deepen the analysis beginning from the point of view of the organizations members, listening their point of view and confronting them with the hypotheses suggested by the theoretical perspectives. The analysis of the decision process within the organization and their financial flows would also allow to judge the organizational efficiency and, consequently, detect eventual rewards, or benefits received by the members of the organization. With the intent of enriching the knowledge about the collective research organizations, especially noting their challenges and their competitive advantages, other aspects suggested to be investigated are: the way they deal with property rights; their relationships with competitors; and the different strategies adopted in order to maintain the level of competitiveness in the market.

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