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THE TRANSACTION COSTS IN BIOTECHNOLOGY

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Abstract

This paper aims to relate the principles of Ronald Coase Theorem with negative impacts of biotechnology, taking cases of specific research groups and medium-sized companies in biotechnology. We consider an application of economic theory on transaction costs (TEC) provides a good foundation for understanding the underlying problems of this sector, even more, when analyzing the political economy of biotechnology since the transaction costs can best viewed their limitations and the limited scope of government policy. In biotechnology it is possible to get a policy that combines both equity and efficiency, that is, a wider range of policy applications to improve the living standards of people in Colombia.

Keywords

Coase Theorem, Transaction costs, Biotechnology, Public Choice, Colombia.

JEL: B2, B21, B41, D03, D43, D82, N56, O13

THE TRANSACTION COSTS IN BIOTECHNOLOGY

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1 - Overview and Hypothesis

1.1 Impact of Biotechnology

Biotechnology has made a profound impact on agriculture and food industry the world over the past 15 years (Phillips, 2002; Herdt, 2006.; Dahlandera and Gannb, 2010; biotecVisions 2011)¹. Companies in developed and emerging countries have broadly adopted innovations in genetically modified (GM) with their relative advantages (Lusk, Jamal, Kurland, Rouco, Taulman, 2005, Qaim and Zilberman, 2003). What has led to efficiency gains ranging from higher yields, lower costs to control weeds and pests and diseases of depressed populations, the same way there have been significant environmental benefits (Pray, Paarlberg and Unnevehr, 2007). The evolution of the expectations and forecasts on crops with improved agronomic characteristics, and new ingredients in the food production potential of an extraordinary nature are, according to some researchers (Gaskell, 2006). Who observe these advantages, consider the fulfillment of the promises implicit in biotechnology requires overcoming barriers of restrictive regulations on genetically modified (Zilberman, 2006)². However, there are problems that go beyond the legislative framework (McHugh, 2007). Mainly in countries with institutional imbalances, economic imbalances and limited investment in the development of scientific knowledge.

The concept of biotechnology as a key technology for emerging agricultural applications overflows obtained after multiple applications made basic

¹ The advent of biotechnology has presented major challenges for the food industry worldwide. However, while the scientific basis for food production are part of a revolution, it is unclear how to implement technologies for biotechnology advocates and much of agrifood policy makers around the world project a positive future technology overcomes the food shortages, improving the environment, eliminates disease and leads to healthy and prosperous societies. However, a reverse reaction expressed by consumers and environmental advocates have founded arguments for considering that biotechnology represents, in contrast, exacerbation of food insecurity, environmental threats and hazards to human security, ultimately, worsening global society. This thesis does not take a stand against these dilemmas, but rather we are interested in seeing how responsive government institutions and the implementation of biotechnology, in particular, if public policy in Colombia provide the conditions to adapt or innovate biotechnology so that it can improve the quality of life and welfare of a majority of its population.

² For an extensive argument on the subject of regulations, see: Ian M. Sheldon (2002), although the author responds to an excessive reliance on the rules of the World Trade Organization, which is observed in the policies of emerging technology, are relatively complex problems between collective action and institutions, as justifies the present investigation.

procedures for millennia by breeding and application of microorganisms in the food chain production³. The DNA rediscovery and new knowledge for handling, constitute a tipping point that opens many new opportunities for use and application of biological resources. From this perspective, the potential impact of biotechnology on society with new products and processes, and initiation of new technologies are an important source of added value to the innovation capacity of companies in different industrial sectors (Raney, 2006). Biotechnology and genetic processes have advanced a reality with new challenges (Colciencias, 2008). According to this understanding of the potential of these technologies to improve productivity and articulated in different lines of business, also support to biotechnology as a strategic sector of the economy in many countries as Colombia, in general, biotechnology is a special field public policy requirements imposed by an economic geography of international (Colciencias, 2008; McCann, 2011).

For countries like Colombia, the importance of developing the biotechnology sector within its borders, is also based on contemporary economic vision for the generation of competitive advantages as an engine of growth and development for the country. Biotechnology creates opportunities to promote the entry into new markets and create jobs in high level international qualification. Additional jump from one of peasant agricultural economy towards high value added sectors of biotechnological base is a challenge of considerable scope. What major changes can also predict the development of Colombian society in many areas⁴.

On the other hand, are considerable opportunities provided by biotechnology to reduce problems related to hunger and malnutrition phenomena in many nations (Prakash, 2010)⁵. The techniques used could enhance global food production by more than 25% (Prakash, 2010.). An improvement in the capacity of the land to absorb minerals, have a greater level of productivity, allowing continuous planting, obtain resistant crops harsh weather, pests and diseases, foods with higher nutrient levels and counteract the deficiency of vitamin A , 'cause of blindness in these nations, and iron, which affects physical and mental delays and is causing major nutritional disorder worldwide killing half a million newborns per year (Lisinge, 2000, p.113) - are some of the direct benefits generated by this technology. The importance of such biotechnology applications is necessary not only for the current humanitarian crisis figures, but from the effects of climate change (Prakash, 2010)⁶. The conditions are still

³ View and Santa Ana Andre Valle. Silvio (1995), "Public perception of biotechnology: problems in the Third World", Tibtech, Vol XIII. The thesis of the authors discovered that there are many prejudices in public policy related to a poor and widespread misinformation.

⁴ Indeed, Colombia is considered one of the most attractive countries in the field of biotechnology applications from international markets in new technologies, see: (Myers, Sexton and Tomek, 2010).

⁵ The conditions of the famine in Somalia is a sign that the economies of developed countries have not yet managed to create conditions to make way for public policies in the poorest countries. The case of Somalia is a typical case of imbalances in the global economy and severe disturbances of the local economy policies.

⁶ The planet's climate change by the process gases caused by human activity, generate multi-million dollar losses to the agricultural sector. The increase in temperature and changing rainfall patterns will affect crops of rice, cotton, coffee, sugar, rice, cassava, corn and soybeans, among others. In general, several countries are expected to decrease areas suitable for agricultural crops. The set of alternatives to

critical gaps in policy load with global reach, as shown in the table below schematic:

MALNUTRICIÓN A NIVEL MUNDIAL
La malnutrición es un factor importante entre los que determinan, cada año, la muerte de aproximadamente 13 millones de niños menores de 5 años por enfermedades e infecciones evitables, como sarampión, diarrea, malaria, neumonía y combinaciones de las mismas.
Se estima que 800 millones de personas en el mundo sufren de subnutrición crónica y no pueden obtener alimentos suficientes para satisfacer siquiera las necesidades energéticas.
Aproximadamente 200 millones de niños menores de 5 años padecen síntomas de malnutrición aguda o crónica, cifra que aumenta en los períodos de escasez estacional de alimentos y en épocas de hambre y desórdenes sociales.
La situación es especialmente grave en África central, oriental y meridional, donde el 44 por ciento de la población total se encuentra subnutrida.
Los estudios indican la existencia de 526 millones de personas subnutridas en Asia. Sólo China alberga 164 millones de personas bajo estas condiciones.

* Information from FAO, 2006.

However, while global investment in agricultural research by the private sector continues to grow thanks to the growth of markets and the emergence of new technologies in developed countries (Alfranca and Huffman, 2001), the additional investment by the public sector and Governments in many poor countries has stagnated or declined (Byerlee and Echeverria, 2002). This research explores how the evolutionary dynamics between the public and private, with respect to the generation of new knowledge, adversely affects the diffusion of public policies on technological innovation, while offering advantages to the private sector on external support. Paradoxically, the best applications of those technologies that contribute to poverty reduction (Byerlee and Fischer, 2002). Comparing the recent historical evidence on private sector investment in agricultural biotechnology data, the findings indicate that a more open and international, with further expansion into agricultural research can be sensitive to addressing poverty (CGIAR, 2005a, 2005b; Dorward, Kydd, Morrison, Urey, 2004), only to the extent that the public sector leadership is reinforced by governments can change those conditions. The design of public policy-oriented research in biotechnology (Hall, 2005) should reassign the functions of private sector research (Kherallah and Kirsten, 2001). A public policy on biotechnology with an organizational system that is used in agriculture for the benefit of emerging countries, as in the case of Colombia⁷.

address the problem posed by the movement of crops to new regions with better climatic conditions, generating millions in losses for the countries, or breeding to withstand climate change.

⁷ This argument ignores the affirmative character who has had private initiative in biotechnology, but this makes collective coordination failures and public policy in countries with basic food needs. It is precisely such imbalances important premises of this research. Not many private investors willing to put their capital at the service of public causes. This phenomenon is not confined to emerging countries, but also the design of public policies in Europe and the United States, see: *Nature biotechnology*, "Firms seek new models to access public equity", volume 27 number 10 october 2009.

Concern about the concentration of power in the new bioeconomics⁸, especially in the private sector in developed countries, from the use of patents, is valid justifications (Calestous.2002, Lesing, 2004). The trend towards the privatization of knowledge resulting from the research priorities determined by the financial return on investment, raises the possibility that the benefits of these favors only those with the necessary purchasing power (Leisinger, 2004. this sense, it poses important limitations to be imposed to the potential of biotechnology to improve farm productivity in developing countries and poor regions inhabited mostly by poor social class and low income. The problem is how to mitigate the effects poverty, hunger and malnutrition. In general the situation previously described, raises the urgent need to strengthen investment in research by the public sector, which for 2000 was only 20% of total investments at international similarly, the establishment of more partnerships between the public and private sectors. A public policy on biotechnology in Colombia should promote a correction to the income imbalance between private and public, as well as encourage people with children Social opportunities (Amartya Sen, 1997)⁹.

On the other hand, the strategic importance of biotechnology has forced us to rethink mechanisms for their promotion in many developed nations and emerging countries in recent decades¹⁰. The complexity of biotechnology expertise derived from the multiplicity of agencies involved, and the resources required, further suggests the desirability of an environment that allows coordination to provide the necessary incentives to eliminate or reduce potential obstacles to development. In connection with this, the role played by governments is essential. In Colombia, many applications of scientific developments in biotechnology and the country's potential in this field, related to comparative advantages in terms of biodiversity, have prompted government agencies to make changes in order to coordinate the efforts made in isolation during the last decade in order to institutionalize their development.

1.3 Formulation of government

In this sense, in Colombia since the early nineties made the first steps to institutionalize the biotechnology program through the Department of Administrative Science, Technology and Innovation Colciencias. In 1991 under Agreement No. 1 of the National Council of Science and Technology, created

⁸ The term does not define exactly a business school or mainstream markets in biotechnology, but includes a growing tendency to operate with capital in countries with important biodiversity reserves as Colombia.

⁹ They are still outstanding contributions of Amartya Sen to reflect that originally raised an objection to the principles analytical expression of utilitarianism Pareto, as well as the criticism required by the first version of distributive justice of John Rawls.

¹⁰ Again, André Sant'Ana and Silvio Street, "Public perception of biotechnology: problems in the Third World", Journal BTech, April 1995 (Vol. 13). The authors emphasized the mid 90's the strategic nature of biotechnology and the need to increase public awareness of it.

the National Biotechnology Program (GNP) as a component of the National Science and Technology, whose technical secretariat would be responsible for Colciencias, and whose creation was understood as a recognition of the strategic importance for the country (Castellanos, 2006.2). Later, in 1997, determine the lines of action and activities of GNP in 1998 would result in the formulation of the Strategic Plan 1999-2004 National Biotechnology Program, as a means of planning and prioritization of areas of research (p. 2.).

According to this line of action the Ministry of Foreign Trade, decided in 2000 to include biotechnology as one of the key areas in the National Exporter of New Technologies, the National Planning Department (DNP) defines biotechnology as an area In conducting an exercise on its focus, likewise, the group of Biogestión National University jointly with the Ministry of Commerce, Industry and Tourism Colciencias, made the proposal for an Industrial Policy in Biotechnology, The Institute Alexander von Humboldt published a key document in 2000 BioTrade in reference to the close relationship between international markets for biotechnology and bio-demand and considers this technology as a key factor to improve the benefits provided by natural resources has Colombia. Similarly, the national government through the Ministry of Agriculture said biotechnology as an instrument to support technological upgrading of agriculture to the North American Free Trade Agreement with the United States (Cano, 2003).

The relevance of public policy on biotechnology has also been highlighted in the documents Conpes 3527 of "National Policy on Competitiveness and Productivity", Conpes 3582 National Policy on Science, Technology and Innovation, Conpes 3080 of "National Policy on Science and Technology 2000 - 2002 ". And in the 2002-2006 National Development Plan "Towards a Communitarian State" refers to biotechnology as a "strategic area for development and competitiveness of the country" (Colciencias, 2008, p.31.)

In June 2011 under the government of President Juan Manuel Santos Conpes approving the 3697 Policy for Business Development in Biotechnology from the Sustainable Use of Biodiversity, to which public policy is formalized in biotechnology in Colombia. Among the policy objectives are: 1 - Create the economic, technical, institutional and legal resources for attracting public and private development companies and products based on the country's biodiversity; 2 - Improving the institutional capacity to commercial development of biotechnology, 3 - Develop a set of economic instruments to attract public investment in business development and biotechnology products, 4 - Adapt and revise the regulatory framework related to access to genetic resources, production and marketing of biotech medicines and herbal products, 5-Evaluate the creation of the national bioprospecting.

Finally, in the "Basis of National Development Plan: Towards Democratic Prosperity: Vision 2010 -2014," within the locomotives for growth and generating new agricultural products and innovation-based sectors recognize the importance of sustainable biodiversity and the development of biotechnology as key elements in improving growth and competitiveness (Conpes, 3697). Today, interest in developing the potential of biotechnology to produce knowledge Colombia is consistent with the tendency to regard science and technology as key issues that urgently need to be incorporated into the public agenda. Not in vain with the enactment in 2009 of the Law on Science and Technology, aims to identify strategic sectors for improving the competitiveness of the country from the comparative advantages, such as biotechnology¹¹.

Notwithstanding the foregoing, it is necessary to state that any development of the biotechnology sector requires additional factors to the creation of public documents. Need to build an adequate institutional framework and perform a successful intervention by the government "environment interaction between academia, the private and public, and eventually lead to what is the rationale for biotechnology: the generation of new biotechnology-based companies "(Colciencias, 2008). In turn, the latter two requirements need to be based on a correct diagnosis of the state of the art development of biotechnology in Colombia. That is:

It requires knowledge of the potential, the progress and status of biotechnology in the country, to generate public policies that enable the development of this line of knowledge for the benefit of the Colombian business sector and citizens¹².

The public sector plays a key role during the development of science and technology. The cases of countries that have made significant progress in these fields corroborate this claim. Reason is that "biotechnology has become the workhorse of policy makers" (Pinilla, 2004, p.2). On the other complementary to the above has commented that:

The implementation of biotechnology requires public policy decisions and investment. However, such decisions are as long as there is public will built from knowledge of what happens in different social fields in the scientific, economic and cultural. From this desire, and based on exercises of decision making are proposed and investment policy instruments (Pinilla, 2004, p.3).

¹¹ "Biotechnology: Colombia strategic sector for 2015," Colciencias, Ministry of Education, <http://www.mineduacion.gov.co/cvn/1665/article-161751.html>).

¹² Ibid

In turn, the strategic importance of biotechnology should be incorporated into the agenda of different public policies. One of the main reasons for this idea is supported by studies showing that:

Developing countries increasingly dependent on knowledge and innovation capacity. (Perez) stated that biotechnology is a technological paradigm, and as such, affects the entire structure of production from the production of agricultural inputs and outputs, to the food industry, the mining and processing of minerals to human health and animal . If steel has been referred to as a key factor to achieve the industrial revolution, or the chip in the computer age, this new revolution is key genetic resources. Biotechnology has been used as one of their key arguments ability to meet the nutritional challenges of the third world (Pinilla, 2004.p.2).

Regarding public policy, they should aim at reducing obstacles facing the development of biotechnology in Colombia. Indeed, the biotechnology production occurs in an environment characterized by the existence of imperfect competition in the presence of monopolies as well as problems of coordination, market risk, uncertainty, opportunism and inefficiencies arising from existing institutions, among others. Terms theoretical problems reminiscent of neoclassical thinking in relation to the characteristics of markets, and prove the existence of transaction costs.

1.4 Failure of government and market failures

The technological development in Colombia has two serious limitations. The first relates to the characteristics of the markets that have specific benefits for foreign-invested sector, namely companies with economies of scale projections and potential for exploitation of natural resources. The second is the shape government policy, with obvious mismatches also associated with an investment in key sectors such data were limited to the development of populations. In short, the policy has introduced technology-related governance failures and lack of resources imbalances, if you compare it with the initiatives that have accompanied the private sector¹³.

¹³ Concern about government failures and market failures does not correspond only to emerging countries, the presidential message of 2010 targeted at farmers' society in the United States, contains a vehement demand for collective action and public policy. View David Blandford, "Presidential Address: The Visible or Invisible Hand? The Balance Between Markets and Regulation in Agricultural Policy "(2010).

In these cases, government failures and market failures correspond to inefficiencies associated with the structure and design policies improved technology. Many biotechnology-based companies have operated on conditions beyond ex post policy decisions of government and governments in Colombia itself offered no technology-based policies with additional incentives for the private sector. One of the gaps in technology-based policy has been to consider biotechnology as a subsidiary of other sectors of the national production, which limits their relevance research leading to inefficient results. By failing to provide equilibrium conditions in the markets, the various governments away the possibility of opening benefits a key sector for growth and development. If public policy is limited in dictating restrictive rules, employers are losing incentives to help with investments in areas that benefit the population.

The biotechnology market in Colombia also presents information gaps. Policy documents containing obvious gaps on the conditions of the firms that invest in the sector. As data gaps are, individually, investors can not solve. In summary, these mismatches disorient both the government and the private sector. There is confusion about copyrights, patents and recognition of capital flowing into these markets. The consequences of this situation play an inefficient use of natural resources are there in much of the country's geography. Subsequently extended these considerations.

This research aims to link these negative impacts of technology policy improvisation, taking cases of specific research groups and medium-sized companies in biotechnology. We consider an application of economic theory on transaction costs (TEC) provides a good foundation for understanding the underlying problems of this sector, even more, when analyzing the political economy of biotechnology since the transaction costs can best viewed their limitations and the limited scope of government policy. In biotechnology it is possible to get a policy that combines both equity and efficiency, that is, a wider range of policy applications to improve the standard of living of the population in Colombia.

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