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The Construction and (De)legitimation of Knowledge

The Biotechnological Agrarian Model in Argentina

Renata Motta, Carla Poth and Markus Rauchecker



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The Biotechnological Agrarian Model in Argentina

Renata Motta, Carla Poth and Markus Rauchecker

Abstract

This paper examines the dispute about scientific knowledge, which surrounds the so-called Biotechnological Agrarian Model in Argentina. The most important element of this model that differs from conventional agriculture for the topic of the paper is the alteration of the main input factor from soil to knowledge. We focus on the role of knowledge in the public debate and the regulation regarding this model. Which knowledge enters in these arenas and which knowledge is considered valid as scientific knowledge? The contested denomination of knowledge as (non-)scientific is understood as a (de)legitimizing mechanism. Based on a critical theory of the public sphere, we analyze three narratives regarding different contested aspects of the Biotechnological Agrarian Model in various arenas: (1) the regulation of transgenic seeds on the national level; (2) the discussion about pesticide spraying in national mass media, and (3) political conflicts regarding new municipal pesticide regulations. We argue that the following five aspects of the mechanism of (de)legitimizing knowledge contribute to a further development of a critical theory of the public sphere: (1) the hierarchization of different types of knowledge is based on the interest of each actor; (2) the legitimation and delegitimation of knowledge is used to support the interest of each actor; (3) experts/scientists do not only facilitate knowledge for the (de)legitimation of knowledge, but the experts themselves are part of the game of (de)legitimation; (4) knowledge enters in political decisions in connection with power and the power holder decides which knowledge is valid, and (5) the scientific language is used as a mechanism to exclude persons who are not treated as legitimate scientists.

Keywords: asymmetries of knowledge | (de)legitimation of knowledge | Biotechnological Agrarian Model

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1. Introduction

The introduction of transgenic seeds entailed great changes in agriculture such as the Green Revolution. Central to the so called Biotechnological Agrarian Model is the linking of three basic technologies of conventional agriculture – seeds, pesticides and no-till farming – in an interconnected technological package (Bisang 2004; Campi 2011). Its major defining feature is the replacement of soil by knowledge as the main input factor (Gras and Hernández 2009a; Hernández 2007). Furthermore, we observe a domination of the supply of the technological package by a few multinational companies, which is supported by restrictive patent regulations on international and national levels with exceptions in Argentina (Delvenne et al. 2013; Rauchecker 2013, 2015). It results in an asymmetry between natural science and “alternative” knowledge. Commodified, patentable, natural scientific knowledge is the type of knowledge which lies at the heart of the Biotechnological Agrarian Model.

If we look at public discussions about this model and its political regulation, the following questions come up: Which knowledge enters in these arenas? To answer this, the paper investigates the legitimation of scientific knowledge as such in the case of the Biotechnological Agrarian Model in Argentina. We are furthermore concerned with the social processes of setting the limits of what is considered “scientific” and what is excluded as a result of such definitions. The contested denomination of knowledge as (non-)scientific is understood as (de)legitimizing mechanism. The analysis of this mechanism can contribute to a further development of a critical theory of the public sphere.

First, we discuss the Biotechnological Agrarian Model as the basic context of the three case studies. Second, we present the critical theory of the public sphere as conceptual framework for the joint analysis of our cases. Third, we discuss three nodes of the social and political negotiation of the Biotechnological Agrarian Model in different arenas in Argentina: (1) the regulation of transgenic seeds on the national level; (2) the discussion about pesticide spraying in national mass media, and (3) conflicts regarding new municipal pesticide regulations. Our major finding is that the visibility and influence of knowledge and the asymmetry of knowledge in the public sphere differs between the first two and the last node of the narrative depending on different power relations.

2. The Biotechnological Agrarian Model in Latin America: Causes and Background

In the mid-70's, as financial capital began to displace industrial capital, new productive structures were implemented (like Toyota-ism) and patterns of consumption began to change. Adding to these, neoliberal public policies began to disarticulate labor forces and speed the accumulation of capital. To do so, those policies opened the national markets, promoted the flexibilization of labor, cut the powers of trade union organizations, reduced salaries, implemented policies of regressive taxation and monetary stability (reducing public expenditures) and changed the structure and functions of state through privatization and decentralization of public services (Pascual et al. 2007).

Furthermore, these changes were reinforced by changes in the global legal framework and in bilateral free trade agreements in which the commodification of life and nature were introduced for the benefit of multinational companies. This commodification is based on international enforcement of patent rights in combination with intellectual property rights e.g. in the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Eimer and Schüren 2013; WTO 1994).

Within these changes of the international environment, biotechnology started to be important. By decoding the genome of living organisms, biotechnology enabled the creation of genetically modified organisms dividing and reinserting chromosomes from different species. These new organisms, deliberately manipulated, had a specific use different from that in the original species (Bercovich and Katz 1990).

Biotechnology promised to have better seeds and varieties (genetically modified organisms, GMOs) which are resistant to insects, immune to viruses and tolerant to pesticides, especially herbicides. Even more, it was possible to reduce the length of the growth cycles and to increase the adaptability of crops to different climates (Bisang 2004; Campi 2011; Martins 2000).

The insertion of GMOs was followed by a technological package, which combined basically three technologies: genetically modified seeds, the corresponding pesticides and no-till farming in combination with the same agrochemicals. (Bisang 2004; Campi 2011)

We may think this Biotechnological Agrarian Model also as part of an historical matrix of social relationships. Its social function was designed to rearrange the relationship

between capital and labor in agriculture. The introduction of new ways of production, headed by biotechnology, tended to increase the importance of financial capital (Gras 2013) and lower the numbers employed in the work force as well as the salary of rural workers (Rodríguez 2010).

The Biotechnological Agrarian Model is embedded in and at the same time part of the reprimarization of the economy (*reprimarización de la economía*) in Latin America. This model caused the spatial expansion of export-oriented productive logics. Agricultural limits were expanded into spaces that were considered unproductive or wasteland beforehand (Dietz 2011; Svampa 2008; Svampa et al. 2009). The international increase of commodity prices promoted the consolidation of this process of accumulation by dispossession of territories, natural resources, knowledge and traditional crops in every country in Latin America (Harvey 2004).

Nowadays, “to control the process of reproduction of life and richness is simultaneously a purpose and a mechanism of construction of power”¹ (Ceceña 2001: 17). Biotechnology meant the consolidation of the biopower logic (Foucault 1992), allowing to control living organisms from its beginning, giving them a commercial logic. Nature, which Altvater calls “humanized nature”, is seen in an intrusive way (Altvater 2006: 351). That is why it is possible to control, appropriate and manipulate it. Biotechnology allows the analysis, absorption and articulation of human relationships with nature, according them to the needs of the capitalist market.

In this way, the environment is constantly appropriated and conditioned by rhythms of capital production (commodification). Capital’s need for expansion and accumulation has grown to treat production and reproduction of life itself as a new way to dominate and define with commercial logic the conditions of existence of biological subjects, including plants.

To understand the significance of biotechnology, it is important to keep several interrelated aspects in mind: First, with biotechnology, it is possible to insert genes into the DNA chain, creating life with commercial objectives. That is why biotechnology shows that specific logics of capitalist markets can be introduced into the process of life reproduction. Second, life processes are introduced into the capitalist markets at the same time. This is related with what Lander calls “total market utopia” (Lander 2004: 31). For him, things that could not be considered goods, like nature or knowledge, nowadays are appropriated and commercialized within global markets.

1 This quotation, and all others in this paper that have been quoted from non-English sources has been translated by the authors.

Finally, the Biotechnological Agrarian Model is based on the articulation between the agrarian production and the scientific knowledge production. In contrast to the Green Revolution, which was based mainly on projects of public research institutions, the Biotechnological Agrarian Model is fostered particularly by the research and technologies of corporations. Furthermore, this model promoted the concentration of the production of agrarian inputs like seeds and pesticides (Campi 2011).

2.1 General Characteristics of the Biotechnological Agrarian Model in Argentina

Clive James (2014: n.p.) states that 181.5 million hectares were under production using GMOs all around the world in 2014. There were 28 countries that produced and commercialized these crops, 11 of them from Latin America. Argentina, one of the six countries planting the first commercial GM plants in 1996, is the country with the third-largest area of GM cultivation in the world, with 24.3 million hectares (see Table 1).²

Table 1: Area of Biotech Crops in 2014 by Country

Position	Country	Area (millions of hectares)	Main biotech crops
1	United States	73.1	Maize, soybean, cotton, canola, squash, papaya, alfalfa, sugar beet
2	Brazil	42.2	Soybean, maize, cotton
3	Argentina	24.3	Soybean, maize, cotton
4	India	11.6	Cotton
5	Canada	11.6	Canola, maize, soybean, sugar beet
6	China	3.9	Cotton, papaya, poplar, tomato, sweet pepper
7	Paraguay	3.9	Soybean, maize, cotton
8	Pakistan	2.9	Cotton
9	South Africa	2.7	Maize, soybean, cotton
10	Uruguay	1.6	Soybean, maize

Source: Own elaboration based on data from James (2014: n.p.).

² This source is highly problematic and used with caution by many authors. First, because the biotech industry is behind it and, in its lobbying activities, recurrently uses the argument that the wide adoption of GM crops proves its benefits to farmers. Thus, ISAAA has strong interests in inflating the numbers. Second, because their data is indeed target of many objections: they calculate the area of crop by genetic trait, so a crop with stacked-genes is counted as many times as the traits it contains. Nevertheless, it is the most quoted data, not least because of their successful media relation strategies. The numbers and claims from its latest report have been questioned by The Africa Centre for Biosafety (2013).

The new fluid capital was fundamental to implement the agribusiness paradigm in Argentina, in which the main characteristics are vertical and horizontal integration of the productive chain, the integration of industry and agrarian production and expert knowledge. So-called “innovation” in the agribusiness paradigm is the main factor that defines productive practices and crystallized new ways of accumulation. Networks are the principal mediation between land and markets. Nowadays, producers put their sight on global markets, and especially on the global demand for commodities (Bisang et al. 2008; Hernández 2009).

That is why we can see some displacements as consequences from this process in Argentina. First of all, there is a landslide³ from the idea of land exploitation to the idea of the innovative enterprise. Then, there is another landslide from customary production methods to the practices of corporate management. The third landslide shows a displacement from the physical property of land to the virtual notion of territory. Finally, land ceases to be being considered as the main production factor in the Biotechnological Agrarian Model. Now, expert knowledge takes the first place in order of importance (Gras and Hernández 2009a; Hernández 2007, 2009).

We can see that new technologies are fundamental to develop all these landslides, creating a rupture of space and time with all of them. With the space rupture, new technologies move production to different places in a short period of time (or they help to produce in different distant places at the same time), so absentee producers do not have to live in the same place they are producing. The temporal rupture refers to the idea that the cycles of production are not merely related to climate or natural facts. With these ruptures it seems as if production is not connected with territory and, as a direct consequence of them, there is a rural tradition that exploded, separating producers from their own lands.

Another characteristic of this model is the articulation of different and multiple markets in Argentina. The invention of GMOs created new captive markets because the same corporations dominated the markets for seeds and agrochemicals (for soy production see Rauchecker 2015). Another group of companies dominated the processing and export of soy products (see Rauchecker 2015) and production of biofuels (Muñoz and Hilbert 2012).

3 Although this concept is used to talk about displacement of lands specifically, we use it as a metaphor of the multiple movements that are closely related to this natural resource.

2.2 New Aspects of Biodiversity Control

As we have said, biotechnology enables the creation of new species. Trying to invent optimized organisms, science disintegrates nature and each organism changing them into transferable genes that can be manipulated, modified and potentially appropriated. In this way, the entire genetic reservoir of living things is considered to a valuable resource to be permanently extracted by corporations, reducing biodiversity in its place of origin with deforestation and monoculture (Heineke 2002). The biodiversity loss becomes even worse with any genetic contamination. This “original accumulation of germoplasm” makes deeper the expropriation of peasant’s resources (Kalcsics and Brand 2002: 29).

2.2.1 Knowledge and Power

With biotechnology, the Western model also imposed the idea of an accumulative knowledge that can be appropriated, and promoted new ways of manipulation.

Biotechnological production implies high levels of concentration. There are not many companies that are able to invest in this kind of technology because of its costs. That is why we only see multinational corporations researching about these technologies. Furthermore, the connection between biotechnological corporations, chemical industries and universities is drawing ever closer, shaping what Paulo Martins (2000) portrays as a guarantee for the concentration of expertise. The fusion of different corporations has concentrated basic research, allowing access to these new technologies to big corporations without their own research capacity.

From the input link, to commercialization, final distribution and consumption, there is total control by large corporations that merge to obtain new patented technologies and more capital. One exception is the production phase, which is characterized by the high number of producers in the case of the soy commodity chain (Rauchecker 2015). The largest companies controlled nearly the entire production chain and define the rules of both production and consumption. This is what Vandana Shiva (2003: 57) calls “alimentary totalism”. The new technological package, based on patents of interconnected technologies, increased the dependence of small and medium farmers on suppliers. The high cost of inputs made these economies more vulnerable and unstable, forcing agricultural producers to adapt to this system, or expelling them into other activities or lands. Despite this, the situation of Argentina differed from that of other countries because of the lack of a patent on the most-used transgenic soy plant and the legal conflict over seeds and patent law about the farmers’ privilege to save

and reuse seeds (Delvenne et al. 2013; Domínguez and Sabatino 2006; Rauchecker 2013; Teubal 2003).

The legal framework of patents was reconfigured from a two-fold perspective. In one way, it became increasingly restrictive for knowledge circulation. In the other, it became more flexible in defining what was considered patentable (e.g. in TRIPS as well as in the International Convention for the Protection of New Varieties of Plants, UPOV Convention in 1978 and 1991, see Rauchecker 2013). These regulation frameworks crystallize and consolidate the commercial logic of current science. Knowledge becomes a good for sale with access reduced to people able to pay for it. At the same time, knowledge produced in laboratories is considered more important than knowledge produced by peasant communities that are stripped of their historical patrimony (Lander 2005).

What we can see within scientific production is the hegemony of economic rationality. Secrecy, both academic and commercial, is the main strategy to protect benefits until discoveries are patented. Public laboratories are absorbed by multinational companies, socializing costs and restricting benefits with patents (Lander 2005).

State and university laboratories conduct research funded by corporate investment. This connection determines investigation topics and reproduces competitive logics of knowledge production. Even more, universities prepare scientists according to market needs, creating a scientific meritocracy that is placed in research foundations (defining what can be research or not), in publishing commitments of scientific magazines (defining what can be published or not), and, at the same time, they are researching in these corporate labs. With these mechanisms, there are certain slants that benefit some investigations more than others (Lander 2005). As an example, the agrochemical industry investigates methods that can be profitable for their own benefit, and not about sustainability for producers or the environment.

Biotechnology allows corporations to increase productivity and, at the same time, to create new types of control mechanisms. As Marcuse says (1967: 58) “[technological society] could have a high quality of life and new ways of control that will destroy the value and essence of authentically human liberty”.

Although in capitalism there had been expropriation and destruction of other ways of knowledge production, in this phase of capitalist accumulation, one of the most important characteristics is how these mechanisms of imposition are legalized in regulatory frameworks. The expansion of commercial logics into culture and nature

and the mechanist and determinist character of science exclude the recognition of another knowledge that breaks with the universalistic tendencies of Western science.

The elimination of different experiences and productive knowledge is centralized in networks, structures that expand one way to produce from large companies to small and medium producers creating new cores of power. These networks are built with the idea of “democratization of a non-democratized knowledge”, which implies the expansion and diffusion of only one type of production that is not a collective and social knowledge (Giarracca and Teubal 2008).

This “hegemonic science” (López Monja et al. 2010: 44) analyzes biosafety from a perspective that separates the technical aspects (legal evaluations and risk management of transgenic seeds) from the social, economic and political aspects of biotechnology. In this perspective, impacts of GMOs are calculated according to technical criteria alone, reducing risk to something that is simply something to be managed rather than avoided altogether. This technical view is centralized in scientific experts that decide whether to release GMOs, neglecting participation by the public that is considered to be unprepared to evaluate this kind of knowledge. Even more, the lack of information and incomplete construction of it in turn legitimates participation of only a small group of experts that define crucial policies (Glover 2003).

2.2.2 The Main Role of Knowledge

As we can see, what must be considered in the Biotechnological Agrarian Model is the new role of knowledge, which is directed towards the generation of value.

First of all, the agrarian chain of production and the chain of knowledge production are joined from the beginning. The increased use of technologies as inputs for the Biotechnological Agrarian Model turns knowledge into a fundamental premise for agrarian production (Gras and Hernández 2009a; Hernández 2007). Because of this, large corporations introduced themselves into a race where technologies and scientific research are the main contenders.

In the last 40 years, we see a third phase of capitalism where the increased importance of knowledge and its diffusion⁴ has mobilized living knowledge (the labor knowledge). In this phase, “capital accumulation increasingly derives from the control and exploitation

4 This process refers to industrial capitalism in which higher levels of education and the intellectual content of labor were the basis for the production of knowledge and the polarization of knowledge between capital and labor (Vercellone 2005).

of the intellectual product of labor and the transformation of knowledge into a commodity” (Vercellone 2005: 8).

Second, it is an important part of the subject constitution within the agrarian structure. The importance of experts, technical education and scientific knowledge create new agrarian actors that reinforce the existence of an externalized knowledge produced in labs and big corporations. This knowledge has to be purchased to participate in agricultural production (Gras and Hernández 2009b).

Finally, there is another main characteristic of knowledge in this phase of capitalism that keeps a leading role, and we will see it in this article: knowledge is a main part of the legitimation process of this model. Although scientific knowledge has always been important in this way, facilitating the universalization of the cultural spirit of capitalism and making it a valid way of life for everyone (Gramsci 2003), nowadays, this scientific knowledge has changed its ways of legitimation, turning the public sphere into a mechanism of socialized information that (as we will show) is not a democratic mechanism for decision-making.

In this paper, we present empirical data from our research that shows how scientific knowledge is used and contested to legitimize the new Biotechnological Agrarian Model. But first, we will describe some important concepts related to the processes of legitimation in the public sphere and in the political and state institutions. For that, we resort to critical theory of the public sphere, which questions how asymmetries of knowledge may pose legitimation problems for contemporary democracies.

3. Building Legitimation by Creating Asymmetries of Knowledge

As we have seen, the Biotechnological Agrarian Model has been constituted on the basis of the development and wide-scale adoption of new scientific and technological knowledge regarding genetic engineering. Moreover, as we will show in our empirical cases, this knowledge is also fundamental to legitimate the new model of agrarian production. However, this is not unproblematic. Our cases demonstrate the asymmetries of knowledge that are constituted and reproduced in the processes in which social actors attempt to build the public legitimation of this model. In order to explore this problem, we adopt a theoretical approach that identifies knowledge as a source of both legitimation in the public sphere and inequalities which, in turn, might undermine the former.

A critical theory of the public sphere offers modes of drawing distinctions in order to identify the closure of a public debate on an issue that could be potentially treated as a political issue, by imposing the domination of one type of knowledge and argument, while silencing others. The adoption of biotechnology in Argentinian agriculture has been a “silent revolution” (Bisang et al. 2008: 165). However, its consequences became increasingly the object of local conflicts. The strongest node of controversy over the model has emerged when neighborhoods affected by pesticide spraying started to mobilize and voice their concerns on the health and environmental impacts of the Biotechnological Agrarian Model. While such resistance has been evolving over the last fifteen years, it has not yet reached the status of a nationwide public controversy (Motta 2016). What mechanisms prevented such dramatic changes from being openly debated in the national public sphere?

The concept of public sphere (*Öffentlichkeit*) will be used as an analytical tool, in the tradition found in the works of Bernhard Peters (2008) and Jürgen Habermas (1992, 2008). This choice has inevitable normative implications, as noted by Calhoun (1992: 462-463). It fulfills the demand for justification of why a certain type of knowledge is more entitled to settle public issues. In this model public sphere can be defined as: “a form of collective based upon a particular structure of communication, or a sphere of communicative action within which a ‘public opinion’ can form with quite special characteristics” (Peters 2008: 36). Such characteristics derive from three normative principles, namely, equality of participation and capacity to deal with issues, openness to topics and discursive structure. It is the first principle that is of most interest to our research problem.

The principle of equality and reciprocity means that everyone should be able to equally participate in a communicative context, alternating the roles of speaker and listener.⁵ While there had been historical limitations to the realization of this principle based on such rules, today social differentiation factors such as family background, gender, ethnicity, age, status, income, occupation, education and expertise cannot be considered to impose the same degree of formal constraints to the participation in public communication as in the past. Nevertheless, even if these do not exist formally in law, social characteristics do influence the actual chances of participation. Peters (2008: 44) calls attention instead to the graduated asymmetries or variable inequalities,

5 There is an arithmetical limitation according to which only in a dialogue there can be an equally distributed chance between speakers and listeners. In other words, in a large public sphere the principle of equality cannot be fully automatically applied. However, the interesting question is the sociological limitations of this principle. The asymmetries in actual communicative relationships show their most radical expression in the formal or informal rules of exclusion from the debate.

to be divided into three basic forms, which can appear in combined ways: visibility, influence and asymmetries of knowledge.

Visibility can be different because some speakers receive more space in the public sphere. In some regions of the public sphere, the distribution of such space is controlled by other actors, acting as gatekeepers. In most cases the public discourse has the mass media as one of the gatekeepers. Influence means “the fact that acceptability of utterances might be based upon perceptions of the person or the status of the speaker – beyond the power of the arguments presented to convince” (Peters 2008: 44). Even in such a technical issue as biotechnology, in which knowledge or expertise are considered important by most parties, influence means that the argument from someone is accepted independent from its persuasive character, without having been proven in its content. This is related to the third type of asymmetry: whereas different cognitive preconditions are a common feature of contemporary communications, they become problematic when there are structural asymmetries of knowledge. This may happen in two forms: when the issue demands information for which there is a monopoly (due to patents or ongoing research, it is not accessible for all and thereby not subject to scrutiny); or when the monopoly refers to a specialized knowledge with borders patrolled in part by the experts that generate it. In the latter case, although information is public, its handling is argued to require specific training in knowledge that laypeople do not have.

The concrete forms of asymmetries found in modern societies can be explained by the structural character of the general society and by specific characteristics of the public sphere. The latter are related to the differentiation and stratification of the public, on one side, and on the structures of the mass media, on the other. Peters (2008: 45-48) identifies two characteristics of the social context that create inequalities in the public sphere: structures of social stratification and power, and the social distribution of knowledge. The former can be summed up as follows: those higher in the social and political structures have more money, power and organizational resources that can be converted into more visibility and influence in the public sphere. As Habermas (2008: 173) states, the exercise of political and socio-economic power is not illegitimate as such. In a discursive Habermasian model, power must be legitimated by democratic procedures. The use of social power to gain political influence must be, nevertheless, legitimized in the public sphere under conditions of transparency. This implies that in order for the most powerful in other spheres make their opinions prevail, they must obtain public approval through justification and argumentation, not just the assertion of their position of power.

The social distribution of knowledge becomes a structural source of asymmetry due to the increasing importance of cognitive knowledge in many areas of social life for which a specific training process is required. Such previously acquired knowledge cannot be assumed from any person wanting to enter into public debate. Thus, the public is considered to be not equally competent for all issues and often relies in the knowledge and credibility of experts. Such dependence on spheres of action with knowledge monopolies creates the danger of limiting the cognitive sovereignty of the public. This could also be an intentional result, since issues framed in highly technical terms reduce political participation, informally or even formally, in technocratic institutional designs. Nevertheless, even in formal deliberative bodies composed by experts, conditions of transparency and guarantee of public access can counter exclusionary effects.

This raises the question of which type of knowledge is considered relevant to decide and debate about the Biotechnological Agrarian Model. This leads us to the three case studies in which we analyze practices of definition of what scientific knowledge is considered to be legitimate as a basis for state regulation of genetically modified crops on the national level (Section 4), in the nationwide mass media discourse on the risks of pesticides especially glyphosate (Section 5) and in the conflicts regarding new municipal pesticide regulations (Section 6). This empirical analysis will show the mechanism of (de)legitimation of knowledge as a contribution to a critical theory of the public sphere.

4. Regulation of Transgenic Seeds on National Level

In this part, we will see how scientific knowledge is introduced into the biotechnological regulation by the state on national level. We will describe the main characteristics of biosafety regulation and the state body Comisión Nacional Asesora de Biotecnología Agropecuaria (National Advisory Commission on Agricultural Biotechnology, CONABIA) that issues the main rules.

Then we turn to focus on the concept of risk within the regulation and this state body. The concept of risk is based on the basic perspective that regulators have concerning technological risks. Biosafety regulations implement risk assessment according to the conception of biotechnology held by members of this body. As we have stated above, biotechnology is a fundamental “moment of material forces of production, because it is produced by determined social forces, it expresses a social relation and it corresponds to a determined historical period” (Gramsci 2003: 17). That is why these technologies are associated with a determined conception of science that builds the idea of risk with specific characteristics.

Finally, once we have described the characteristics of this risk conception, we analyze the idea of science that structures the regulatory framework and the consequences of this conception.

4.1 Biosafety Regulation and State Bodies

CONABIA was created in 1991, as a state body to evaluate GMOs. Furthermore the committee had to create technical assessment standards and to suggest regulatory frameworks for the release of GMOs for production and commercialization. Based on the evaluation of CONABIA, the Secretary of Agriculture takes the political decision to release a GM variety (SAGyP Executive order 124/1991). CONABIA's creation was based on the assumption that the use of new genetic material "increase[s] the quantity and quality of the available food" (SAGyP Executive order 124/1991).

The committee consisted of members of the state sector (fundamentally, experts of the Secretary of Agriculture), scientists, and representatives from private corporations with knowledge of vegetable improvement (SAGyP Executive order 124/1991). The participation of state and private actors as well as scientists was meant to form an expert committee "the most scientific as possible" (Interview 1).⁶

The first regulation was based on biosafety norms of other countries. American, Canadian, European and Mexican regulation were considered and replicated in the Argentine legal framework (Poth 2013).

The following criteria of the risk assessment were used to evaluate the experimental GMO release to the environment: the main characteristics of the organism, its behavior in the environment, how it alters the ecosystem, its capacity for survival, dissemination, pathogenicity within other organisms, characteristics of the environment in which they are released, experimental conditions, GMO's management, and potential negative effects on human beings (SAGyP Executive order 656/1992). Finally, regulation is based on familiarity and substantial equivalence principles that suppose a basic equality between genetically modified organisms and their conventional homologues.⁷

6 This quotation and all interview material in this paper has been translated from the original Spanish by the authors.

7 "The substantial equivalence' principle says that 'if food that comes from new biotechnology can be characterized as an equivalent of its conventional predecessor, it can be supposed that there are no new risks, so it's acceptable to be consumed'. The 'familiarity principle' means that it's necessary to compare similar organisms, or organisms that have similar behavior." (Poth 2013: 300).

The risk assessment is applied to the product and not to the process by which it is obtained. It has to be made and presented by the private company that wants to release its GM variety. Furthermore, the risk assessment is confidential. Neither the information about events nor the debates inside the committee are available to the public. The arguments to support these criteria in a public institution are that risk assessments have sensitive commercial information that has to be kept confidential. In fact, members of the commission affirm that “we do not know why it could be necessary to make them public. What it is public are the final resolutions of release. When we are in the middle of the discussion the deliberations are not, because discussions are made between experts” (Interview 2).

Before the approval of the Cartagena Protocol on Biosafety and the moratorium on GMOs imposed by the European Union, the risk assessment had two parts. First, the biological and environmental evaluation by CONABIA and, second, the food safety evaluation by the Servicio Nacional de Sanidad y Calidad Agroalimentaria (National Service of Agro-Alimentary Health and Quality, SENASA) (SAGPyA Executive order 289/1997).

The commercial ban in Europe was crystallized in a third moment of risk assessment: the evaluation of commercial possibilities. The evaluation of the potential international GMO markets by the Dirección de Mercados Agrícolas (Department of Agrarian Markets, DIME-AGRO) were included (SAGPyA Executive order 39/2003). This policy was part of a national commercial strategy that were called the “mirror policy”, in which the Secretary of Agriculture only releases GM seeds that could be commercialized in European, or other international, markets.

4.2 Risk and Policy

It is possible now to see that the core principles of the biotechnological policies are rational risk and the expert, who decides about which risk is to be measured.

The rationalist conception of risk (Funtowicz and Strand 2007) is related with the causal relationship in case of different dangers. To see this risk, we do not know if there will be danger, but we suppose that it is going to happen. To see the risk in a rational way means to choose the most rational option to prevent this dangerous effect. These different possibilities to choose are called scenarios, and are built by looking at the information that is already known.

This conception of risk supposes that we know every single variable (or most of them), and every single movement in these different scenarios that are considered. It supposes, even more, the existence of an expert that is capable of reconstructing every scenario with all the information and the objectivity of the phenomena that are being analyzed (Callon et al. 2001). This model of rational risk imposes a hierarchical order between the observers who have the knowledge and the ones who are unaware of these preconditions.

As Ulrich Beck (1998) says, we are in a historical moment when uncertainty is highly relevant for policy, so science is becoming the main priority in state organs. That is why it is fundamental to view clearly the historical rules of science and question them critically.

In this study, we identify some specific characteristics in risk regulation and state institutions related to transgenic seeds in Argentina.

First, risk is evaluated based on the principle of the historical accumulation of knowledge: Dangers considered as a risk formerly changed in every period of time, but this change is not a specific construction of one period. Risk changes in relation with the accumulation of knowledge that science claims to make. In this perspective, knowledge construction is made in a progressive quantitative line from ignorance to total knowledge of a topic. Knowledge is made step by step, without gaps, or black holes. This notion of total knowledge reduces the threat of risk, and brings an appearance of certainty.

Within this conception it is possible to believe that “risks that we thought that were risks twenty years ago, are not any more” (Interview 1). An example of this idea is the high estimation of gene flow in transgenic seeds that science used to make years ago. Nowadays, within this perception, the risk of gene flow between transgenic and native species is too low and, if it happens, it is not a big problem. Gene flow is not considered as a risk because every species is essentially destined for extinction. In this way,

I think we must not to be frightened. Twenty years of experience in regulation indicates that every event⁸ that is actually being commercialized has been evaluated so much and studied, and that is why they have been released to be commercialized. But this experience of studying so much and recognizing that this event is as safe as its equivalent non-GM seed, shows that what is being

8 An event is a genetically modified organism with a specific gene inserted.

modified is so small and thin that it cannot have enormous consequences in any respect (Interview 3).

Within this conception, scientific studies eliminate risks progressively.

Second, risk is associated with production for capitalist markets: In Argentinian biosafety regulation, the evaluation of GMOs is conducted in three stages. First, CONABIA has to evaluate whether the GMO changes the environmental conditions of the area where it is going to be cultivated, using the principle of familiarity. Next, SENASA analyzes whether this GMO can be safely consumed by animals or humans. This phase is completed in only one year. In this case, regulations establish that the risks have to be measured with the principle of substantial equivalence between the GMO and its genetically unmodified homologue. Finally DIME-AGRO analyzes the GMO on the international markets. This is meant to avoid potential negative impact on Argentinian exports. Under these conditions, GMOs are not considered to be different from their conventional homologues. The use of genetic engineering to construct these transgenic seeds does not change anything in general characteristics of these species. This is possible because scientific selection performed in laboratories enables the elimination of malformations, reducing risks: “you look the normal factors in plants with the gene inserted, and ensure that this organism express what you are looking for (...) With multiple tests, every fear must be removed” (Interview 3).

Substantial equivalence and familiarity principles mean that the commonly-understood principles of uncertainty and precaution are removed as valid objections, thus promoting the release and commercialization of GMO products as well as artificially protecting confidence in regulatory process (Newell 2002). These definitions of risk “help streamline and standardize a regulatory process, making approvals for new products easier and quicker” (Scoones 2003: 2). Besides, in this idea of risk there is the notion that hazards can be objectively identified by knowing the genetic composition, restricting the relevant uncertainties to available scientific knowledge.

Third, there is a hegemonic role of certain disciplines for risk conceptions: Risk evaluation could make an approach to the environment in different ways. It is not the same to evaluate agricultural effects of the introduction of a species, or to see the possible effects of this new species in biological interaction with environment or its impacts on social relationships within a community or a village. Although biotechnology requires the molecular biologists' view or another social test, the hard presence of agronomic engineers in regulatory institutions brings to the process of risk assessment two particularities.

On the one hand, applied research exerts dominance over basic research, because the preeminent evaluation is related to the application of a technological invention and not to the process of its creation. This reinforces the idea that defines risk assessment as necessarily oriented not to the biological elements of transgenic seeds, but to their particular agronomic and productive characteristics.

On the other hand, social sciences also have a subordinate place within these regulations and institutions, which means that social consequences (and even the criteria of impact on local economies) are not considered as legitimate grounds on which to evaluate transgenic impacts. Social sciences are not included because they are not considered to be science: they do not deliver precise results and are often biased to produce the results desired: as one interview partner put it: “they have many things that are not scientific but religious” (Interview 1). Studies in the social science disciplines are not considered to be valid because their methods are related to the subjective knowledge of researchers. They are seen to be not neutral and as not having pre-determined, shared methods to arrive at findings recognizable as having been proven. That is why these social disciplines are subordinate to those who “have their hands on the lab bench or in test tubes for many years” (Interview 3).

Sometimes the ones who have this perspective believe that it is possible to establish a division of work inside the biosafety regulation process. Because the biosafety has to be as scientific as possible, it has to evaluate environmental and health impacts using only certain methods and scientists from biology, genetic engineering or agronomic engineering. Social sciences would instead make policy about biotechnology in governmental issues. In this way, the political dimension of biosafety is eradicated from the conception of risk and from the political practices of people who are defining risks in public bodies.

Fourth, risk is measured by a specific expert: This conception of risk supposes the existence of an expert that has specific knowledge about these topics and a particular scientific and labor trajectory with biotechnologies.

How do these experts construct the idea of risk? First of all, they include all the perspectives below. They believe that science is a sphere where knowledge is accumulative, that has universal rules based in a shared epistemological view (most often the hypothetic-deductive model promoted by Karl Popper) and that is constructed on the basis of actual neutrality and objectivity.

The constitution of this scientific knowledge is in fact completely sectarian, creating an enclosure with a specific language. With this enclosure, experts are separated

from people that does not conduct research, and from the ones who participate in scientific circles but do not speak the scientific language that we described above. To the insiders, these other scientists are outsiders because their research is conducted with an ideological, programmatic or religious bias that precludes neutrality, objectivity, and even any truth-value of their findings.

Within their language, the method is the most important thing to guarantee objectivity. This method is based on the double-blind method which erases the historical origin of the phenomenon (Horckheimer 2000).⁹

Within these enclosures, the experts have what they call insider knowledge. That knowledge is related with the specific networks in which those scientists and regulators are involved. They have specific knowledge about public administration because they have been administrators at universities, in public bodies or research projects. At the same time, they have relations with the domestic or international private sector through their participation in international congresses, scientific forums or different state programs that connect the public and private sectors (Poth 2013).

The intimate relationship between science and markets in agriculture is seen as natural, because common sense holds that science produces technologies to increase the efficiency of agrarian production. In this way, science must research what is important to produce value, leaving aside those studies that focus on local perspectives or have no commercial value. The practical objective of science is strongly associated with the production of goods that can be sold in the markets.

But when we talk about the relationship between science and policy the idea is that science is close to what Funtowicz and Strand (2007: 268) call the “modern model of legitimation”. In this model, apparently, science informs policy through inputs of objective, valid, complete and trustworthy knowledge. With this information, politicians order possible policies according to values and social concerns as well. What we may see in this perspective is that the political arrangement about what we may do with transgenic seeds is in fact rooted in a scientific method that imposes a dubious

9 This experience describes an especially way of conducting an experiment which attempts to eliminate subjective and achieve a higher standard of scientific rigor. As described by one interviewee: “One director gives to a doctoral student a sample, but the doctoral student doesn’t know what each one is. The director says: ‘make the experiment and then you will tell me the results’. One of this samples has one result. The other, another result. The third, another one. Why do you do that? Do you want to make the doctoral student a joke? No. This mechanism is important to eliminate suspicious, to eliminate the manipulation of samples. Then you look with more objectivity at every sample. The double-blind method means that the one who makes the experiment doesn’t know the origin of the sample.” (Interview 2).

separation between policy and science, denying that scientists making risk assessments are in fact deeply involved in a political decision.

4.3 Some General Ideas about Biosafety Regulation and Science

The conception of risk gives us an idea of what type of science is playing the main role within this regulation. Even more, to see that those scientific arguments and validations are central in Argentina's regulation opens a question about another kind of role that scientific knowledge has inside the Biotechnological Agrarian Model: to legitimate and consolidate the current mode of agrarian production.

The ones that made regulation (scientists and politicians) believe that: "not only transgenics, but biotechnology is, possibly, the revolution of the 21st century to feed the world" (Interview 4). For those views, biosafety implies precaution to look for only one kind of risk: the one related with global markets. In this way there is so much evidence that is not included because it is considered to be political evidence.

Science, for these actors, has the leading role in political regulation, giving certainties that are needed to keep on moving. Thus, the precautionary principle is embedded at the core of what we have called the modern model of legitimation.

At the same time, in this committee there is a structure of political decisions that exclude everyone who does not speak their scientific language as they define it, considering that this language is a common definition of the agrarian model of development. This is a political arrangement to release transgenic seeds that rests on genetic determinism, a perspective shared by every member of the National Commission of Agrarian Biotechnology. That is why science is seen as the way to construct consensus, offering the possibility of avoiding intense debates about transgenic seeds because there are no non-scientific political discussions that would polarize the problem. However, what this does not do is build a public institution where political discourse and consensus is possible, since this way excludes any alternative perspectives about GMOs. We can see thereby how visibility and influence are two different ways in which science creates an asymmetry of knowledge legitimating the agrarian model in public bodies.

5. Public Discussion about Pesticides in Nationwide Mass Media

In a similar manner, we can observe a silencing of alternative knowledge by the mass media in the public debate. This section focuses on the role of mass media in shaping public opinion on the Biotechnological Agrarian Model in Argentina. The mass media

system is differentiated in functions and roles. In the journalistic function, namely, reporting on public issues, the media has a dual role of producing their own contributions to the debate and creating a public stage, since they reproduce – in adapted ways – the contributions of other actors (Peters 2008: 55). In other words, the media is both an arena of the public sphere and an actor in it (for the case of the Biotechnological Agrarian Model in Argentina see Motta and Alasino 2013). The role as organizer or gatekeeper to a public sphere relates to the admission from external contributions and presentation of arguments. How does the journalist distribute the opportunities of this form of public communication? Research on public debates on GM crops has confirmed the patterns founded in cumulative research in sociology of news: actors from a higher position in political and economic power structures prevail in mediated political communications (Rucht et al. 2008). How do asymmetries of knowledge relate to influence and visibility in the case at hand? What types of actors receive more visibility to speak in the public sphere about the Biotechnological Agrarian Model? This section is concerned with the issue of how asymmetries of knowledge are related to visibility in mass media.

We address this question with an analysis of the media coverage from the newspaper *La Nación*. Drawing from previous work on Argentina media (Motta 2013, 2016; Motta and Alasino 2013), our selection of this newspaper is due to its consistent editorial position regarding the Biotechnological Agrarian Model. In addition, relying on the notion of political parallelism (Hallin and Mancini 2004), *La Nación* can be classified in relation to the current context of polarization in Argentina. Two main conflicts overlapped to create two camps: the conflict arising from Resolution 125, in which a rural sector, represented by the four big farmers' associations Sociedad Rural de Argentina (SRA), Federación Agraria Argentina (FAA), Confederaciones Rurales Argentina (CRA), Confederación Intercooperativa Agropecuaria (CONINAGRO) formed opposition to the government (Giarracca and Teubal 2010; Aronskind and Vommaro 2010); and the conflict between the latter and the media groups. The newspaper *La Nación* was selected for its clear position as an opponent of the government and ally of the rural sector. *La Nación* presents a historically consistent coverage of the interests from agribusiness that has not changed in face of conjunctural conflicts between the rural sector and the government or the latter and the media. This has not been the case with *El Clarín*, the newspaper with the widest circulation in Argentina, which started to oppose the government systematically in the conflict with the rural sector in 2008 because of its own disputes with the government. Given that the Argentinian debate about agrobiotechnology cannot be disembedded from such a context, the systematicity of the political bias from *La Nación* in the coverage of the interests from agribusiness in Argentina ratifies this.

The long controversy that dominated the Argentinian political landscape in 2008 over the Resolution 125 opened new political opportunities to debate the effects of the Biotechnological Agrarian Model (Svampa 2008: 27). The environmental and health damage associated with the pesticides used in the technological package of genetically modified seeds have been long discussed by affected communities, rural doctors and environmental organizations.¹⁰ However, one of the few occasions on which the topic reached the national public agenda was in 2009. On April 13, *Página/12*, a newspaper once identified with a more progressive agenda (which has become less and less so due to its support to the government) published the results from a study conducted by Andrés Carrasco, Professor at the University of Buenos Aires and researcher from the Consejo Nacional de Investigaciones Científicas y Técnicas (National Council for Scientific and Technical Research, CONICET). The study showed negative effects of glyphosate on health and environment. Five days later, based on it, the Asociación Argentina de Abogados Ambientalistas (Argentinian Association of Environmentalist Lawyers, AADEAA) took judicial action in the Supreme Court to suspend use of the pesticide. On April 20, the Ministry of Defense prohibited the use of glyphosate on its lands rented for agricultural production. These events led off to a fierce controversy on the effects of the technological package.

The newspaper *La Nación* published nine articles on the topic: two editorials (*La Nación* 2009a; 2009b), one opinion article (Mira 2009) and six news articles (Bertello 2009a, 2009b, 2009c; Colombres 2009; *La Nación* 2009c; Seifert 2009). The newspaper gives most credence to the rural sector in their claims defending the technological package of glyphosate-resistant genetically-modified soy, framing its economic benefits and biosafety. The media framing is clearly pro-GMOs:

Together with GM soy and no-till farming, in which soil is not removed to facilitate preservation, glyphosate is one of the key components of soybean production. It is an active ingredient in herbicide that aims to control weeds that compete or

¹⁰ Groups of neighbors living in urban areas close to soy plantations started to organize against pesticide spraying over their houses, schools and small farming lands. *Madres del Barrio Ituzaingó Anexo* (Mothers of Ituzaingó), a group organized in a district of the City of Córdoba, was one of the first major examples of this. As early as in 2001, they had collected data on the incidence of cancer in the neighborhood on which to base their claims against pesticide spraying. They received support from ecological organizations, doctors, and scientists. In early 2006, the environmental movement organization *Grupo de Reflexión Rural* (Group of Rural Reflection, GRR) organized a national campaign aimed at raising awareness about pesticide use. Under the slogan *Paré de fumigar!* (stop spraying), it was specifically targeted at the pesticide glyphosate, associated with the use of transgenic soy developed to be resistant to this active ingredient and the mode of application, namely, large-scale application sprayed from airplanes and large agricultural machinery (*Grupo de Reflexión Rural* 2006). The report of 2009 recognized the campaign had many outcomes, such as mobilization, gaining media access, changes in municipal legislation, but noted they had not managed to achieve its main stated goal, namely, a policy change to stop glyphosate spraying (*Grupo de Reflexión Rural* 2009: 8).

may compete with crops for vital resources such as light, water and nutrients. Registered at the SENASA, it has been used in Argentina for 33 years. There are more than 140 countries in the world that use it. In Argentina, 160 million liters are sold per year on a market turnover of over US\$ 600 million (Bertello 2009a: n.p.).

The editorial line at *La Nación* positioned itself openly against the prohibition of glyphosate and in defense of its safety. In order to justify this position, the newspaper adopted three main discursive strategies. The first was to delegitimize the study from Carrasco, shedding doubt on its scientific credibility. The second was to rely on the scientific authority of official institutions. The third was to recruit experts to speak about the advantages of glyphosate. Together, these strategies created asymmetries of knowledge in the media discourse, by dismissing as non-scientific any knowledge that threatens the Biotechnological Agrarian Model, and accrediting as expertise any type of knowledge that promotes it.

Delegitimation strategies included the use of qualifying expressions such as “alleged damage”, “presumed damage” (Bertello 2009a: n.p., 2009c: n.p.; Mira 2009: n.p.), “a study of alleged scientific validity” (Bertello 2009b: n.p.); “those doubtful papers” (La Nación 2009a: n.p.). The denial of the study’s credibility with claims such that the original study had been requested but not delivered and that the study is not registered nor recognized by CONICET (Bertello 2009b, 2009c; Colombres 2009; La Nación 2009b; Mira 2009). The status of what is considered to be scientific was challenged with the argument that the study was “still unpublished” (La Nación 2009a: n.p.), “has not gone through the necessary steps for a publication to achieve a scientific status” (Mira 2009: n.p.); “[scientific journals being] the common way through which researchers disseminate their relevant findings” (Colombres 2009: n.p.); that it was a “report unknown in academic circles” (La Nación 2009a: n.p.). A journalist even names these episodes as a plot: “A plot typical of a thriller, above all because the research has not been published, none of the institutions where the author works speaks for it, and the person in charge himself is difficult to find” (Colombres 2009: n.p.).

Also, sources were quoted such as Guillermo Cal, director of Cámara Argentina de Sanidad Agropecuaria y Fertilizantes (Chamber for Agriculture Safety and Fertilizers, CASAFE): “There are no serious scientific studies in Argentina and in the world that invalidate glyphosate” (Bertello 2009a: n.p.). A spokesperson from the Asociación de la Cadena de la Soja Argentina (Association of the Soy Production Chain in Argentina, ACSOJA) is quoted saying that the study “is unfounded” and that “scientific works and academic investigations demonstrate that such arguments are erroneous” (quoted

in Bertello 2009b: n.p.). Note that none of these studies with contrasting results are actually identified and cited. It remains, at most, a dispute in which the influence of the sources (CASAFE and ACSOJA) provides for the fact that their arguments will be taken at face value, without any need to justify their claims with specific counter-arguments, beyond the general reference that there are other studies that prove the contrary. No detail is given on why Carrasco's study is not "serious" or which are the errors committed.

The second strategy was to use recourse to the credibility of state institutions, making reference to the national institutions SENASA and Instituto Nacional de Tecnología Agropecuaria (National Institute of Agrarian Technology, INTA) (Bertello 2009a; La Nación 2009b; Mira 2009, Seifert 2009). Both are agricultural bodies and thus not competent for the evaluation of health and environmental risks (Section 4). These institutions, for their part, turn to the authority of international organizations like the WHO and FAO. When consulted by La Nación, the representative from SENASA states that glyphosate is a product that offers no danger, according to the criteria of WHO and the risk classification of FAO. The interesting information is that the "technical" source to whom La Nación gave visibility to speak about the environmental and health risks of glyphosate is an agronomic engineer, who coordinates the area of Agrochemicals and Veterinary Products of SENASA. Again, objectively he can be considered as qualified to speak, at best, about the agronomic efficiency and risks of such a product (Section 4). The guarantee of its safety is bureaucratically and not scientifically justified: that the product "is registered at the Register of Phytosanitary Products in Argentina, that it has been approved by a resolution from the Secretaría de Agricultura, Ganadería, Pesca y Alimentos (SAGPyA) 350/99" (Seifert 2009: n.p.). The equation between (official) science, certainty and societal progress becomes clear in the following passage from an editorial:

It does not matter for the launching of the new adventures that this country witnesses, incredulous and embarrassed, that the most important scientists in the world and the most influential academic societies have accepted the genetic modification of grains. It does not matter that a historical revolution started in the food production to alleviate hunger among a world population whose vital needs are still unmet. It does not matter for those who take part in such a policy that, if it continues in this direction, will make the country set back in decades, that the overwhelming scientific opinion goes in the opposite direction to theirs (La Nación 2009a: n.p.).

The third strategy consisted of giving visibility to specific voices, which the newspaper named as experts. Apart from one article which gave the entire media space to a representative from SENASA (Seifert 2009), a state institution, the other sources consulted by La Nación were mostly representatives of sectoral bodies, but also producers and consultants. Note that all are market actors, all directly involved in the activities of the Biotechnological Agrarian Model. As it could be expected, these actors gave predominantly their views about the economic risks of regulating glyphosate use. In only a few instances did they mention health and environmental risks, but the media framing did not allow for full discussion of such risks.

In an article, the newspaper consulted various experts and asked them the question of “what would happen to the production if glyphosate would be suspended or prohibited” (Bertello 2009c: n.p.). Visibility was given to two producers and three sectoral bodies (ACSOJA, CASAFE and Asociación Argentina de Productores en Siembra Directa (Argentine Association of Agricultural Producers Using Direct Seeding, AAPRESID)). The producers emphasized the risk of losing yields and of having to abandon direct seeding while AAPRESID used the opportunity to maintain its market chances by contesting that the no-till farming technique is not dependent on glyphosate. The director from CASAFE, Guillermo Cal, stated that yields would drop 30 to 40%. The newspaper also mentioned that CASAFE had disseminated a statement on the studies that demonstrated the low risk of glyphosate, but none of these data were presented to the reader. Rodolfo Rossi, president of ACSOJA, ranked, along with agronomic impacts (higher pest management and production costs, reduction in no-till farming, less flexibility, less efficiency in water use, smaller productivity and decrease in yields), also environmental issues: “the return of chemical products with more toxicity and with less efficient control; more accumulation of other herbicides in soil and water” (Bertello 2009c: n.p.). In another article, actually, a short note, three market consultants were given visibility for their arguments on the “blow to no-till farming” (La Nación 2009c: n.p.). They stated the same arguments as those already mentioned including the claim about environmental and health risks, namely, that without glyphosate producers would start to use other, more hazardous pesticides.

In sum, the third strategy gives visibility to those actors who have influence in the Biotechnological Agrarian Model. However, the newspaper also performed the role of certifying their expertise as the type of knowledge which is appropriate and valid to speak about the effects of the model. None of the sources given visibility were actual scientists from a recognized scientific institution, such as a university or a research institute. Nevertheless, their practical knowledge regarding the operation of the Biotechnological Agrarian Model was accredited as expertise by La Nación. The only

source whose scientific training was cited (agronomic engineer from SENASA) was part of the Secretary of Agriculture, the state institution responsible for fostering and promoting the agrobiotechnological package. All sources had in common their interest in promoting the actual model and their sectoral competence to speak for economic performance. None had the independence or the appropriate knowledge to speak of assessment of risk to health and environment. The delegitimation of Carrasco's study and type of knowledge goes hand in hand with the legitimation of these other types of knowledge.

6. Conflicts regarding Municipal Pesticide Regulations

In contrast to the other cases, we can observe in this part how "alternative" knowledge (in this case criticizing the Biotechnological Agrarian Model) was prioritized over "appropriate" knowledge (in favor of the model) due to different power relations. We follow the process of how knowledge is translated into political and judicial decisions. Regarding the main question of the paper it is of special interest not only how but which knowledge is legitimized within the political process. To analyze these questions, we focus on three conflicts regarding municipal pesticide regulations and especially the role of knowledge. The conflicts about pesticide use near urban areas in Barrio Ituzaingó Anexo in Córdoba Capital (Province of Córdoba), San Francisco (Province of Córdoba) and San Jorge (Province of Santa Fe) are deployed to construct a coherent narrative based on the interview material of the three cases (for a further analysis of the case of Barrio Ituzaingó Anexo, see Carrizo and Berger 2009; for the case of San Francisco, see Raucher 2015).

The struggle about pesticide use near urban areas and the impact on human health was only one conflict surrounding the Biotechnological Agrarian Model and its aspect of cultivation (Raucher 2015). The conflict emerged at the municipal level because local neighborhood groups discovered the problem and demanded regulation by municipal, provincial and national state actors, but there were nearly no actions by provincial or national state actors to solve the problem. That is why environmental groups and actors of the agricultural sector focused mainly on the municipal level (based on interviews 5-14).

The following three conflicts gained importance in municipal pesticide regulation in Argentina. The neighborhood initiative Madres de Ituzaingó Anexo (Mothers of Ituzaingó Anexo) formulated their political demand to restrict pesticide use in 2001. They argued that pesticide use had affected the health of the population of Barrio Ituzaingó Anexo in the City of Córdoba (Province of Córdoba). In more than 10 years of struggle, various scientific studies were conducted, and municipal norms prohibited pesticide use, but

were not implemented (Avila 2010; Carrizo and Berger 2009; Interviews 9-10; Matheu 2010; Public Lecture 1). In this section we focus on the trial against two agricultural producers and one pesticide applicator based on the national law on hazardous waste. The conflict in Ituzaingó Anexo is also important because it subsequently gave rise to various struggles about municipal pesticide regulations.

In San Francisco, the neighborhood initiative Voz Ciudadana began its anti-spraying campaign in 2005. After an inquiry of various scientific studies, Voz Ciudadana conducted a public campaign to pressure the city mayor and the city council to restrict pesticide spraying (Interview 11; Rópolo 2010). The local farmers' association Sociedad Rural de San Francisco reacted with its own campaign directed to municipal authorities (Interviews 12-13). The result of the interaction process was one of the first municipal norms regarding pesticide use in Argentina. The legal norm of 2006 introduced a buffer zone of 500 meters to the urban area in which pesticide spraying is prohibited (Ordinance 5.531/2006).

The neighbors of the Urquiza district in San Jorge began demanding a pesticide regulation in 2004 because of a high rate of disease in this neighborhood. After unsuccessful demands to the city mayor and various efforts to introduce a legislative initiative in the city council, the neighborhood initiative went to court in 2009 (Interview 14). Here we focus on the trial against the agricultural producers who own fields near Urquiza, the Municipality of San Jorge and the Government of the Province of Santa Fe. After decisions in favor of the neighbors of Urquiza, the final decision in 2012 reduced the previously-introduced buffer zone from 800 to 500 meters, and more importantly diminished the general prohibition of pesticides to the sole prohibition of glyphosate (Berros 2011; Judicial File No. 208-2009; Interviews 14-18). The turnaround of the judicial decisions was due to the initial demands of the neighborhood initiative to prohibit glyphosate without a reference to other pesticides in their petition for injunction (Interview 15).

In Ituzaingó Anexo, San Francisco and San Jorge the conflict actors can be distinguished in neighborhood initiatives and environmental groups, who criticized the Biotechnological Agrarian Model, and agricultural producers, seed and agrochemical producers, distributors and applicators together with other actors of the agricultural sector, who supported this mode of production. Both actor groups were constituted through their interest against or in favor of pesticide use near urban areas. The conflicts between both actor groups are understood as interaction processes in which the two actor groups addressed local state actors and courts in order to foster and impose their

interest in political and judicial decisions. Based on their interest, the state actors are classified as belonging to one of the actor groups or as being neutral.

The empirical evidence shows two different types of knowledge: everyday knowledge and scientific knowledge. The everyday knowledge of the two actor groups was based on their personal experiences and experiences of others with pesticide use over a certain time period. Furthermore, the everyday knowledge was interrelated with the interest of the actor groups regarding pesticide use. During the political struggle, which began with the first demand of neighbors to restrict pesticide use near urban areas, each group searched for verification of their everyday knowledge by scientific knowledge. This raises the question of which knowledge was recognized as scientific and thereby as a legitimate basis for state decisions. What we found in our investigation is that every actor group presented different and contradictory studies of scientists to support their everyday knowledge.

We start the analysis with the reconstruction of the everyday knowledge of each actor group. The neighbors realized that not only they themselves or family members were ill, but that many people in their neighborhood had similar diseases like cancer or had already died because of the diseases, much more than before. They questioned what the reasons were for the diseases. They consulted medical personnel to find out what was going on. The medical personnel pointed to the possible effect of pesticides or the people connected pesticide spraying with immediate effects like respiratory problems and through that they linked also the other diseases to pesticide spraying. They talked with other neighbors and collected their experiences (Interviews 9, 11, 14). Like in the case of Ituzaingó Anexo, the neighbors made spatial correlations between the houses, where ill people lived, and their proximity to the soy fields. The Mothers of Ituzaingó discovered that there were more cases of disease near the soy fields (Interview 9). They augmented this knowledge with their own experience, which included whether they or family members were ill. Over time, these experiences became transformed into everyday knowledge.

In contrast, farmers, pesticide producers and distributors emphasized their experience of working with pesticides for many years without any health effect for themselves or their workers. One farmer from San Jorge showed me that he lives within his fields, that he sprays glyphosate in a distance of more or less 10 meters from his house, and that no one in his family is ill. He himself and his workers mixed pesticides for application and he claimed that no one's health had been affected, because he had sent his workers to medical personnel to monitor their health (Interview 18). An agricultural producer from San Francisco highlighted that the health of the workers and the farmers was the most important and that they would be the most affected because they work

every day with pesticides (Interview 12). A representative of the Cámara Empresaria de Proveedores de Insumos Agropecuarios de Santa Fe (Chamber of the Suppliers of Agricultural Inputs of Santa Fe, CEPIAS) made similar statements (Interview 19). From their experiences, they concluded that agrochemicals have no effect on human health if they are used correctly. As in the case of the neighbors, the farmers' experiences became everyday knowledge.

Focusing on glyphosate, we can observe some change in the everyday knowledge of the farmers. Before, many of farmers said that glyphosate is not toxic, culminating in the statement of the Minister of Science, Technology and Innovation Lino Barañao that glyphosate is like water with salt (Asociación de Madres de Plaza de Mayo 2011). By 2012, in all the interviews, the interviewees admitted that glyphosate and agrochemicals in general are toxic, but not dangerous for human health if used correctly.

We can observe different everyday knowledge based on the long lasting experiences of each actor group, which was not contested by the exchange of experiences between the actor groups. So what happened when everyday knowledge met scientific knowledge? Initially we define scientific knowledge as produced by scientists, legitimated by their formation and academic titles, in scientific institutions like universities. We analyze the presentation and perception of scientific studies of both actor groups within the political process in San Francisco, and the trial proceedings in both Ituzaingó Anexo and San Jorge.

The presentation of scientific studies and the holding of lectures by scientists to legitimize their own everyday knowledge also had the function to delegitimize the everyday knowledge of the other groups and the scientific studies and lectures of scientists they presented. Although each actor group interacted mainly with state actors, each group reacted to the presentation of scientific knowledge of the other group.

For example, in the case of San Francisco, the neighborhood initiative presented various studies and invited the well-known biologist Prof. Dr. Raúl Montenegro of the Universidad Nacional de Córdoba for a lecture to back their position against pesticide spraying (Interview 11). As a reaction, the local farmers' association Sociedad Rural de San Francisco introduced a contradictory study (Asociación Toxicológica Argentina 2006), which showed that there is no effect of pesticide spraying on human health. Furthermore, they organized a lecture with the toxicologist Dr. Silvia Martínez of the Universidad Abierta Interamericana who is also chief of the toxicological service of the Provincial Hospital of Rosario (Interview 12). In this context a state actor in favor of

the agricultural sector disqualified Raúl Montenegro as scientist, because he is one of the founders of the environmental NGO Fundación Para La Defensa Del Ambiente (Foundation For The Defense Of Environment, FUNAM) (Interview 5).

Each actor group interpreted scientific knowledge differently. This is the case especially for newly-produced scientific knowledge and its reception within political and judicial processes. The following two studies were involved in the trial of San Jorge: The study of the Universidad Nacional del Litoral (UNL) focused on aerial drift during pesticide application. The study of the Ministry of Health of the Province of Santa Fe showed fewer diseases during the phase of prohibition of pesticide spraying within 800 meters of the urban area (Judicial File No. 208-2009). Each actor group reacted to this newly produced knowledge with different interpretations of the studies based on their original everyday knowledge. For example, the UNL studies and the Ministry of Health studies were interpreted as follows: a judge at the second level of jurisdiction in the trial of San Jorge ruled in favor of a minimum distance of 500 meters to urban areas for pesticide spraying (Interview 15). One of the lawyers of the farmers of San Jorge argued for a minimum distance of 100 meters (Interview 16). Both based their arguments on the UNL. A representative of the environmental NGO Centro de Protección a la Naturaleza (Center For The Protection of Nature, CEPRONAT), which acts mainly in the Province of Santa Fe, told me that the study of the Ministry of Health shows the need for a minimum distance of 800 meters (Interview 8). While one of the lawyers of the farmers of San Jorge argued that the study is not valid because the conducting of the study became public before the study was concluded. In his opinion, the people went to another medical station in order to lower the disease rate with the intent of supporting the demand to stop pesticide spraying (Interview 16).

We can observe that the perception of scientific studies by each actor group is preconditioned by their everyday knowledge. The interviewees of both groups distinguish between serious scientific knowledge and non-serious/rather non-scientific knowledge produced by scientists. As an example we can use the already mentioned case of Raúl Montenegro, who was discredited as a scientist because of being an environmentalist. Another example is Prof. Dr. Andrés Carrasco, as mentioned above. After publishing a study about the negative effects of glyphosate on frog embryos, he was attacked and also discredited as a scientist. Several interviewees in favor of pesticide spraying called the study false without mentioning any reasons. The only critique was that Carrasco is an environmentalist (Interviews 5, 16). That shows that not only the content but also the status of the speakers were called into question based on the degree of conformance with the everyday knowledge of each actor group.

After discussing the use of scientific knowledge in the political and judicial processes we ask why knowledge entered in political and judicial decisions. The evidence presented in the following shows a connection between a certain knowledge and the power or influence of the actors. In the trial of Ituzaingó Anexo, several studies were presented by both sides and different scientists testified for one of the sides. The report of FUNAM and the testimonies of Raúl Montenegro and Andrés Carrasco were heard and recognized. The judgment was in the same direction as the arguments of Montenegro and Carrasco, but the most important question of the trial was whether it could be proven that the accused farmers and pesticide applicators sprayed pesticides in a certain field near Ituzaingó Anexo and were therefore guilty of producing toxic residuals (Cámara 1a. del Crimen de la Ciudad de Córdoba 2012).

In the case of San Francisco, the scientific knowledge criticizing pesticide use near urban areas because of its effect on human health was completely copied to the municipal law (see Ordinance 5.531/2006 – Fundamentos completos). This happened because of a switch in the opinion of the ruling faction in the municipal council to support the ordinance. The scientific knowledge accumulated by the neighborhood initiative, the support of the local population and a councilor of the ruling faction changed the opinion of the other councilors of the ruling faction (Interviews 20-21). So what we can state here is that the scientific knowledge entered in the decision based on a question of power.

In the case of San Jorge, we can observe a much more complex role for knowledge, part of which was produced during the trial. In the end, the interpretation of the studies of the UNL and of the Ministry of Health by the judges was against the use of pesticides (Judicial File No. 208-2009; Interview 15). This was not the reason why the final judgment was less favorable for the neighbors of San Jorge than prior judgments like mentioned above. In this situation, the judges were the powerful actors and supported the scientific knowledge of one side with their decision.

To sum up, we showed that the everyday knowledge of each group interrelated with their interests was the basis for their evaluation of scientific knowledge. This caused a distinction between serious and unserious natural scientific knowledge and led to different interpretations of scientific knowledge. Scientific knowledge was used to support the everyday knowledge of each group and to delegitimize or subordinate the scientific knowledge presented by the other group.

Furthermore the attempts to (de)legitimate different types of knowledge by the two actor groups were directed towards the content of knowledge and also the status of the

scientist or actor who produced and/or supported the knowledge. The conflicts among the various (de)legitimation actions against rival knowledges were settled by power. In other words, the scientific knowledge and to a certain extent also the everyday knowledge entered in political or judicial decisions based on the influence of the actor groups in the public sphere. This interconnection of knowledge and power can lead to the reproduction or the change of the structural asymmetries of knowledge.

7. Conclusion

In our paper, we have analyzed the fundamental role of scientific knowledge in the Biotechnological Agrarian Model. Knowledge does not only count as a factor of production at the moment of research and development of agrarian inputs such as transgenic seeds and associated pesticides. Scientific knowledge is also key both to build the legal structure of the model and for the arguments that defend its legitimacy in the public sphere. Therefore, a type of knowledge supports the Biotechnological Agrarian Model along the agrarian chain and beyond: from its beginning, in the production of transgenic seeds to its maintenance, in the defense against emerging criticisms to it on the public sphere. We sought to explore in this paper how knowledge is involved in the public sphere, which type of knowledge is considered relevant to produce, decide and debate about the Biotechnological Agrarian Model and, finally how the use of knowledge influences the equality of participation in public sphere.

We see that science produces legitimacy for political decisions and arguments in the public discourse, but knowledge enters only in political decisions or in the public discourse in connection with power. Furthermore each actor group compares scientific knowledge with its interests and everyday knowledge and use certain scientific knowledge to support its position. Power holders and influential actors decide which knowledge is valid. Mass media is an elementary gatekeeper helping to construct the authority of the selected voices on the issue and, in turn, to consolidate the legitimacy of the model in Argentina. This explains the differences in prioritization of knowledge among groups of actors (in favor or against the Biotechnological Agrarian Model). In the case study of the national regulation of transgenic seeds, we saw the super ordination of natural science over social science. The analysis of the mass media showed the predominance of agronomist and economic science over medicine, biology and social science. The study of the conflicts regarding municipal pesticide regulations emphasized the distinction between serious and non-serious natural science. Scientific language is used as the mechanism to exclude dissident scientists from the discourse within scientific circles.

In this way, the struggle about adequate knowledge contributes to build asymmetries within the public sphere. The visibility of one type of knowledge (related to the rational conception of risk, considered to be a neutral and objective scientific knowledge) is combined with the silencing of alternative knowledges that are excluded from the public discourse and political decisions about the agrarian model as if they were conducted with ideological, programmatic or religious ideas. These mechanisms create inequalities of access to and participation in the public discourse, the political and judicial processes. By that, a dominance of positive perceptions of the Biotechnological Agrarian Model is (re)produced in the national arena. In difference to that, visibility is not controlled by a specific actor on the municipal level, because of changing power relations between the actors. The absence of a powerful actor coalition in favor of the Biotechnological Agrarian Model opens the possibility for alternative knowledges to be taken into account at municipal level.

These results show various processes and mechanisms to distinguish and (de) legitimate different types of knowledge. The asymmetry of knowledge was produced in the discussed case studies along the lines of “adequate” and serious or non-serious knowledge. This distinction becomes manifest in the denomination of knowledge as either “scientific” or “non-scientific”. In this way, when we focused on experts or scientists we saw that they are part of the game of (de)legitimation. Other actors (de) legitimate experts labeling them as a serious or an ideologically driven scientist. The training and status of the scientist seem not so important as her/his opinion about the Biotechnological Agrarian Model. As the examples of Carrasco and Montenegro showed clearly, this is another mechanism in which science has a main role in the consolidation of inequalities in the public sphere, in the processes of political regulation and in court proceedings.

In sum, by analyzing the mechanisms of both legitimation and delegitimation taking place in our case studies, we made an empirical contribution to the critical theory of the public sphere showing how these mechanisms produce visibility, influence and asymmetry of knowledge. Our conceptual contribution to a critical theory of the public sphere is to hint to a possible development of the analysis of environmental conflicts. We speak of a two-fold process of legitimation and delegitimation, because actors seek to legitimate their knowledge and experts at the same time as they act to delegitimize the opposed knowledge and experts. This means that there is no neutral knowledge but that actors construct possibly contradictory knowledges. This is interconnected with the different types of knowledges we identified in the cases and with the mechanism of hierarchization of knowledges. The (de)legitimation of knowledge goes hand in hand with the (de)legitimation of scientists. Especially important in these processes is the role

of power, in that it is disguised in technical language. The very core of such inequality in the public sphere is the different perceptions and interests related to science and scientists backed by asymmetries of power.

8. Appendix – Summary of Interviews Conducted

Identities are given as affiliations without names in order to protect the identities of politically vulnerable interview partners.

- Interview 1: Former member of CONABIA, Buenos Aires, October 2010.
- Interview 2: Member of CONABIA, Buenos Aires, October 2010.
- Interview 3: Member of CONABIA, Buenos Aires, February 2011.
- Interview 4: Secretary of agriculture and creator of CONABIA, Buenos Aires, March 2011.
- Interview 5: Former mayor of the Municipality of San Francisco, San Francisco, 12/11/2012.
- Interview 6: Mayor of the Municipality of San Jorge, San Jorge, 15/11/2012.
- Interview 7: Representative of Colectivo Paren de Fumigar Córdoba, Ciudad de Córdoba, 23/03/2012.
- Interview 8: Representative of CEPRONAT, Ciudad de Santa Fe, 17/10/2012.
- Interview 9: Activists from Barrio Ituzaingó Anexo, Ciudad de Córdoba, 02/04/2012.
- Interview 10: Environmental lawyer, Ciudad de Córdoba, 28/03/2012.
- Interview 11: Activist from San Francisco, San Francisco, 29/11/2012.
- Interview 12: Former representative 1 of local farmers' association of San Francisco, San Francisco, 25/04/2012.
- Interview 13: Former representative 2 of local farmers' association of San Francisco, San Francisco, 25/04/2012.
- Interview 14: Activist from San Jorge, San Jorge, 02/05/2012.
- Interview 15: Judge of the 2nd instance, Court of the Province of Santa Fe, Ciudad de Santa Fe, 09/05/2012.
- Interview 16: Lawyer of the farmers from San Jorge, Ciudad de Santa Fe, 09/05/2012 and 18/10/2012.
- Interview 17: Farmer 1 from San Jorge, San Jorge, 07/05/2012.
- Interview 18: Farmer 2 from San Jorge, San Jorge, 08/05/2012.
- Interview 19: Representative of CEPIAS, Rosario, 16/04/2012.
- Interview 20: Former city councilor 1 of San Francisco, San Francisco, 20/04/2012.
- Interview 21: Former city councilor 2 of San Francisco, San Francisco, 23/04/2012.

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