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Incentives and financing for research and innovation in agriculture: study in research foundations in the South of Brazil

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Abstract

Brazilian agriculture is increasingly consolidating as one of the world's leading food producers. The major challenge of this branch is to meet global demand for food, which, according to the Food and Agriculture Organization (FAO), will be 60% higher in 2050 than today. This challenge is aggravated by changes in dietary habits, climate change, and environmental impacts. This research was based on the Resource Dependency Theory, which assumes that no organization is capable of generating all the types of resources that it needs for its survival and growth, and therefore depends on its external environment to obtain resources that enable its operation. The general research objective was to discuss the dependence of resources for research and innovation in agriculture in five Research Foundations in the south of Brazil. The study was descriptive and comparative, with a qualitative approach. For data collection, semi-structured interviews were conducted with the managers responsible for the five selected Research Foundations. The results pointed out that, despite the existence of financing lines and fiscal incentives, there is still a predominance of private resources in researching for innovation in agriculture. The researched foundations rely on maintainers, who are responsible for providing resources not coming from the public sector or from the entity's organic revenues.

Keywords: Innovation Policies. Research and Development. Theory of Resource Dependence.

Incentivos e financiamentos para pesquisa e inovação na agricultura: estudo em fundações de pesquisas na região sul do Brasil

Resumo

A agricultura brasileira cada vez mais se consolida como um dos principais produtores mundiais de alimentos. O grande desafio deste ramo é atender a demanda global que segundo a *Food and Agriculture Organization,* em 2050 será 60% superior a atual. Tal desafio é agravado pelas mudanças de hábitos alimentares, mudanças climáticas e impactos ambientais. Esta pesquisa utilizou como base a Teoria da Dependência de Recursos, a qual parte do princípio que nenhuma organização é capaz de gerar sozinha todos os tipos de recursos que necessita para a sua sobrevivência e crescimento, e, por isso, depende do seu ambiente externo para a obtenção de recursos que viabilizem seu funcionamento. Dessa forma, buscou-se como objetivo geral discutir a dependência de recursos para pesquisa e inovação na agricultura em cinco Fundações de Pesquisa na região sul do Brasil. O estudo desenvolvido tem caráter descritivo e comparativo, com abordagem qualitativa. Para coleta dos dados, foram realizadas entrevistas semiestruturadas com os gestores responsáveis pelas cinco Fundações de Pesquisa selecionadas. Os resultados apontaram que, apesar da existência de linhas de financiamento e incentivos fiscais, ainda existe um predomínio de recursos privados na condução de pesquisas para inovação na agricultura. As fundações pesquisadas contam com mantenedores, os quais são responsáveis por prover os recursos não oriundos do setor público ou das receitas orgânicas da entidade.

Palavras-chave: Políticas de Inovação. Pesquisa e Desenvolvimento. Teoria da Dependência de Recursos.

Incentivos y financiamientos para investigación e innovación en la agricultura: estudio en fundaciones de investigación en la región sur de Brasil

Resumen

La agricultura brasileña se consolida cada vez más como uno de los principales productores mundiales de alimentos. El gran desafío de este ramo es atender la demanda global que, según la Food and Agriculture Organization, en 2050 será un 60% superior a la actual. Este desafío se ve agravado por los cambios de hábitos alimenticios, cambios climáticos e impactos ambientales. Esta investigación utilizó como base la teoría de la dependencia de recursos, que parte del principio de que ninguna organización es capaz de generar por sí sola todos los tipos de recursos que necesita para su supervivencia y crecimiento y, por eso, depende de su ambiente externo para la obtención de recursos que viabilicen su funcionamiento. De esta forma, se buscó como objetivo general discutir la dependencia de recursos para investigación e innovación en la agricultura en cinco fundaciones de investigación en la región sur de Brasil. El estudio desarrollado tiene carácter descriptivo y comparativo, con abordaje cualitativo. Para la recolección de los datos, se realizaron entrevistas semiestructuradas con los gestores responsables de las cinco fundaciones de investigación seleccionadas. Los resultados indicaron que, a pesar de la existencia de líneas de financiamiento e incentivos fiscales, todavía existe un predominio de recursos privados en la conducción de investigaciones para innovación en la agricultura. Las fundaciones encuestadas cuentan con patrocinadores, que son responsables de proveer los recursos no oriundos del sector público o de los ingresos orgánicos de la entidad.

Palabras clave: Políticas de innovación. Investigación y desarrollo. Teoría de la dependencia de recursos.

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INTRODUCTION

In the last decades, both the growth of the productivity and the new agricultural creations, both driven by public and private investments in technological innovation in agriculture, have surpassed the increase in the amount of land and labor employed, and are the main booster of the rise of the total food availability (PARDEY and ALSTON, 2012).

The innovation is a great challenge, mainly in business like agriculture, which involves a number of risks, such as climatic factors and price variabilities. In this context, in order to achieve greater efficiency in agriculture, its managers are responsible for executing two tasks: integrating technology strategically suited to the entire production and commercialization chain; and develop and exploit the innovation capacity in the sector (BURGELMAN, CHRISTENSEN and WHEELWRIGHT, 2012).

Besides, there are improvement factors that need to be constantly improved and researched. According to Tan and Nasurdin (2010), agriculture needs creative solutions to solve problems identified in its daily life, as well as the development or improvement of processes, for new cultivars and services related to the production chain. As improvement examples we have the search for cost reduction, increased productivity and products quality, making them healthier.

The creation of Research Foundations, not for profit, represents and synthesizes a fundamental milestone in society, which Salamon (1998) calls the Associative Revolution. This revolution, according to the author, originates from the people's own awareness of the need to form associations, foundations and other types of Third Sector organizations, in order to develop projects for the benefit of society and the environment. The continuity of such organizations, although benefiting from certain incentives and public policies, needs other resources that allow the maintenance and development of their projects.

Regarding the need the resources for innovation, Costa (1999) states that it is not about spending, but rather of applying the resources. According to Freeman (1984), the innovation system of a country must be able to operate in order to meet the requirements of the innovation in four areas: a) The State intervention through public policy; b) The way companies formulate their strategies in research and in R&D development; C) The education policies for human resources training; d) The conglomerated structure, the internal organization of the firms and the relationships between them. In the vision of Corder and Salles-Filho (2006), the State is better able to provide direct resources, either through tax subsidies, fiscal incentives, or assuming risks, rejected by the market, stimulating the private initiative to new projects, based on partnership with the public sector.

To analyze the degree of resource dependence in the Foundations studied, the Resource Dependence Theory (RDT) was used, which defends the idea that certain decisions are made within the political and internal context of organizations in order to relate with the conditions of the environment where they are inserted. This theory has as one of its main aspects the idea that there is a choice of managerial strategies to adapt to the environment, that is, strategies of how to relate to the dynamic environment, manipulating it in its favor and capturing resources such as: raw materials, financial resources, human resources, systems and information that are necessary and vital for decision-making (ROSSETTO and ROSSETTO, 2005).

With regard to the structure of the article, firstly will be presented the theoretical framework, which approaches the innovation concept in agriculture and the resource need based on the RDT; Next, the methodology used in the research development will be described; and, lastly, the result analysis obtained in the field.

THEORETICAL REFERENCE

Resource Dependency Theory (RDT)

RDT assumes that no organization can generate on its own all the resource types it needs for its survival and growth. Thus, all organizations depend on their external environment to obtain resources that enable their functioning. These resources can be the most varied, from raw materials, financial resources, human resources, systems and information. Therefore, there is an organization's dependence on its environment. However, Rossetto and Rossetto (2003) add that organizations manipulate the

environment in their own benefit. Unlike the deterministic aspect of Institutional Theory, the Resource Dependence Theory has a voluntarist bias. Thus, the environment is noticed and interpreted by human actors within the organizations and is subject to different perceptions regarding organizational decisions that are made (ROSSETO and ROSSETO, 2005).

The necessity for improved control of available resources and the continued search for the needed and missing resources emphasize the relevance of managers' role in the decision-making process, considering that decisions are taken internally, even influenced by a political context and by stakeholder concern. It is assumed that managers are delegated with the mission of managing their organizations, dealing with coherence with several groups of interests connected to the organization (PFEFFER and SALANCIK, 1978). In Child's opinion (1972), the interaction between the organization and the environment generates a set of strategic alternatives that meddle in decision-making. Already in the vision of Mudambi and Perdesen (2007), the basis of this perspective is grounded on the power concept and its proper exercise.

Within the Resource Dependency approach, some initiatives are suggested to balance such dependencies. One of them relates to adapting or changing restrictions applicable to the organization. An alternative points to the change in interdependence relationships, through fusions, diversification or portfolio growth and partnerships with other organizations, with which it is possible to identify synergy of interests (PUGH and HICKSON, 2004). Foundations can carry out partnerships with public or private companies, which are, very often, the main maintainer.

Considering the theoretical background, it is perceived that innovation in agriculture is straightly connected to its dependence on external resources, stemming from both incentive and financing public policies.

Thus, the Research Foundations are responsible for conducting their projects and managing the available resources and structure, aligning them with the strategic choices originating from the political context in which they are inserted. The endeavor for the reduction of resource dependence and the best utilization of those available constitute great challenges for the organizational actors.

METHODOLOGY OF THE RESEARCH

Regarding the methodological approach, this study is characterized as a qualitative research. We sought to discuss the resource dependence for research and innovation in agriculture in five Research Foundations in the southern region of Brazil. According to Creswell (2010, p. 11), the "[...] qualitative research process is quite inductive, with the researcher generating meaning from the data collected in the field". Due to the proposed objectives and the nature of the matter, this research is classified as descriptive. This is because, according to Godoi, Bandeira-de-Mello and Silva (2010), the descriptive research aspires to illustrate the situation complexity and the aspects involved therein. The chosen strategy is a descriptive and comparative study. According to Yin (2010), this is a strategy that allows explaining certain situations, providing contact with the reality and with the contextual conditions.

According to data published in 2012 by IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA), Brazil has approximately 290,000 foundations and associations, among which only 0.6% are focused on the area of studies and research. In the present study, will be investigated five Foundations with a focus of research on agriculture, more specifically in grain production in the southern region of Brazil. In order not to expose the name of the researched Foundations, a numerical sequence of 1 to 5 was used for identification questions, as follows: 1 – Guarapuava/PR; 2 – Castro/PR; 3 – Londrina/PR; 4 – Cascavel/PR; 5 – Passo Fundo/RS.

The main criteria for choosing the organizations investigated were: a) the presentation of research projects connected to agriculture; b) the common interest, among the organizations studied, for researches on soybean and maize cultures and, in some cases, by winter crops such as barley and maize; c) the economic importance of agriculture in the region, in which the foundations of important agricultural producers in the country are installed, which constantly look for higher indices of productivity, competitiveness and sustainability; d) the personal interest of the author of this research, since he is a collaborator of the main maintainer of one of the researched Foundations and realizes the great demand for resources for the accomplishment of research projects.

As for the choice of individuals, a representative, CEO and/or managing director of each of the five Foundations investigated was interviewed – the interviews were done by telephone and Skype. According to Minayo (1998, p. 102), the sample size is not the most important, but rather a proper selection that privileges "[...] the subjects who detain the information and attributes that the researcher intends to know".

One of the most relevant data collection techniques for this research was the semi-structured interview, which, according to Godoy (2010, p. 134), "[...] are appropriate when the researcher wants to learn both the understanding of the world of the interviewee and the elaborations he uses to substantiate his opinions and beliefs".

The research is divided into categories of analysis that represent the constructs, objects of study of the present work. For Cooper and Schindler (2011), the construct concerns an idea that is at the abstraction level and was defined exclusively for a particular research or for a theory development. Box 1 presents a division into three main categories. In the analysis categories are determined the constitutive and operational definitions. The first ones refer to the concept, that is, they relate to the definition of what will be investigated, at the abstract level and in the perquisition of meanings, while in the operational ones it is assumed a more empirical character, turned to the reality of the researched context (COOPER and SCHINDLER, 2011).

Box 1

Analysis categories (constructs)

Category	Constitutive Definitions	Operational Definitions	References
Costs and financing (Raw material and financial resources).	Existence of internal financing; Existence of external financing; Access to public lines of incentive; Managerial capacity.	Credit lines; access to lines of fiscal and financial incentive; managerial capacity of managers and cost reduction.	Davis and Cobb (2009); Pfeffer and Salancik (1978); Rosseto and Rossetto (2005); Sbragia, Stal, Campanário et al. (2006); Reis (2008).
Knowledge (Researchers).	Access to qualified employees; Access to information and technology; Access to external services and consultancy; Access to partners to develop products and services.	Qualification of professionals in order to enhance the generation of knowledge and improve the effectiveness of researches.	Pfeffer and Salancik (1978); Chegini (2013); Fugar, Ashiboemensah and Adinyira (2013).
Products and infrastructure of innovations.	Evolution of research and development infrastructure; Gains (productivity) verified with R&D investors; Trademarks/ Patents/Royalties.	Input and output sources of information; responsibility for financing researches in the agricultural area and in the evolution of infrastructure and adjustments, due to the utilization of official resources; productivity gains.	Pfeffer and Salancik (1978); Rosseto and Rossetto (2005); Sbragia, Stal, Campanário et al. (2006); Reis (2008).

Source: Elaborated by the authors.

The category Costs and Financing endeavored to identify the relevant factors, such as the utilization of credit lines, access to fiscal and financial incentive lines and approached the origin of resources for the realization of researches and maintenance of the Foundation. Aspects related to the managerial capacity of managers were also approached, aiming to analyze how this influences the achievement of resources and cost reduction.

The category Knowledge dealt with aspects related to the qualification of professionals who are part of the foundation's functional framework, access to information sources and use of information technology as a way to maximize results and reduce costs and risks. With regard to the knowledge of the researcher and the manager, the more skills they possess, the greater their performance, and, consequently, they will can contribute significantly with suggestions for improvements, ideas, and innovations. Human capital is one of the main resources of the Research Foundations (CHEGINI, 2013; FUGAR, ASHIBOEMENSAH and ADINYIRA, 2013). It also emphasized the use of consultancies and partnership with other companies in order to strengthen the generation of knowledge and improve the effectiveness of the researches, resulting in the generation of new products and services.

In the third category were treated other aspects related to information input and output sources; related to the responsibility to finance researches in the agricultural area and in the evolution of infrastructure and to make adjustments, due to the use of official resources. It was intended to work on aspects such as the evolution of physical infrastructure and governance, registration of trademarks and patents, and receipt of *royalties*. Thus, we sought to encompass several factors that influence the generation of information as well as aspects related to costs and revenues, carried out by the foundations. This research also aimed to address the gains verified (i.e. the productivity) of the users of investments in research and development.

In the present work, there were used the analysis of the documentation, the transcription of the interviews, the observation technique and the content analysis. According to Bardin (2004), this type of analysis assists the researcher to examine the data with objectivity and clarity. Already Flick (2009, p. 291) underlines that the content analysis is "[...] one of the classic procedures for analyzing the textual material, no matter which the origin of this material".

RESULT AND DATA ANALYSIS

Relevant factors of cost and financing

According to Davis and Cobb (2009), for organizations to remain perennial, they need to analyze the mechanisms of survival, autonomy, and stability. The conduction of research projects demands financial and nonfinancial resources, and the scarcity of these resources can compromise the continuity of the research, as well as that of the organization itself.

In view of this, the managers of the foundations were questioned about how the indicators of costs influence the correct conduction of innovation projects and which are the main financial difficulties encountered to promote more innovations. It can be noted that factors of costs present a high impact on the qualitative and quantitative definition of projects, as mentioned in some responses.

> Innovation projects, in general, usually require investments in new technologies, software, new components, inputs [...]. The indicators of costs direct us to where the research can reach, according to the available budget of each project (FOUNDATION 1).
>
> We only have cost, the transfer of the stakeholders only occurs after the project is completed [...]. We depend on the available resource to start new projects. Sometimes we have situations that demand studies but lack interested, because the research can take years, and they think it is better that others expend with the study (FOUNDATION 3).
>
> We depend on the approval of the funds of the maintainers, who are responsible for defining which projects will be conducted [...]. The resource always comes, but we could expand the number of projects if we had more resources. The result is in the long term. With this crisis, one has to think very well where to invest the money (FOUNDATION 2).
>
> We depend entirely on private resources we cannot conduct projects relying on official resources. The maintainers do not leave us in the lurch they fulfill what has been agreed. The Government changes the rules when least expected. It is a resource that helps and is important, but who can have to diversify the sources of input (FOUNDATION 5).

According to Pfeffer and Salancik (1978), the foundations are inevitably connected to the conditions of their environment, which constitutes a source of resources. In the Foundations analyzed, the cost factor is restrictive and influences innovation projects. The decision of which and how many projects will be conducted depends on the availability of resources, which, according to the totality of the answers, indicate a predominance of resources originating from private institutions.

After reports from managers regarding the indicators of cost and financial difficulties to promote more innovations, the second part of this category deals with the main tax benefits accessed by the foundation, in the municipal, state and federal spheres and their respective counterparts, required by public authority.

According to Cassiolato and Lastres (2005), the development of an innovative system with concrete results depends on efficient public policies. There are some tax benefits granted to Research Foundations, which are important to bring down project costs and stimulate the participation of more funding entities.

Box 2

Relevant Factors for Financing and Cost

Interviewee Reports	Access to Financing
"We are qualified as OSCIP. We have exemption of several taxes, because we are not for profit. As we do not compete with anyone, we have a good image to access companies and public agencies. If we were in another format, it might be more complicated" (FOUNDATION 4).	Financial resources through tax incentive. It has the ease of accessing this type of resource because it is an OSCIP (Organização da Sociedade Civil de Interesse Público).
"We have the exemption from ISS (Imposto Sobre Serviço) (is a municipal tax), ICMS (Imposto sobre Circulação de Mercadorias e Serviços) (is a state tax) and PIS/COFINS (Programa de Integração Social/Contribuição para o Financiamento da Seguridade Social) (is a federal tax) [...]. It seems little, but in a year it helps to lower costs. Did you ever wonder if we had to subject ourselves to normal taxation? We do not have much to do in terms of revenue, we depend very much on partnerships" (FOUNDATION 5). "We got it sometimes by CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) [...]. We have no one taking care of this matter. It is up to each researcher to present new sources of resources. It is easier to work together with multinationals, these companies are interested in showing the result of their products, the foundation becomes a means of disclosure" (FOUNDATION 5).	The tax incentive received helps in reducing costs. Access to financial resources stemming from funding agencies for research. Access difficulty, because there is no person responsible for analyzing available edicts. Financial resources of private companies, such as multinationals. Existence of external financing.
"We have a certificate of public utility in the federal, state and municipal spheres. The title of public utility allows us to participate in edicts of the federal Government and access resources of FINEP (Financiadora de Estudos e Projetos), CNPq, Lei do Bem, as well as platforms for purchases of equipment with price differentials" (FOUNDATION 2). "We have a person who researches sources of resources, researchers also assist [...]. CNPq and FINEP are very interesting, but the bureaucracy is great. It's interesting being "hostage" from only one source. It's not good for anyone. The more interested in the projects, the better" (FOUNDATION 2).	It has the facility of accessing resources because it is a Organização da Sociedade Civil de Interesse Público (organization of the civil society of public interest). It has access to financial resources originating from funding agencies for research. There is a responsible person, in addition to the researchers, to analyze the available edicts. There is difficulty with the bureaucracy of the funding agencies.
"The exemption of the taxes on revenues is important to reduce the cost of services and enable more events to disseminate knowledge, which is fundamental in a research foundation [...]. Knowledge needs to be socialized in order to benefit the entire society" (FOUNDATION 1).	Financial resources, through tax incentives, lead to a reduction in costs and facilitate the dissemination of research.
"As a foundation, we have some benefits and our tax situation is simplified. On the other hand, the Public Prosecutor's office audits all our expenses and we regularly have to render account of everything and leave it available for public consultation" (FOUNDATION 3). "We have already tried several times, but we rarely succeeded. It is easier in conjunction with the IAPAR (Instituto Agronômico do Paraná) and EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária) [...] We have an administrative assistant who takes care of this. But it's complicated, you have to be studying edicts, the researcher has no time and no willingness to be adjusting to these things" (FOUNDATION 3).	Tax incentive for maintenance of the foundation. But (the foundation) does not relieve itself of the rules and regulations. There is a difficulty in accessing lines of the funding agencies for research. There is a difficulty in time and availability.

Source: Elaborated by the authors.

All foundations understand that tax exemptions are essential for financial continuity. The extinction of these benefits would put them on an equal footing with the other organizations, no longer justifying their existence in the legal form of foundation. They could be treated only as a research department within private organizations. However, the link with public entities, universities, and, mainly, the socialization of results of the researches would be compromised.

After reports from the managers regarding the main tax benefits and counterparties required to access them, the managers were asked about which the main public lines of resources and whether they had governance structure to expand the fundraising. The origin of resources is a major challenge because it is a high-risk investment whose return will depend on the result generated by innovation. The resources can come from several origins. According to Corder and Salles-Filho (2006), the most common forms of origin of resources are: national system credit lines, own resources, mutual funds with growth expectations, Public funds of fomentation and tax incentives.

Although most managers emphasize that most resources are originating from private institutions, three of the Foundations maintain a structure of people and processes described in order to expand the governmental fundraising.

Foundations 1 and 4 do not access official resources for carrying out researches and also do not currently have a staff structure to do so. In front of the scarcity of official resources, the search for maintainers (partners) becomes necessary, which reinforces the cooperative character of the system. Finally, in this category, managers were asked about how the qualification of managers of these resources occurs.

For the World Bank (2008), there is a very clear link between human capital and innovation. This can be noted in countries with a high level of innovation, in which investment in human capital is done in a high degree. In order for innovations to occur in Research Foundations, it is indispensable that managers encourage employees to innovate and pursue effective results. Efficient management of resources depends on the human capital, qualified and prepared to optimize the resources. According to the respondents, the qualification occurs as follows:

> There is no specific qualification, we have people with training in administrative areas that manage the resources and balances of the projects. In the administrative areas are people formed in administration, accounting, but in the research, area has to be agronomist, except for some special need (FOUNDATION 2).
>
> We have an annual budget and the follow-up is monthly. The manager must comply with the budgeted and deliver the approved projects. We can't do miracles, we have to work as we can afford it. The study needs to bring results and be aligned with the expectations of those who are paying (FOUNDATION 1).
>
> The major objective of the qualification is to fulfill the requirements of the Public Prosecutor's Office; for this, the controllership area is always passing demand and questioning expenditures. We never had problems, but I know foundations that are trying to explain themselves, not because they had bad faith, but did not take care of documentation (FOUNDATION 5).
>
> The resource is finite if you let the researcher at ease he spends everything in the first months of the project. Communication and leadership are fundamental for everyone to be aligned on how much and when the resource can be used. We have a saying that we use with our people: "Not to bite off more than you can chew." If we make debt, we have to pay, and our sources are restricted (FOUNDATION 4).
>
> The foundation is small, the management committee defines how much and with which projects will be spent the resources. The participation of the foundation manager is basically in fulfilling what has been defined. Our role as a manager is more to account, we do not have any interference in the activities of the researcher (FOUNDATION 3).

In the face of this, it was possible to observe that the formation of researchers is a challenge of the managers of the foundations. The search for experienced professionals in the market is expensive and the Research Foundations opt to form researchers who are aligned with the policies and procedures of the foundation. Often the lack of knowledge of the professionals, who make the management and controllership of the resources, ends up burdening the foundation itself. The directors of Foundations 3, 4 and 5 make clear the importance of the symmetry in information for better control of resources and costs.

Relevant factors for knowledge

By the Frascati Handbook (OECD, 2002), the work of Research and Development (R&D) is defined as a creative work, systematically carried out, in order to increase the stock of knowledge, while new applications may emerge, which would result from the use of this stock of knowledge.

According to Viotti (2013), is still missing the creation of an indicator to measure the outcome of the innovation process, whose main objective is to assist in the definition of public policies. The definition of indicators is a dilemma. One of its causes is the lack of adequate control and the difficulty in interpreting some concepts. However, not having reliable indicators is less serious than not respecting some legal prerogatives. Therefore, reading and the proper use of the legislation are fundamental to avoiding discussions or fiscal liabilities.

In the interviews, the managers were questioned about which indicators are used to measure the knowledge production, how knowledge can be accessed and prioritized by the stakeholders and what benefits are generated for society. They all manifested difficulty in defining specific indicators.

> Our indicator is the market. If we develop a variety of culture, which is accepted by the market, it is a sign that the work was successful" (FOUNDATION 3).
>
> [...] We publish the result in periodicals; Internal reports, directed to the management committee, and registration of new cultivars are some of the indicators that measure the performance of the researches (FOUNDATION 2).
>
> We disclose (information) in internal reports, directed to our maintainers, we register the cultivars considered commercial and we promote field days, that are open to the whole community. People from various regions participate and access information that results from several years of researches. Our events are extremely technical and focused on generating knowledge (FOUNDATION 1).

Thus, it was possible to perceive in the interviews that there is a certain difficulty in standardizing and defining the indicators that measure the generation of knowledge; this makes it even more difficult to orient public policies geared towards innovation, as described by Viotti (2013). For this reason, the managers expressed concern with this item and pointed out the need for indicators that bring more transparency and that resources can be directed to projects with greater effectiveness.

According to Smith (2005), the character itself of the innovations hinders its measurement, recommending the use of statistical models as measuring tools. It is possible to find guidelines for measuring innovation in the Oslo Handbook (OECD and EUROSTAT, 2005). The measurement of the specific inputs of the innovation process is described in the Frascati Handbook (OECD, 2002).

As for the benefits generated for society, it is possible to perceive that the managers are aware of the important role developed by the Research Foundations and how important they are for the strengthening of Brazilian agriculture. The search for greater competitiveness and productive processes less impactful to the environment make the researches in agriculture increasingly relevants. When questioned about the benefits generated for society, the respondents mentioned:

> We strive to bring the result to those who will use it. New cultivars that result in increased productivity, cost reduction, higher profitability, less agrochemicals, and greater efficiency are always well accepted. The cycle of the cultures is always becoming smaller and the resistance to diseases is always a point of concern (FOUNDATION 2).
>
> In some cases the results obtained by the research projects are considered strategic and the result goes through the approval of the management committee and the maintainers, [...] The projects take several years and consume a lot of money from the maintainers, therefore the result must be first made available to them (FOUNDATION 1).

The results are directed to the maintainers, who become responsible for the diffusion of the benefits generated, as noted in the statement of the manager of the FOUNDATION 3: "... we have two main partners, EMBRAPA and IAPAR, which become responsible for the diffusion of the results".

Thus, it was possible to perceive that the private entities, which direct resources for research, expect to gain competitive advantage, being pioneers/holders of knowledge about cultivars or changes of processes with better performance.

According to Bin, Gianoni, Mendes et al. (2013), so that a Research Foundation functions as a propeller instrument of innovation in agriculture, it is necessary to have an adequate evaluation of the return on the investment in question. And for this, the return needs to be perceived by the financing agent.

Regarding the innovation types in agriculture, Sunding and Zilberman (2001) affirm that the innovation in agriculture generally does not occur for unpublished products but rather by improving the performance of existing products.

Finally, the managers were asked about the formation of the researchers, to which they responded:

> The researchers are well qualified, with masters and doctorate. They are professionals who participate in many events during the year (FOUNDATION 2).
>
> We have partnered with many universities. Our researchers do doctoral and post-doctoral studies, some even outside the country. Often, trips and technical visits that add a lot of knowledge occur. The result of the researches depends on the performance of the researchers. They need to be well prepared and have a lot of qualification (FOUNDATION 5).
>
> Our eight researchers have agreements with universities, as well as a partnership with other research institutions. We consider that alliances with universities and organizations, that bring us trends and expectations of the consumer market, are indispensable (FOUNDATION 1).

The concern with the constant qualification of researchers can be observed in all foundations. This concern is justified because, according to the Innovation Research - PINTEC 2011, the lack of qualified personnel is among the factors that most inhibit the implementation of research and development projects, accompanied by economic risks, high costs and scarcity of funding sources (IBGE, 2013).

Products and infrastructure of the Innovations

In this category, the managers were questioned about the necessary infrastructure and the evolution over time, as well as about the products arising from the innovations, which resulted in patent registration or receipt of royalties. Finally, the respondents were asked about the existence of other sources of funding and who is responsible for funding researches in agriculture.

When questioned about the existence of other sources of resources, the following answers were obtained:

> We promote days of fields in which we sell spaces for companies that want to disclose some product or service. We provide some services connected with agricultural activities and some projects are funded by multinationals (FOUNDATION 2).
>
> Our main maintainer source is a cooperative, which spreads knowledge to its members. We receive *royalties* from seeds of wheat, barley, and soybean that were developed internally by the Foundation after several years of research (FOUNDATION 1).
>
> Many multinationals sponsor events and strive to spread products. However, we have to take care not to link our name to the result of what is being disclosed. If we do not participate in the research, we have no way to attest that the result in the field will be what is actually being said. The farmer's field should not be a test laboratory. The ideal is that the product will go through firstly through the Foundation (FOUNDATION 5).

When questioned about who should finance researches in agriculture, the respondents acknowledged that the private sector has an important role, because the commercial interest justifies the targeting of resources for this purpose. However, they acknowledged the necessity to improve public policies, as the result of the work is uncertain and the growth of agriculture generates gains throughout the country.

> Responsibility is shared between the public and private sectors. Public entities such as EMBRAPA and IAPAR are essential. However, greater synergy between these entities is needed. The protagonist should be the State and most of the resources should be official [...] The Federal Government and the State Government should provide adequate edicts to the Research Foundations. Some researches are already funded by public and private entities such as SENAR (Serviço Nacional de Aprendizagem Rural) and FAEP (Federação da Agricultura do Estado do Paraná), as well as cooperatives and multinationals (FOUNDATION 3).
>
> Having only tax incentives is not enough for the foundations. It is necessary to expand the sources of official resources and to reduce bureaucracy. The State is always overdue. When we talk about agriculture, we should be decades ahead, given the importance for the GDP and the trade balance (FOUNDATION 4).

Finally, when questioned about adaptations and evolution of the structure, the respondents pointed out that the legal format of a research foundation requires that certain formalities and rules be followed. Access to official resources and the use of some tax incentives can only occur after suitability with all these requirements has been proven.

> In recent years we have worked on various adjustments, such as public utility requirements, changes in the foundation's statute, which needs to be approved by the Public Prosecutor's Office, creation of our own website, in short, countless details so that we can participate in edicts and have access to lines of official resources and tax incentives on equal terms with other foundations (FOUNDATION 1).
>
> We had to adjust to the demands of the Public Prosecutor's office and we contracted consultancy to assist us in the search for official resources. For this it was necessary to adjust our website, statute, mission, finally, we had to adjust our purpose (FOUNDATION 2).
>
> When we began, we visited some existing foundations and we looked for to be born in the befitting form to seek official resources, although in practice these are few and difficult to access. It is difficult to make plans only with official resources, but if you have a foundation, you have to consider the Government like an important partner (FOUNDATION 5).

It was possible to observe in the interviews that the demands of public authority are not considered relevant for an organization to be recognized as a Research Foundation, compared with the benefits that such legal format provides. In addition to the tax incentives earned, it was considered that, because it is a Research Foundation, access to multinationals, universities and the public sector present differentials when compared to entities that do not act in the foundation format.

FINAL CONSIDERATIONS

This study had the general objective of discussing the dependence of resources for research and innovation in agriculture in five Research Foundations in the southern region of Brazil. We take as a basis the RDT, which assumes that no organization is capable of generating on its own all the types of resources it needs for its survival and growth, and therefore depends on its external environment for obtaining resources that enable its functioning.

In the Foundations researched, although some use official lines and all benefit from the tax matrix attributed to the foundations, most attribute to the researcher the effort by framing the research project to financing lines, or prefer to develop projects in partnership with public institutes. It was observed that the foundations that use incentives for technological innovation bring a differential and manage to expand the number of projects.

This reality can be observed in Foundations 2 and 3, which enjoy resources originating from FINEP and CNPq, and also make good use of partnerships with public institutions maintained with official resources.

In the last decades, many Government initiatives are being implemented, directed at encouraging and developing the capacities of the innovation systems. Considered as a whole, these initiatives, however, have a limited impact. In many cases, they are little aligned with the needs and priorities of the agricultural sector and of the Research Foundations. In other cases, these are specific initiatives of the Research Foundations, with high bureaucracy and limited scope. They are almost always non-interconnected activities, not directly linked to a general strategy, what leaves some needs without attendance.

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In the Foundations surveyed it was possible to observe that all consider the non incidence of taxes in the municipal, state and federal spheres as an important differential. However, only this benefit is insufficient to the perpetuity of the research activities. The use of official resources happens mainly through FINEP and CNPq, a modality most frequently used by the Foundation 2. In the other foundations, these resources are used sporadically and their representativeness is almost nil. Even so, it is possible to perceive an interest in enhancing the use of these resources.

Another fairly common way for foundations to access official resources is by developing projects in partnership with public institutes. In this case, mainly via IAPAR and EMBRAPA. This is the predominant modality in Foundation 3.

The Research Foundations have a representative role in technological diffusion since they perform field days, technical events and create other mechanisms to socialize the result of the works. This diffusion can occur in projects developed not only by private companies, which tend to retain the results of the projects in order to get a competitive advantage. Developing projects in the attempt to innovate in agriculture requires financial resources, compliance with legal and environmental aspects, which become less complex if practiced regularly by organizations, whose research is among the main activities.

The interaction of the Research Foundations with the other organizations is favored, given that the first ones are nonprofit, even though the result of their projects can represent significant economic gains. The cooperation between these entities allows greater applicability of the results obtained and greater availability of resources for costing the research projects.

In the present study, it was possible to observe that the Foundations 2 and 3 depend solely on the partnership with public entities to defray their research, but the Foundations 1 and 5 depend on their main maintainers, which represent the main source of resources, being therefore not dependent on official resources. In Foundation 2 it is possible to identify greater participation of private resources. However, the use of resources via FINEP and CNPq is significant and important in the conduction of projects.

It is concluded that there is a predominance of private resources in the financing of the researches developed by the Foundations and that, although there is a public policy of funding for innovation, it needs to be revised in order to make it more adherent to the needs of the agricultural sector.

Some aspects may have limited the development of this research, such as the fact that there was no response from three more Research Foundations, located in the Midwest region. This region is an important agricultural producer and in the States in which these foundations are located, specifically in Mato Grosso, Mato Grosso do Sul and Goiás, agriculture has great economic representativeness. The growth observed in the last few decades is probably linked to numerous researches in which these foundations may have participated.

As a suggestion for future researches, it is recommended to apply this study in other States, as well as in other research organizations. It is also indicated that researches are carried out that seek to understand the strategies of the Government, related to initiatives aimed at expanding the governmental fundraising for researches in the area of agriculture.

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