15 YEARS OF GENETICALLY MODIFIED ORGANISMS (GMO) IN BRAZIL: RISKS, LABELING AND PUBLIC OPINION

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ABSTRACT

The objective of this paper is to present the introduction and diffusion of genetically modified organisms in Brazil, emphasizing the contentions about labeling and the public opinion about the issue. The findings are based on long-term research on the topic, as well as in analysis of interviews with stakeholders and the general public. It is disclose that disputes related to GMOs in Brazil were very polarized and unfolded as conflicts of risks. It is also shown that labeling is considered by those opposed to GMOs as an essential condition for the consumer´s choice of products, while companies and institutions in favor of GM products have a different opinion on the issue. The results of a survey with over than 800 Brazilian consumers indicated that they are more concerned with issues related to contamination (biological and chemical) and nutritional characteristics of foods than plant biotechnology.
Key words: Consumers, genetically modified organisms, GMO, labeling, public opinion, risk

RESUMEN

El objetivo de este trabajo es mostrar la introducción y difusión de los organismos genéticamente modificados en Brasil, con énfasis en los argumentos sobre el etiquetado y la opinión pública sobre el tema. Los hallazgos se basan en investigaciones a largo plazo sobre el tema y en el análisis de las entrevistas realizadas con las partes interesadas y el público en general. A partir del estudio se revela que los conflictos relacionados con los OGM en Brasil fueron muy polarizados y se desarrollaron como conflictos de riesgos. Se muestra así mismo que el etiquetado es considerado por los que se oponen a los transgénicos como una condición esencial para la elección de productos por parte del consumidor, mientras que las empresas e instituciones en favor de los productos transgénicos tienen una opinión diferente sobre el tema. Los resultados de una encuesta con más de 800 consumidores brasileros indicaron que estos están más preocupados por las cuestiones relacionadas con la contaminación (biológica y química) y las características nutricionales de los alimentos que con la biotecnología vegetal.
Palabras clave: consumidores, etiquetado, opinión pública, OGM, organismos genéticamente modificados, riesgo

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RÉSUMÉ

L'objectif de cet article est de présenter l'introduction et la diffusion des organismes génétiquement modifiés au Brésil, en mettant l'accent sur les allégations relatives à l'étiquetage et l'opinion publique sur la question. Les résultats sont basés sur la recherche à long terme sur le sujet et à l'analyse des entrevues avec les intervenants et le grand public. Il est démontré que les différends liés aux OGM au Brésil étaient très polarisée et s'est déroulé comme les conflits de risques. Il est montré que l'étiquetage est considéré par ceux qui s'opposent aux OGM comme une condition essentielle pour le choix du consommateur de produits, tandis que les entreprises et les institutions en faveur des produits génétiquement modifiés ont une opinion différente sur la question. Les résultats d'un sondage avec plus de 800 consommateurs brésiliens ont indiqué qu'ils sont plus préoccupés par les questions liées à la contamination des caractéristiques (chimiques et biologiques) et nutritionnelles des aliments que la biotechnologie végétale.
Mots-clé : Consommateurs, étiquetage, OGM, organismes génétiquement modifiés, risques, opinion publique

RESUMO

O objetivo deste trabalho é apresentar a introdução e difusão de organismos geneticamente modificados no Brasil, enfatizando as contendas sobre rotulagem e a opinião pública sobre o assunto. As conclusões são baseadas em pesquisas de longo prazo sobre o tema e na análise de entrevistas com as partes interessadas e o público em geral. Demonstra-se que os litígios relacionados aos OGM no Brasil eram muito polarizada e se desdobraram como conflitos de riscos. Mostra-se que a rotulagem é considerada por aqueles que se opõem aos OGM como uma condição essencial para a escolha do consumidor, enquanto as empresas e instituições favoráveis a esses produtos têm uma opinião diferente sobre o assunto. Os resultados de uma pesquisa com mais de 800 consumidores brasileiros indicaram que eles estão mais preocupados com as questões relacionadas à contaminação (química e biológica) dos alimentos e às suas características nutricionais do que com o fato de serem produzidos utilizando a biotecnologia.
Palavras-chave: consumidores, OGM, opinião pública, organismos geneticamente modificados, risco, rotulagem

1. INTRODUCTION

Brazil is the second largest producer of genetically modified organisms in the world, behind only the United States. Currently, four products were approved for cultivation and marketing: soybeans, corn, cotton and beans (Table N° 1). Most transgenic approved are resistant to herbicide, to the attack of insects and a combination of these two characteristics.

At a first glance, such widespread production and release of GM organisms in Brazil would lead to the conclusion that these products are fully accepted and absorbed in the country. However, since the first imports in 1997, a number of legal, political, economic and social disputes brought by different actors (such as non-governmental organizations, farmers, business and government) questioned the

Table 1

Genetically modified organisms authorized for commercial cultivation in Brazil until July 2013, and cultivation area for each crop, 2012/2013 harvest

Crops	Authorized GM varieties	Total cultivated area (millions of hectares)	Total GM cultivated area (millions of hectares)	GM / Total (%)
Soybean	5	29,6	27	91%
Corn	19	15.4	12.5	82%
Cotton	12	1.0	0.6	56%
Beans**	1	3.2	---	---

(**) GM beans are already authorized, but not yet cultivated at commercial scale. This is the first GM product developed by a Brazilian public institution, the Brazilian Agricultural Research Corporation (EMBRAPA), and it is expected to be distributed to Brazilian producers - royalty free - in 2014

Source: Author's elaboration, based on data from Céleres (2013) and CTNBio (2015)

convenience of legalizing GMOs in Brazil. These disputes remain in the present, but the emphasis has shifted to the design of the rules controlling their release, the responsibility for that decision, and the standards for marketing, food labeling and other practical issues, rather than the legalization of GM products itself.

This article discusses the introduction and diffusion of GMOs in Brazil. It emphasizes the debate relative to GM labeling and the public perception of the question, based on the analysis of interviews with stakeholders and the general public. This research is justified because it seeks to understand the process of diffusion of plant biotechnology in Brazil, inferring how organisms of the same nature will procedure and how it handles the acceptance of new technologies applied to food.

Thus, the first section briefly reviews the introduction and spread of GMOs, as well as the governing bodies and actors involved in decisions on the subject, analyzing media sources, documents and legislation. The second section exposes the discussion regarding the labeling of these organisms. Interviews were realized with representatives of companies that produce or sell GMO-free soy, and with employees of the customer service center (CS) of companies selling soybeans oil with the «T» symbol on their label. The third section presents the results of a survey carried out with more than 800 respondents about their food preferences and knowledge about GMOs. The results are compared with previous studies on the same issue in Brazil.

2. GMOS IN BRAZIL

Disputes in relation to the release of GMOs in Brazil began with the first request to import RR soybean (Roundup Ready glyphosate-resistant), in 1997. At that time, some civil society organizations protested against the authorization in the National Technical Commission on Biosafety (CTNBio[2]). This commission, composed by 18 members, representing the government, scientists and social movements, was created after the Biosafety Law (n. 8.974/95), with the attribution to establish rules concerning biosafety, risk classification and had the power to approve or not the GMO in Brazil (Brasil, 1995).

These contentions became much more significant after 1998, when Monsanto requested an authorization for the cultivation and marketing of its RR soybean and CTNBio issued a favorable opinion after only two months of the request, without recommending a study of environmental impact.

This approval was challenged in court by the Institute of Consumer Defense (IDEC) and Greenpeace, supported by other social organizations, with the justification that more rigorous research should have been done on the impacts of this GMO product. As a consequence of the legal process, the use of Monsanto's GM soy was temporarily choked, and its release was conditioned to the establishment by the government of rules concerning labeling and environmental impact studies. After this decision, both Monsanto and the Federal Government (Executive) filed another lawsuit challenging the ban on the cultivation of RR soy.

This legal dispute went on for several years, with decisions pending sometimes agreeing with the NGOs and others deferring favor of Monsanto. Social organizations questioned the methods, interests involved and the capacity of CTNBio to be the body responsible for authorizing GMOs. On the other hand, Monsanto and the Federal Government reinforced the vision that the members of the Commission have all the technical skills required to decide on the risks related to GM organisms.

But even during the prohibition, RR soybean was cultivated, without any monitoring, control or labeling. Although the crop was illegal, its cultivation enjoyed legitimacy among many, especially in Rio Grande do Sul. Menasche (2003) argues that the reasons for this legitimacy were a campaign by the media to portray the crop's

[2] Established by Law n. 11.105 of March 24, 2005 (Brasil, 2005a), *«it is a multidisciplinary collegiate body… whose purpose is to provide technical advisory support and advice to the Federal Government in the formulation, updating and implementation of the National Biosafety relating to GMOs, as well as to establish technical safety standards and technical reports relating to the protection of human health, living organisms and the environment, for activities involving the construction, testing, cultivation, manipulation, transportation, marketing, consumption, storage, release and disposal of GMOs and their derivatives»* (CTNBio, 2015).

ban as a mere temporal measure by the government, and the portrayal of the crop as offering technological advantages. These portrayals acquitted the users of the illegal crop in the public eyes, as did the Federal Government's failure to restrict the use of this illegal crop.

Since then, NGOs, farmers, businessmen, politicians and other social agents established a fierce debate about the legalization or not of GMOs, pointing out the different risks associated to each option and using them as arguments to decision making.

Some NGOs created the «Campaign for a Transgenic-Free Brazil» in 1999 to seek support from other sectors of society against the release of GMOs (Castro, 2012). This campaign disseminated information on the impacts and risks of GM products, and argued that the key risks included:

• Economic risks generated by the need for application of larger quantities of pesticides in the long term[3] and the payment of royalties that would increase the cost of cultivation. It was also mentioned that the approval of GMOs could generate a decline in demand for Brazilian agricultural products.

• Environmental hazards to human and animal health, mainly by the increase in the use of herbicides and the uncontrolled dissemination of GMOs.

• Risk to the maintenance of conventional crops, primarily due to contamination of crops, machinery and storage silos.

• Socioeconomic risks, such as the possibility that small farmers become dependent of the companies that control the technology either, in the use of the technological package or in terms of legal restrictions of saving the seeds for future cultivation. Moreover, it is often argued that this technology would induce land tenure concentration and monocultivation.

After that, the topic won national scale, and these actors had major gains throughout the process: A lawsuit delayed for five years the legal commercialization of GM crops, obliged the government to stipulate a standard labeling for its use (which does not mean it was enforced), and altered the composition of CTNBio.

To fight this resistance, pro-GM NGOs and associations were created. These organizations sought to promote the technology through different actions, such as holding events, organizing promotional material and lobbying in government bodies. The main organizations created were the Council for Biotechnology Information (CIB), the National Biosafety Association (ANBio), and the Brazilian Association of Biotechnology Companies (ABRABI). Among their associates were the companies Monsanto, DuPont, Aventis, Cargill, Brazilian Association of Plant Breeders and others. These organizations argued that there were risks related to the prohibition of GMOs:

• Economic risks: they argue that GMOs can reduce the costs of farming, because their use requires less work and smaller quantities of pesticides. Proponents of biotechnology claim that banning these organisms would turn domestic agricultural production more expensive than that produced by countries where they are allowed.

• Environmental hazards to human and animal health because those in favor of GMOs believe they reduce the need for pesticide application, improving the quality of life for farmers, the environment and consumers.

• Risks in delaying the development of science and technology in the country. The prohibition of GMOs could retract domestic studies on biotechnology.

For the proponents of GM, each organism has a specific feature and thus, advantages and disadvantages that should be analyzed case by case. This controversy allowed that RR soy became widespread without the accomplishment of the biosafety legislation and labeling until 2003, when the recently installed President Lula authorized, through provisional measures[4], the cultivation of GM soy with the commitment to create a new Biosafety law, with the understanding that the Law n. 8.974/95 was not efficient to solve disputes related to GMOs.

[3] Many critics point out that the constant use of a single herbicide in crops has led to the emergence of resistant weeds, requiring the application of greater quantities of pesticides to control them (Altieri, 2004).

[4] Provisional Measure 113/03, converted into Law n. 10.688 in June 13, 2003 (Brasil, 2003a; Provisional Measure n. 131, converted into Law 10.814 in December 15, 2003 (Brasil, 2003b); and Provisional Measure n. 223, transformed into Law n. 11.092 in January 12, 2005 (Brasil, 2005b).

These Provisional Measures represented a failure by the Federal Government in the enforcement of its own legal procedures defined as necessary for the approval of GMOs (CTNBio risk analysis), and with legal actions in progress that would define about the necessity of conducting environmental Impact Studies to release such organisms. In fact, the Provisional Measures created the legal support for RR soy until new Biosafety Law (n. 11.105) was approved in 2005 (Brasil, 2005a).

The new law gave broad decision powers to CTNBio, with a new composition of 27 members. This committee became responsible for performing risk analysis, establishing the rules and release authorizations for experimental and commercial use of GMOs in Brazil, and RR soy was finally released in the country.

Law 11.105/2005 addressed some of the original claims of the stakeholders against biotechnology: The creation of the Biosafety Information System and the possibility to hold public hearings. However, other conflicts remained unsolved, concerning the request of authorizations for GM maize and cotton, resulting in a new wave of protests. These crops followed a similar pattern of RR soybeans: CNTBio authorization of imports and, afterwards, commercial use, were followed by institutional and legal disputes. Given the legal uncertainty, these organisms were grown illegally with the condescension of the Federal Government until they became an accomplished fact. Then, the Government, issued Provisional Measures and other political resources (such as reducing the quorum needed in CTNBio for approving GM commercial use) until these GM products became legal.

Another similarity is that most GM seeds introduced illegally in Brazil belong to large transnational corporations that control the global seed market (ETC GROUP, 2007). These companies did nothing to prevent the spread of the seeds when they were unauthorized, however, since early times they articulated to guarantee the financial revenues for their intellectual property rights.

It should be noted that the companies detaining technology property rights are those that come closest to control and identify GM crops, in order to capture the technology fees they are entitled. On the other hand, the Brazilian government and public companies have difficulties in establishing the amount of GMOs in the market, producing no official data about it.

This debate is far from being over, but some common features can be identified. First, it is clear that there is a polarization of views in favor and against GMOs. The bias in each side does not allow a suitable dialogue on the issue. However, there are other positions between the extreme opposite sides, with less radical arrangements and more room for uncertainties in understanding the problem.

It can be argued that the legal arena was the main stage where disputes over transgenics occurred, since the popular mobilization and participation were limited. Anyway, the judicial cases had the merit to publicize the issue, encouraging new actors to participate.

It was evident that there was a rapid expansion of the cultivation of GMOs in the country. However, this expansion can not be explained only by the efficiency of the technology (which still causes controversy), but also by economic, political, social and institutional arrangements of the process under analysis. Thus, it is important to mention that three actors were primarily responsible for this diffusion: The biotechnology companies, with the institutional power to influence farmers and government; farmers that fostered illegal production due to its expected agronomic advantages; and the government, which did not enforce the judicial decisions and did not fulfill its role of supervising the production.

In contrast, NGOs were very active in the resistance to GMOs legalization. Changing their strategy of action and claims over time, these organizations achieved a number of accomplishments, as already mentioned. The focus changed gradually from the fight against the release of RR soy towards broader issues, such as labeling, the competence and composition of CTNBio, among others.

Finally, it is possible to point out that the discussions on GMOs in Brazil can be unfolded as conflicts of risks, using similar arguments as those theoretically proposed by Beck (2010), Giddens (1991) and Douglas (1996). These authors argue that risks are a key notion to understand the contemporary society.

In first place, the arguments to support or reject GMOs are based on notions of risk. The actors involved use arguments of risk to justify its legalization and to reject the support of genetically modified organisms. Secondly, GMO risks are not perceived as consequences of natural processes, but as an outcome of human actions and technologies. Thirdly, decisions related to GM adoption or rejection in Brazil are taken in an environment of uncertainty of their magnitude and future consequences. In fourth place, GMOs can generate problems that run through national or class frontiers, since commodity production chains are interconnected and developed by transnational companies. Moreover, seeds might suffer mutations and outcrossing with non-GM species.

Even when these disputes contain ethical or economic arguments, their validation is based upon scientific research dealing with the notions of risk. In other words, conflict positions that are not submitted according to the scientific logic (such as moral or religious criticisms) are not considered valid in the debate.

By the way, scientific arguments are in all debate. The actors involved in the strife began to make use of different research results to support their views, mobilizing a competition between scientific arguments and counter-arguments. This competition was responsible for increasing the scope of science, at the same time for promoting their slump of credibility, since its use does not guarantee the success of any risk perspective. According to Beck (2010, p. 40) the notions of risk depend on the constitution of scientific knowledge, but it is also legitimized by society, where the scientific presentations of risks are translated in the perceptions of hazards, as a question of acceptance and how we want to live.

Referring to social acceptance, Douglas (1996) believes that the definition of what is risky varies according to the different world views, social and economic characteristics, thus defining the place of the individual in society. In that sense, to be in favor or against the legalization of GMOs in Brazil puts everyone in a side of the dispute, defined arguments and projects. However, the perceptions related to risks are not static, but continuously change in response to changes in personal experiences, local knowledge and specialization. This results in a dynamic relationship of interaction and transformation between the individual perception and the social environment.

Indeed, it is possible that this is the main reason why a consensus is so difficult to be reached: The perception of risks depends not only on scientific evidence, but also on the world views and interests of the actors involved in strife.

3. LABELLING

An issue that gained repercussions in the case of GMOs was labeling. Decree n. 3871 was promulgated in 2001 as the first specific labeling rule for GM food in Brazil (Brasil, 2001). It established a mandatory labeling for any food product with more than 4% of transgenic organisms. However, after protests from different social entities, this was amended by the Decree n. 4680/2003 (Brasil, 2003c), and the minimum threshold of GMO in food composition to be labeled was reduced to 1%.

Thus, food products containing (or produced from) at least 1% of GMOs must spotlight the «T» label (Figure N° 1). Products derived from animals (such as meat, milk, butter and eggs) are exempted from this rule, and foods that do not contain (or are not produced) from GMOs are allowed to label the expression «GM-free».

Figure 1
Symbol identifying the presence of genetically modified organisms in food products in Brazil

Source: Brasil (2003d)

Nevertheless, the legislation approved in 2003 was constantly disrespected by producers. The manufacturers claimed that the traceability of these bodies would imply a high cost to the productive chain. Moreover, the industry *«does*

not want to unite their brand to a warning, like a dangerous thing» [5] (Salomon, 2005).

Even the Brazilian Federal Government did not respect labeling procedures determined by Decree n. 4680. In the discussion of the international rules involving GMOs in the Cartagena Protocol on Biosafety in 2005, the Brazilian representatives supported the adoption of the expression «*may contain genetically modified organisms*», instead of a clearer information system to the importer, disclaiming quantity and origin of the exported product. The paradox of establishing internally a very restrict information system, while at the international level the Government proposed a lenient rule, indicates the weakness of the policy and the lack of will to enforce it.

The debate about labeling went on, with critics to GMOs quoting the precautionary principle, environmental safety issues and, most frequently, the right of choice by consumers. On the other hand, those in favor of GMOs considered labeling as an unnecessary bureaucratic procedure, since GMOs would be substantially equivalent to conventional organisms.

In October 2005, Greenpeace denounced the Brazilian Government for not requesting the «T» label, even though a lot of products were transgenic. This resulted in a decision by the Federal Court of Justice, in September 2007, reinforced the labeling of all product using GMOs in the country. However, despite all this legal process, only in mid-2008 companies such as Bunge and Cargill have introduced the «T» symbol in their soybeans oils. After that, the respect to the law has increased, and currently it is possible to verify the compliance of other companies that sell soybean oils, cakes, snacks, biscuits and flour to enforcement.

Once the «T» symbol became present in the majority of soybean oils commercialized in the country, a research was held in 2010 with processing companies and sellers of soybean oils[6]. The customer service center (CS) of these companies was contacted and asked about the meaning of the «T» symbol, aiming to understand the information that companies are passing on to consumers about GM foods (Castro, 2010).

From this research, it is possible to point out two strategies used by the companies interviewed to convey information to consumers about GMOs:

The first strategy is the argument of «purification» of production process. Since you can not detect transgenic traits in soybean oil, even if produced from genetically modified soy, companies say that the raw material is transgenic, but the final product is not. This situation appears to allow companies to use the argument of purification, even if -in fact-, that cleansing does not occur (in spite of traces of transgenics not being identifiable), and that goes against the precepts of the current Brazilian legislation based on the principle of traceability. Thus, companies use the «purification» argument as a way to respect the law but without declaring that their product is transgenic.

The other strategy is the confusion about the quantity of GMOs in the soybean's oils. The contacted companies that put the «T» symbol on the label (Cargill, Bunge, ADM, Sadia) said that the symbol meant that the composition of the product could be less than 1% of GMO. However, as already emphasized, the Brazilian law only requires that the symbol is placed on foods that contain over 1% of GMOs. But, if that was the case, the introduction of the «T» symbol on the label was not necessary. Indeed, it is believed that this situation is a consequence of the legislation that does not request the specific amount of the existing GM products in the label, and companies use this flaw to provide vague information to the consumer.

Concerning risks, most of the companies that participated in the research answered that there are no studies proving that GMOs are hazardous to health or what would be the safe amount for consuming them. However, the representative of company ADM emphasized that the authorization for consuming GM soy by the Brazilian authorities was an evidence of its safety.

On the other hand, the group of companies that market GM-free soy stated that this decision was economic and not a subject defined

[5] Statement of the Legal Director of the Association of Food Industries (ABIA), Mr. Paul Junior Nicolellis to the Salomon (2005) statements.

[6] Information received by a telephone interview, through the Cargill's Customer Services Center, on April 26, 2010; Bunge's Customer Service Center, on April 20, 2010; Sadia's Customer Service Center, on April 23, 2010; and Information forwarded by e-mail by Fabio Chiorino (Press office of ADM Company), on April 26, 2010.

by ideological bias or the existence of risks. This was observed in a field study conducted in 2011, where representatives of Incopa, Caramuru, Maggi and Nidera corporations were interviewed (Castro, 2012).

Respondents stated that the market for GM-free products only exists because there are consumers willing to pay an additional amount for them. This niche market is also maintained because they see it as an opportunity to differentiate their products from the commodities trade, and because there is a lack of GM varieties developed for all Brazilian biomes. All respondents highlighted that the largest buyer of GM-free soy is the European market.

For the domestic market, Caramuru produces the «Sinha» GM-free soy oil brand, while Incopa sells the «Leve» oil brand. Indeed, the «Sinha» soybean oil was the first in Brazil to report the «GMO-free» on its label. However, in late 2009, the company withdrawal this information, and replaced it with the «trans fat free» label[7].

In an interview, the quality manager of Caramuru stated that the replacement of that information was a «*matter of marketing*»[8], because in years of commercialization in Brazil, the company did not perceive additional amount on sales from being GM-free, but she ensured that the company remains not using transgenic crops.

Incopa is currently the only company that label their soybean oil ("Leve") as «non-GM» in Brazil. According to director of the Company[9], such action was adopted as a way to boost sales of the product. He said there was broad acceptance of its soybean oil, and in three years he won a share of 10% of the national market, working mainly in the South and Southeast regions. However, until then, Incopa decided not to put a higher price for its GM-free soy oil, keeping it at a level compatible with the other oils available in the market. The respondent considered that it was an indication that, under similar price conditions, Brazilian consumers prefer oils labeled as GMO-free.

With the research presented here, we can say that companies perceive GMOs just as a business opportunity. However, there are different circumstances between the companies that market GM products from the GM-free producers. The first try to dissociate their products from GMOs, mainly through truncated information for the consumers. Perhaps this difficulty is caused by a fear that there is some rejection to them, given all the controversy that these organisms have generated in Brazil. Furthermore, firms that sell products containing GMOs argue that, since these have been approved for cultivation and marketing by the competent bodies, they present no danger or risks and would not need to stamp the «T» symbol on its label.

The companies trading GM-free soy argue that it is an economically based decision. However, these companies understand that the only reason for a market differentiation between transgenic and conventional products is the belief that GMOs may pose a risk. They also understand that the continuation of the GM-free market is left entirely in the hands of the consumers, and this niche market may not survive if consumers remain not interested in paying a higher value for these products (recognized through labeling).

Moreover, since 2007, sales of soybean oil increased significantly in Brazil -from 3.647 million tons, before the introduction of the label, to 5.328 million tons in 2012 (ABIOVE, 2013)-, even with the explicit transgenic information in the product label.

As mentioned, in the contest of labeling, some actors have transferred responsibility for maintaining the market free of GMOs into the hands of consumers. It is pointed out that this transfer of responsibility towards the consumers is a consequence of the impossibility of science or the State to solve the dispute related to the acceptance or rejection of GMOs. Given this impossibility, the stakeholders involved in the debate started to search for another place where it could be established the «truth» whether this

[7] The «trans fat free» expression means that the product does not contain a special type of fatty acid, formed from unsaturated fatty acids. The expression «trans fat» refers in that case to the vegetable fat that goes through a process of natural or industrial hydrogenation, and is not synthesized by the body and therefore affect health.

[8] Edvirges Michellon, Quality Manager Company Caramuru, interview held on 10 May 2011.

[9] Roberto Colares, director of Incopa in an interview held on May 11, 2011.

products represent a risk or not. This place, as presented by the interviewees, seems to be the market. Therefore, consumers have now the role for defining the risks of plant biotechnology in their purchasing decisions.

This situation may be an approximation towards the neoliberal governability, in which these questions must be defined by a rational individual maximizing utility in the optimal choice of preferences (Foucault, 2008). By that, risks associated to GMOs are displaced from the collective dimension, with the analysis of environmental, sanitary, and economic problems caused by them, in the direction of individual choices, with consumers defining in supermarket shelves if GMOs are «good» or «bad». However, the perspective of the «maximizer» individual is contested by Beck (2010), who sees in the contemporaneity that individuals are not restricted to the private sphere. With the sub-politics, she/he starts to connect with the global society in a manner that her/his personal choices (including consumption) are defined by the collective interests.

In the disputes related to labelling, it was possible to observe in the speech of the processing companies that the self interested consumers must define the issue, however from the unquestionable information provided by the same companies that, as seen before, can be confusing and contradictory. In these circumstances, the displacement of the question would transfer the focus from the more general risks related to transgenics to the exclusively individual expectations of fear and acceptance.

On the other hand, NGOs pointed out the responsibility to consumers since this would be an opportunity for the interconnection of the individual with the global and, therefore, the rejection of GMOs given their risks. These organizations try to stimulate the politicization of food consumption, in a way it could bring to the private sphere the collective problems.

However, in Brazil, this shift in the decision power about the acceptance of the risks related to transgenics towards the market was more rhetorical than practical due to the absence of labeling in many GM products impede consumers to practice their choices and results that the State remains as the entity responsible for the final decisions. This indicates that the argument that «consumers are the ones who decide» is much more an instrument to support deregulation on the issue than a truly motivated campaign for establishing the market as the locus for deciding which side is correct in the dispute.

Anyway, different studies have been done, in Brazil and abroad, in an attempt to obtain a greater understanding of the public opinion on GMOs, the perception of associated risk and their propensity to consume them. Knowing the public's perception of GMO is important, since it would reveal a trend for the acceptance or rejection of different technologies applied to food products. Moreover, public opinion affects investment decisions of firms as well as the actions of the state in public policy decision making.

4. PUBLIC OPINION

This section presents the results of a quantitative survey asking the public opinion related to GMOs in different cities in Brazil. Questions were made about the criteria used by consumers to choose their food; the confidence in government agencies that certify food safety; if they read the labels; their predisposition to consume GMOs, and finally, their fears related to food products.

Altogether, 827 interviews were conducted between May and November 2011, with urban consumers located in cities with over 150,000 inhabitants. These conditions were defined assuming that in larger cities, people are less involved in agriculture, contributing to a more independent opinion about GMOs (Castro, 2012). The interviews were done in Manaus (Amazonas State, in the North Region), Recife (Pernambuco State, in the Northeast Region), Rondonópolis (Mato Grosso State, in the Center-West Region), Rio de Janeiro and Nova Friburgo (Rio de Janeiro State, in the Southeast Region), Campinas (São Paulo State, in the Southeast Region) and Curitiba (Paraná State, in the South Region).

The questionnaire consisted mostly of closed questions, in which respondents answered according to predetermined multiple choice options. But the questionnaire also contained two open-ended questions[10] where consumers

[10] This article will only addressed one of these issues: the Fears related to food.

could express their views freely[11].

The profile of the sample complied approximately to the distribution of the Brazilian urban population by gender (52% female and 48% male). Regarding age, only people over 15 years were interviewed: 44.4% were between 26 and 45 years, 33.9% were between 46 and 69 years and only 4% had more than 70 years.

Given that many studies point to the existence of a direct relationship between level of education and income in the country (Barbosa Filho & Pessoa, 2010; França, 2005), it was decided to not question respondents about their personal income, avoiding discomfort and distrust[12]. However, information was requested regarding how many years of formal education the respondent has attended: 5.4% declared between 0-9 years of schooling, 42.3% had between 10-12 years, 35.6% between 13-16 years study, and 5.4% reported having more than 16 years of study.

In the first question (closed, with four options), respondents chose, in order of importance, what are the criteria used to choose a food product. The most voted item was «contain more vitamins or less fats» (nutritional qualities), with 35.2%, and «If the food is clean or without pesticides» (hygienic and sanitary quality), with 34.4%. The other options were much less voted: «If the foods are more delicious or more fresh» (sensory qualities) received 16.6% votes, and the price was a criterion mentioned by only 13.3% of respondents.

These results corroborate the study of Wilkinson (2002), which emphasizes that the normative views in relation to food quality, emerged from the nutrition scientific community, and growing concerns about public health, expressed by Governments, social movements and consumer organizations, created a strong identification of food with nutrition and health. According to Wilkinson (2002), this process accelerated the adoption of products enriched with vitamins, fruits and vegetables, but also strengthened the role of retail chains as the main articulator of the identification of the quality of the food with fresh agricultural products, which paved the way for the expansion of organic products.

Price was the least voted criterion in the decision to purchase food. However, it was also perceived, in different locations, that the question created some embarrassment to the respondents. In many cases, this shyness was expressed by laughter, accompanied by phrases like: *«I'll be honest»,* before declaration the option for the price.

The next question was about reading the label. This is an essential question when analyzing the case of GMOs, since it is only through the information expressed in the package of food that consumers can differentiate a conventional product from transgenics. Many different studies have been performed on the labeling of GMOs in Brazil[13]. They show a lack of knowledge of population about the meaning of the «T» symbol. Moreover, as already mentioned, labeling of GMOs has generated disputes between opposing sectors, and research on the knowledge of the «T» symbol can be used as an argument to suggest banning the labeling or to recommend greater investments in education and transmission information on the subject.

The interview results indicate that there is a predisposition to read product labels: Only 19.4% of respondents declared that they do not read the product labels, while 80.6% stated that they do it at least «sometimes». These results do not indicate that respondents understand all the information contained in labels, but reinforce the idea that consumers are interested in knowing the characteristics of the food products they purchase.

The subsequent question dealt with the confidence that respondents deposited in government agencies or professional associations that authorize and/or stimulated the consumption of a particular food, without saying if the product was transgenic or not. We considered this issue necessary because of the role of CTNBio in the release of cultivation and marketing of GMOs in the country. Thus, if the respondents rely on those agencies, there may

[11] Data analysis was assisted by Group of Environmental Economics at the Economics Institute of the Federal University of Rio de Janeiro (http://www.ie.ufrj.br/index.php/gemaý).

[12] The interviewers had no linkage with any official organization of statistical research; in this way, it is believed that respondents would be afraid to provide such information.

[13] Leite (2003); Furnival & Pinheiro (2008, 2009).

be a predisposition to accept its decisions on the risks related to plant biotechnology.

According to results, 81.7% of respondents said they trust the bodies that authorize or encourage the consumption of certain foods. Those who answered «it depends» (8.0%) highlighted that there are many interests related to the approvals of these bodies. It is believed, however, that this high trust on food control apparatus is not derived from a particular confidence in the government agencies or their staff (although it would require to trust in their competence), but mainly on the belief on the existing science behind their decisions, in addition to the regulatory forces which are aimed at protecting consumers from system crashes (Giddens, 1991).

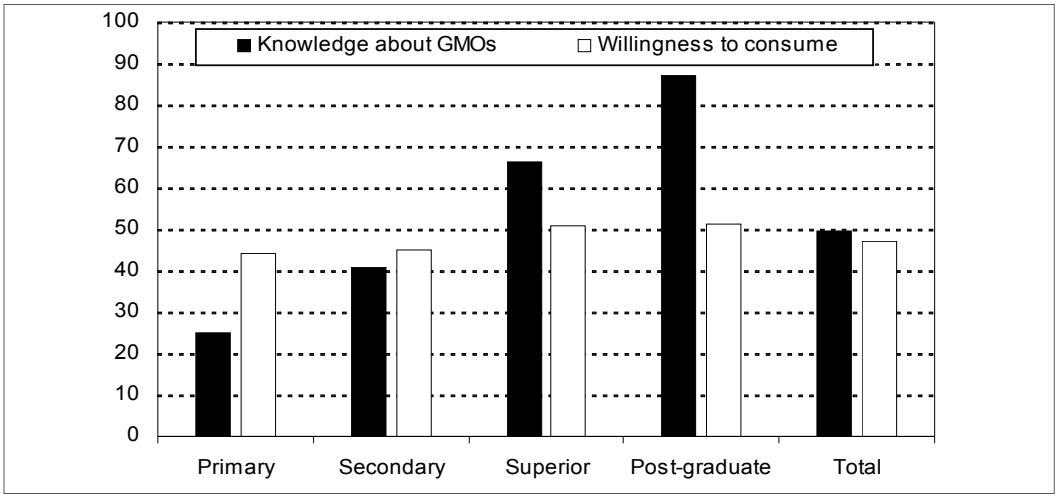
Other studies have tried to analyze the acceptance of GMOs in society based on the confidence posed in government and scientific bodies. Among them, it is possible to mention Siegrist (2000), who identified that trust in people and institutions that develop and use genetic technology has a positive impact on the perceptions of benefits associated with this technology and a negative influence on their risks.

However, the direct relationship between trust in government and scientific bodies and the acceptance of a particular technology is not unquestionable. This statement is corroborated by the Eurobarometer (European Commission, 2010), which identified that GM foods have not had a greater receptivity (acceptance dropped from 1999 to 2010 in the 32 countries where the research was held), despite the growing confidence in the government and the biotech companies. This demonstrates that it is not possible to point to a definite conclusion on the subject, suggesting that further studies are needed.

In the two subsequent questions, interviewees responded if they knew what GM foods are, and if they would buy them. With regard to knowledge about GMOs, there was a higher incidence of positive responses to the question (49.7%) than negative (37.2%), while 13.2% claimed to know roughly what these organisms are. When the question referred to the propensity to buy a food labeled as GM, 47.0% responded positively to the question, 39.7% said they would not buy this product, while 13.3% said it would depend on the occasion. The Figure Nº 2 shows the number of respondents who claimed to know what are the GMOs and their willingness to consume them.

The Graphic 1 confirms the results from the empirical surveys by IBOPE (2002, 2003): The higher the education level, the greater the understanding of what are transgenic products. It is believed that this relationship occurs because it is a complex issue that demands understanding of notions of biology and chemistry. In the 2003

Figure 2
Relationship between education, knowledge about GMOs and the propensity to buy them: consolidated data



Source: Castro (2012)

survey, with 2000 people across the country, IBOPE found that 63% had *«heard about»* GMO.

However, in the present study, the propensity to buy GM products increases with the level of education. These latest results seem to confirm, in some measure, the «deficit model» of scientific communication (Wynne, 1991). According to this model, the knowledge about science and technology (in this case, about plant biotechnology) reduces the rejection to these products. However, in this research, it was not possible to establish the degree of knowledge of respondents about GMOs, since it was not feasible to ask about the different nuances of the matter. But it was not plausible to confirm the proposed model either, given that the acceptance of GMOs showed little variation according to the different levels of education.

This establishes a contrast with the results from IBOPE (2002, 2003), which showed that the higher the education level of the respondent the stronger was the rejection of GMOs. In the IBOPE (2003) study, rejection to GM products was of 84% within respondents who had higher education degree, while in the consolidated sample rejection was 74%. The discrepancy between the rates of acceptance of GMOs listed in this research and IBOPE can be explained by different arguments related to regional and cultural variations between the locations where surveys were conducted, the variations over time between surveys, and the representativeness of the samples. However, regardless of the reasons, it is clear that the results from this present study pointed to a greater acceptance of GM, which increases together with the level of education.

The last question sought to identify whether the respondent had some fear related to their food habits. The answers were balanced: 51.9% responded yes, 43.3% answered no, and 4.9% of the respondents said that it depends on the situation.

Those who have not responded negatively were asked to explain their fears related to food. Most of the fears are related to contamination (47.4%), whether by biological or chemical agents, and their nutritional composition (27%). These data corroborate the results of the first question, where respondents declared that the most important criteria for the selection of a food are their nutritional and hygienic-sanitary qualities.

Only 11 respondents, among the 827 questionnaires, mentioned a fear specifically related to the consumption of GMOs. This result represents only 1.3% of the whole sample -a very small proportion, especially if one considers that the first two questions of the questionnaire were related to this topic.

In summary it is possible to say that, for the majority of consumers surveyed in this research, GMOs do not represent a source of concern and, perhaps, risk, unlike chemical pesticides and biological contaminants, as well as of food nutritional characteristics. Indeed, the market for organic products is growing significantly in Brazil -30% per year, but this represents only 1% of the food market (Moro, 2007)-, while the specific niche of non-GMO products remains fragile, with very few companies investing in this identification and there is no price differentiation.

This leads us to believe that, in Brazil, there is a promising differentiation between organic and conventional products, but not between conventional and GMO products, since the biggest concern expressed by respondents regards the use of pesticides. In this vision, the preference for organic products (pesticides free) could not be compared with the preference for non-GMO, since they may be cultivated using pesticides.

On the other hand, the nutritional characteristics of food are the other source of concern identified by consumers. So, under the current situation, when GM foods are developed with more vitamins or less fats nutritional characteristics, perhaps they will be better accepted by consumers in Brazil than non-GM equivalent products.

Moreover, if the sectors opposed to GMOs can reinforce the politicization and relate GMOs to greater use of pesticides or emphasize their nutritional insecurity, it may be possible that consumers are more likely to reject these organisms in the future.

5. CONCLUSION

The purpose of this article was to present the process of introduction and diffusion of GMOs in Brazil, highlighting the debate about labeling and an empirical survey about the public opinion in respect to its risk. Different methodological approaches were adopted, such

as the analysis of legislation, documents and queries to media sources, as well as interviews, conducted by telephone, e-mail and in person.

It also presented a brief history of the 15 years of the introduction and spread of GMOs in the country. The main actors and institutions involved in the fight were presented as well as their prevailing characteristics. It was found that these discussions were very polarized and developed as conflicts of risks. When referring to risk conflicts, on the one hand, science loses credibility and uniqueness of establishing the truth; on the other hand, it is widely used to support the arguments of all parties involved in the dispute.

Non-governmental organizations favorable to these organisms identified the risks of not legalizing them: Mainly related to the competitiveness of Brazilian agriculture in the international market and the development of domestic research capacity in the field. Organizations opposed to GMOs have emphasize the environmental, health and, especially, socioeconomic risks to authorize then, related to the position of family farming in the country and the risks of its mode of production.

Currently, this dispute is still carried out by different actors, but mainly social organizations participating in the «Campaign for a GM-free Brazil» that shifted the focus from the legal dispute related to the release of these organisms, towards the defense of mandatory labeling.

The need of the «T» symbol on the products that contain GMOs is defended with the argument that the consumer should have the right to choice their food and can define, ultimately, the direction of GM market. However, the ability of the consumer to decide whether to accept GMO is merely a discourse of deterrence, which seeks to hide the fact that the State has already authorized its cultivation and has assumed and accepted these foods with their risks by consumers.

In addition, the labeling of GMOs, despite already introduced in different food products in Brazil, is still questioned. There are new bill proposals[14] being currently discussed at the national congress that seek to alter their rules, some even questioning their existence.

[14] For instance, Bill Proposal n. 4148/2008 (Brasil, 2008).

Interviews conducted with representatives of processing companies that sell GM-free soy products were compared with similar consultations with representatives of processing companies that sell soybean oil with the «T» symbol on their label. Companies that sell soybean oil produced from GMOs use a series of subterfuges to explain consumers about this fact. Through their customer services centers, they use the argument of purification and establish confusion regarding the amount of GMOs in products, seeking to dissuade consumers to regard this issue. They argue that labeling entails a lot of segregation related to production costs and that would be pointless, since the product has already been authorized by the Government for consumption.

In contrast, the soybean processing companies that certify their products as «GM-free» claim that their choice is justified mainly by an opportunity to receive additional revenues and differentiate themselves in the market from the other «commodities». For this group of companies, the information on the label is critical for consumers to differentiate their products, which at a certain point may result in higher prices for them. But in Brazil, as it had seen in this research, the companies selling «GMO-free» soybean oil failed to receive any additional gain in the prices for their products so far.

Given the scope of responsibility to consumers, it was necessary to understand the public opinion about the issue. Therefore, a field research was conducted in different cities of all Regions of Brazil, with a sample of 827 consumers. The results show that they mostly declared trust in government and scientific bodies that approve the consumption of certain foods. In the survey, 49.7% said they know what are GMOs and 47% said they would buy these products. The biggest fears related to food were linked to chemical and biological contamination, as well as the problems associated with poor nutrition (overweight, diseases, etc.), corroborating the criteria used to choose a food product. The opposition to GMOs is, nevertheless, large (38% of respondents said they would not buy them), but the fear related with GMO foods appear just in 1.3% of sample.

Anyway, despite the present research reveals a considerable knowledge of the interviewees regarding transgenics, we can not state that these

knowledge has been translated into an engagement either in favor or against GMOs. By the contrary, part of the population look uninterested in this discussion, being more concerned with the amount of pesticides present in the food or nutritional characteristics, strengthening the market for organic products, while the largest buyer of Brazilian «GMO-free» remains the European market.

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