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Resisting and accepting: Farmers' hybrid epistemologies in the GMO controversy in Chile

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ABSTRACT

There is a growing interest in understanding how different actors involved in debates regarding GMOs produce, justify and mobilize evidence in the face of the 'unknown unknowns' put forward by this technology. Moreover, and in line with the STS literature on the role of non-expert knowledge and concerned groups in the shaping of GMO regulations, there is an ever-increasing interest in understanding how non-scientific actors – for example anti-GMO or groups or non-industrial farmers – create and legitimize an 'evidential culture'.

In this paper we analyze the case of the emergent controversy over GMOs in Chile. Expanding on the concept of civic epistemology and based on in-depth interviews and document analyses, we specifically examine how a key sector in the debate – medium and small farmers – frames its evidences regarding GMOs, what type of trials they mobilize, and which political strategies are fleshed out.

Our preliminary findings suggest a very particular epistemic configuration, one that we call hybrid epistemology: a mix epistemology in which free-market claims are entwined with state intervention demands, consensual political strategies are mixed with perceptions of strong power inequalities, and science-based rationalities are entangled with experiential and intuition-based knowledge.

Finally, the paper opens a question about the epistemological impacts of the Chilean neoliberal experiment on the positions of farmers regarding GMOs.

1. Introduction: what do we talk about when we talk about farmers in Latin America?

> GM products and seed research undertaken by corporations only aim to increase their profits and not the population's welfare […] The dominance of biotechnology and the use of GMOs is moving towards a world seed oligopoly controlled by just eight major economic groups […] Farmers will completely lose control of seed use and will be totally dependent on multinational corporations. (Movimento Sem Terra 2003, in Ref. [44] p. 50)

The Brazilian Movimento Sem Terra (MST) is a prime example of the expected position of small and medium farmers regarding the GM crop debate in Latin America and the developing world at large. For the MST the development of a GM-based agriculture is, above all, an attack to their cultural heritage, labor dynamics and socioeconomic ties. The MST contestation to GM development is not just based on technical arguments about the economic benefit of GM crops or their potential environmental and health risks. As implied in the above citation, MST's query challenges the worldview implicitly and explicitly imposed by the GM sociotechnical arrangement. It thus questions

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how agriculture's significance is defined, which forms of knowledge are prioritized, and what should be the form and content of a politics of rural empowerment. In brief, the contestation to GM technologies becomes a wider "act of social resistance" ([38] p. 3).

The case of Chile replicates, in many senses, the Brazilian framing. Chilean medium and small farmers also challenge key features and assumptions of GM developments – market liberalization, power inequalities and the marginalization of local knowledges. However, our analysis shows that despite this contestation, Chilean farmers are not averse, even when opposing GM technologies to market dynamics, technological development and scientific reasoning, nor to political actions enclosed within consensual and institutionalized spaces. Chilean farmers put forward a neoliberalized idea of agricultural organization, their political role within the public arena, and the knowledge economy they (ought to) mobilize. In this sense, Chilean farmers do not *resist* the dominant epistemology that groups like the MST attack; they *foster* it.

In order to understand how small and medium farmers in Chile cope with and make sense of GMOs we expanded on the concept of civic epistemologies [28,36] and applied it to subnational and controversy-oriented publics. Applied in this way, the notion of civic epistemologies serves as an analytical tool to understand particular collective knowledge framings, associated with specific ways of ordering economic, political and scientific claims vis-à-vis broader webs of meaning. Specifically, we claim that Chilean farmers mobilize an epistemology in which contradictory understandings regarding the political, economic and scientific nature of GMOs co-exist. This hybrid (civic) epistemology indicates the pervasiveness of neoliberalism in the country, but also how civic epistemologies, when looked from the micro-sociological perspective of discourses and practices, defy well-structured and coherent "styles". Thus the case of Chile calls for a thorough revision of how farmers are understood and played out in the accounts on the GMO controversies in Latin America. In the next section we summarize how the position of farmers regarding Agbio technologies has usually been framed. In this section we also develop a more nuanced definition of civic epistemologies. In the third section we briefly describe the Chilean case, highlighting the process of neoliberalization experienced by the country since the 1970s, its regulatory framing on GMOs, and key aspects of the controversy. Next we make a few comments on our methodology to then turn to our results, describing how Chilean small and medium farmers assembled their epistemologies – economic, political and scientific. Finally, we present concluding remarks regarding the hybrid nature of Chilean farmers' epistemologies.

2. The GMO controversy, civic epistemologies and the purified farmer

Almost twenty years after the introduction of the first genetically modified food into the market, the debate over genetically modified organisms (GMOs) remains contentious [33]. Far from having reached a consensual stage, the discussion seems to be ever more polarized, intense and conflictive [9,10,20,25,33]. As with other iconic technological innovations [5], there is no public consensus about the risks and benefits involved in the use of GMOs. This is due, in part, because incumbent parties have multiplied, but also because these concerned agents often frame their claims as a mix of economic, agricultural, ethical, environmental, political, ecological and cultural issues, thus assembling a complex web of positions, arguments and facts. In this context, it has become increasingly important to understand how different actors put forward and operate from particular civic epistemologies or the modalities through which different actors understand and order the world in relation to political, economic and scientific objects, evidences and framings [28,36]. This definition, while based on Jasanoff's accounts, expands and reorients civic epistemologies in ways that are worth explaining.

2.1. Towards a controversy-based definition of civic epistemologies

In this paper we borrow and expand on Jasanoff' concept of civic epistemology and apply it to subnational publics arising from specific policy controversies. Epistemology is concerned with the production of knowledge: with how we get to know our world and what practices are deployed to do so. Emphasizing knowledge production and framing, epistemology involves social and material processes that include (and create) perceptions and opinions, but that cannot be reduced to them. A discrete perception of an object is embedded in larger modes of knowledge ordering, or what Tsing [54] calls worlding: processes by which we attribute worldlike characteristics to our realities. In this sense, perceptions are always entwined in and are dependent on the worlds we enact to make sense of our experience – and the knowledge mobilized to deal with it. This is why Miller [36], in his review of the literature on civic epistemologies, asserts that knowledge co-produces the "social and political arrangements" of its production and application. A focus on epistemology, then, allows for an understanding of the political orderings that validate perceptions and opinions.

The connection to political arrangements and ordering is of vital importance for the notion of civic epistemology. This is, indeed, the *raison d'être* behind the prefix "civic." For civic epistemologies are concerned with a particular kind of knowledge-making processes: those that are related to how publics assess scientific claims [10,27,28]. For Jasanoff civic epistemologies have two distinct features: while they are bounded to a specific social realm (scientific claim-making and -assessment) they are part of the broader cultural framework of a given society. According to Jasanoff "these collective knowledge-ways through which [publics] assess the rationality and robustness of claims that seek to order their lives" ([25] p. 255) are institutionalized and systematic practices that are embedded in – and are part of – national political cultures. Or put differently, the scale of civic epistemologies is the nation-state. Civic epistemologies are the result and a representation of how different national societies have historically organized their public knowledge-making, public accountability, demonstrations practices, objectivity registers, expertise foundations and the visibility of expert bodies [27,28].

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But following Miller's cues [36], we suggest that the "civic" focus of civic epistemologies on nation-states can be expanded – or, better said, reduced. Miller does not contest the national scale of civic epistemologies, but introduces a crucial element: that they are "civic" because they are related to how "*political communities* construct, review, validate, and deliberate politically relevant knowledge." ([32] p. 1896 emphasis added). If we accept that societies are not politically homogeneous but, on the contrary, host many and heterogeneous political communities [3,43], then Miller's definition opens an opportunity to connect civic epistemologies to subnational collectives. In fact, Miller explicitly recognizes this possibility when asserting that the function of civic epistemologies is to make and validate knowledge "in local and political communities" ([36] p. 1908). In short, if civic epistemologies are associated with political communities, then other collectives – different from the national societies – have to be acknowledged.

But how to define these collectives? Miller, again, introduces a key insight. For him, political communities are related to "contests over *policy-relevant ideas*" in which "facts and ideas are formed, validated, critiqued, disseminated, and discarded." [([36] p. 1897) emphasis added]. The research on civic epistemologies, then, "enquires how knowledge is dynamically constructed and applied in the search for meaning and design and implementation of policy." ([36] p. 1897–8). For Miller, therefore, civic epistemologies are related to political communities engaged in concrete and situated policy controversies. This framing is congruent with recent pragmatist-inspired political enquiries within science and technology studies. This line of research has highlighted that publics or political communities are not pre-given entities, but are formed and shaped by the issues and objects of their engagement [4,13,16,34]. Thus civic epistemologies may serve as a tool to think about the knowledge production processes involved in and product of particular controversies. It would be thus reasonable to suggest that, in complex political settings, different political communities or stakeholders may enact their *own* civic epistemologies; this is, their particular way of testing and deploying knowledge claims used as a basis for making collective choices within specific conflicts over policy-relevant ideas.

In sum, our interest is not on farmers' isolated opinions, but on their epistemologies regarding GMOs; this is, on how they put forward broader processes of knowledge making vis-à-vis the wordling of political, economic and scientific orderings. In situations of uncertainty in which scientific statements are transformed into matters of concern [31], agents enact particular realities and assemble a variety of elements – trials, facts, demonstrations, moral commitments, political principles, economic assessments – to make sense of the controversy.

2.2. Farmers and agrotech controversies in Latin America

This paper focuses on the civic epistemologies of a key actor in the GM crop debate in Latin America: medium and small farmers.[1] Indistinctly of their region, farmers have been noted as fundamental players in the GM crop debate and policy-making [24,51]. On the one hand, farmers have to deal directly with GM crop impacts on agriculture [35] and, once it has been approved for commercial use, decide whether to grow it or not [24]. On the other hand, as a collective caught between anti- and pro-GM scientists, interests groups and consumer associations, farmers have to pragmatically resolve the controversy, thus being a good place to look for a more substantive and contextual position on GMOs, its risks and benefits [23,30]. For the case of Latin America, and developing countries at large, farmers represent a significant share of the labor market [8]. More importantly, it has been pointed that agrarian modes of living would be more extended in Latin American that in Europe or North America [11,12,22]. An abundant literature has focused on the impacts of the 'Green Revolution' in Latin America precisely in these terms: how new, industrialized technologies have disorganized – and in some cases dissolved – traditional and locally based skills, techniques and social relations [15,26].

Indeed, much of the research on farmers' role and positions in GMO and agrotech controversies in Latin America has adopted what could be called a *resistance* stance. From this perspective, farmers would be ontologically at odds with the forces of globalization, scientification and bureaucratization put forward by GMOs and agbio technologies in general. This conflict has been usually framed as a cultural clash between Hegemonic and subordinate societies, the North against the South, or the Western culture in opposition to its (colonial) 'other' [2,6,18]. And this clash comprises an attempt to subjugate the *metis* of local farmers to the *episteme* of (western) experts [52]: the collective, embodied and experiential know-how put forward in practical and contextual situations, against the impersonal, cerebral and science-based knowledge that looks for objectivity and universalism. Stripped from their traditional knowledge and forced to embrace new technological and cultural arrangements that are often misadjusted to local requirements, agbio innovations would increase – and not diminish – the impoverishment of farmers in Latin America [21,46]. This is matched by the aggressive introduction of several trade agreements between Latin American countries and the US, the EU and international agencies like the World Bank and the IMF [17]. Thus scholars have claimed that Latin American farmers' position regarding GMOs is not just based on a resistance against the technology per se, but against ubiquitous forces of neoliberalism and global markets [17,18].

In short, an important lineage of research has characterized Latin American farmers as representatives of what Barry [4] calls the *anti-technological* position and as the last resort of resistance against the hegemonic forces of technocracy, neoliberalism and science-based thinking [14,49]. But up to what point can this anti-technological stance be held? As Barry [4] has also stressed, these positions often idealize and purify the "local" – in our case represented by farmers – without attending to the complex epistemologies put forward in controversial settings. Just as Callon and Rabeharisoa [13] have claimed that purified distinctions between lay people and experts may blur under certain circumstances (see also Ref. [19]), the purified demarcations

[1] Just farmers hereafter.

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between *episteme* and *metis*, scientific and experiential, contentious or consensual used to describe the epistemology of Latin American farmers in the GMO debate should be revisited. This is at least what we conclude from the case of Chile. As we will try to demonstrate, Chilean small and medium farmers articulate a particular epistemic framing on GMOs, one in which the nature of economic dynamics, political action and scientific evidence fleshes out a *resistance* against neoliberalization and scientification, but also an *acceptance* of them.

3. Case and context: neoliberalism and the Chilean GMO debate

Profound free-market reforms were implemented in Chile after the military coup in 1973, transforming the country into one of the most open economies of the world. The reforms liberalized capital-markets, reduced trade barriers and privatized many publicly owned enterprises. A central aspect of these reforms was a strong export-stimulating policy, which had a profound impact on agriculture and other natural resource related productive sectors. With the arrival of democracy in 1990, social welfare policies were introduced but the main tenants of an export-lead economy did not change.

In the case of agriculture, three key elements provide Chile with a comparative advantage in the global economy: 1) counter-season production allowing producers to take advantage of lucrative markets in the north, 2) multiple agro-ecological environments which means farmers can grow for varied and niche markets and 3) phytosanitary isolation which reduces pests affecting productivity and yield. Neoliberal policies have indeed successfully generated economic growth and increased efficiency in the agricultural sector. Yet they have also resulted in environmental impacts and profound changes in the nature of social and economic relations in Chile's farming community [1,7,41].

Four aspects of the farming context under Chile's export-lead model are important to small and medium farmers – and that shape them as a particular political community. First, income distribution in the rural sector is very unequal with few benefitting from the high returns of export agriculture [7]. Second, the participation of small-scale farmers in agro-export production has not always been straightforward and the sector has been declining in size [39,40]. Even in the successful fruit-export sector,[2] conversion to an export-oriented agriculture did not always ensure the economic survival of small farmers. In some cases the benefits of the fruit-export boom accrued to large-scale farmers as well as urban and foreign entrepreneurs to the detriment of local, small farmers [40,42]. Third, the export-lead model also pushes farmers to convert to more intensive, monoculture agriculture often requiring more technology and inputs [39,1]. Finally multinational companies have been key players driving the growth of the sector (see Refs. [40,42] for an example of their role in the fruit-export sector). These companies operate via demanding contract farming and exert requirements that are hard for some farmers to meet. This is particularly so in the context of a highly neoliberal environment in which collective action is discouraged and where power and information asymmetries abound.

Therefore, GM crop adoption in Chile occurs in the context of an economic development strategy highly supportive of free markets, global integration and innovation. Currently Chile's policy towards GM crops restricts commercial production to GM seed for export purposes only with non-seed cultivation permitted only for research. Under the existing regulatory regime internal commercialization of GM crops or seeds is not permitted. However, imports of GM food or ingredients for processing are allowed and until recently essentially deregulated. There are no labeling requirements for GM products in general, either food, feed or crops.

According to public records, the first adoption of GM technology for crop use in Chile dates back to 1992, with very small areas of production. Adoption grew slowly until 2000 when GM cultivation areas increased in magnitude with the onset of commercial GM seed production. Since then, production has grown steadily. The main GM crops grown in Chile are maize, soy and canola (Table 1).

Indeed the seed industry in Chile has developed very successfully. Currently Chile is the 6th world seed producer[3] and GM crops represent a very important part of this growing industry. Chile's value as a seed producer stems from its phytosanitary isolation and seasonal difference with the northern hemisphere where key markets are located as well as the presence of a workforce with the required technical skills. GM regulation was developed primarily to enable this export-oriented sector (see Ref. [50] for more detail). Regulatory action for GM crops in Chile began, albeit precariously, shortly after the first GM food product was commercialized in the world. Chile's first GM regulation in 1993 limited seed reproduction activity for export purposes only, and outlined general operating procedures for the sector. Thus Chile's first regulatory action framed the issue as one of "phytosanitary control" and was aimed at managing the technology's impact on a specific economic sector: agriculture.[4] In contrast, regulation dealing with GM products as a "food" was established only in 2003, ten years after the first GM seed production norm. Table 2 indicates the principal agencies and norms that regulate GM crop technology in Chile today along with their enactment date.

[2] Chile's neoliberal reforms had a particularly profound impact on the fruit sector, setting off a major boom in exports in the 80s and 90s [40]. Today Chile is a leader in global fruit-exports. It is often touted as an example of the "success" of neoliberalism in Latin America and a model to follow for other countries wishing to participate in the global agro-food complex.

[3] International Seed Federation: http://www.worldseed.org/isf/seed_statistics.html.

[4] Regulatory oversight of GM crops by the country's environmental authority has been non-existent to date and environmental impacts are considered only under the SAG's framework of "phytosanitary control. The new Environmental Law enacted in 2009 includes the environmental release of genetically modified organisms (GMOs) under its purview and may change this scenario in the future.

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Table 1
Surface area of GM crops in hectare, per crop and production year.

Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Canola or raps	203	36	110	139	746	628	445	1188	4012	1862	2648
Maize	1517	6193	10,931	8436	7614	12,118	17,982	21,831	20,977	17,389	13,614
Soy	6506	279	215	128	273	166	250	1398	5389	5474	3514
Other crops[a]	2	16	12	4	51	18	163	47	4	44	22
Total/year	8228	6524	11,269	8707	8684	12,929	18,839	24,464	30,382	24,769	19,798

Data source for the table are yearly statistics collected by the government agency "Servicio Agricola y Ganadero" and published on their website www.sag.gob.cl. We only show data for the main crops grown.

[a] Other crops include: rice, safflower, alfalfa, *Brassica juncea*, barley, eucalyptus, flax, pumpkin, sunflower, melon, potato, pine, sugar beet, tobacco, tomato, wheat and grapes.

3.1. The Chilean GMO debate

The debate over GMO crops in Chile has grown and become more visible in the last few years. Various actors have intervened and questions about the appropriateness of Chile's regulatory situation have emerged from all sides of the controversy. Promoters wish to expand commercial production and opponents to incorporate more restrictions. Organized opposition to GM crops first emerged in the late 90s when a group of civil society organizations created the first anti-GM group "The Coalition for a GM-Free Chile."[5] Today the most active opposition group is a loose alliance of organizations, coalitions, "green" legislators, farmers and individuals coalescing around an anti-GM campaign initiated in 2011.[6] The alliance has been quite effective in promoting discussions of the topic in a variety of social and mainstream media, revitalizing public debate amongst interested actors as well as maintaining an active website. Beekeepers and organic producers are "passive" participants of this anti-GM campaign, which is lead by a local anti-pesticide action network with strong Latin-American connections. Conventional farmer participation in the anti-GM campaign is limited to a women's farming and peasant organization (ANAMURI) that belongs to the anti-pesticide network. One of the main small and medium farmer associations in the country (MUCECH) does not adhere to the campaign. Biotechnology firms and seed companies supporting the technology have recently created the non-profit organization "ChileBio" to actively promote and defend their position in the public arena. However, in private discussions with the authority the formal negotiating entity continues to be the Chilean Seed Trade Association, where biotechnology firms are key players.

One of the most long-standing and contentious issues in the debate refers to public access to regulatory information, particularly the location of GM field or farm sites. The battle has been fought mainly in the legal and quasi-legal arena, with opposition groups recently winning part of their challenge in 2011. The main agency involved (the agricultural service, SAG) has been forced to disclose part of the information requested by opposition groups and to amend its regulation to better reflect the information's "public" nature.

It is important to note that opposition or other stakeholders groups have no formal opportunities for public participation in the regulatory process. Producers such as organic farmers and beekeepers *may be* – and have been – invited by the SAG to ad-hoc working groups to address specific multi-sector issues. However, these are closed meetings that often take place in a reactive manner. In addition they are construed as "technical working groups", which exclude and black-box ethical, political and social dimensions of the issue. Conventional small and medium farmers on the other hand are not seen as "productive stakeholders" by the authorities since their *main* crops do not currently have GM counterparts, and because they produce primarily for the internal market that does not require segregation. As such they are not included in these working groups.

Nonetheless, some of them have entered the debate with a controversial position on another dimension of the controversy in Chile: the relationship between property

Table 2
Principal regulations and norms in GM food and crop oversight.

Agency	Type of regulation	Year	Applies to
Ministery of Agriculture's Plant and Livestock Service (SAG)	Resolutions	1993	GM seed imports
		1997	Animal consumption of insect resistant maize
		1999	Biosecurity norms for some pharmacrops
		2001	Update of 1993 seed import norm
		2002	Time frames for import and liberation into the environment of GM seeds
		2005	Establishes technical committee for GMOs
		2010	Status of information included in petition
Ministry of Health's Public Health Institute (ISP)	Modification of 1996 Food Safety Rule	2003	Oversight of GM food for human consumption
	Technical-administrative norm	2007	Assessment of GM food events for human consumption
	Resolution	2007	Procedures for establishing Approved Events List
	Resolution	2009	Establishment of new expert panel

[5] In Spanish, "La Red por un Chile Libre de Transgénicos".

[6] The campaign is called "Yo No Quiero Transgénicos" (*I Don't Want Transgenics*).

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rights and GM technology. Chile recently decided to adhere to the latest international breeder rights convention, UPOV91. Anti-GM groups claim this international convention strengthens the rights of industrial breeders, primarily agrochemical and biotechnology companies, to the detriment of ancestral and small farmers rights. The option to adhere or not was debated in congressional hearings where a range of actors presented their opinion. Surprisingly one of the main small and medium farmer groups in Chile (MUCECH) spoke out in strong support of UPOV91, claiming that it will allow them access to improved seed technology.

4. Methodology: grasping farmers

In this paper we focus on how small and medium Chilean farmers construe and assemble their epistemology regarding the GMO debate.[7] But how to seize them? Two methodological comments have to be made. First, and following the actor cartography or stakeholder mapping [37,56], we used a qualitative case study approach in which we identified key organizations participating in the debate. These included farmers and producers, government officials, members of NGOs, scientists and biotech industry representatives. After identifying these key entities, we interviewed their spokespersons or leaders. Regarding small and medium farmers, we interviewed representatives of four key organizations: the Movimiento Unitario Campesino y Etnias de Chile (Chilean Peasant and Ethnic Unitary Movement), MUCECH; the Asociación de Agricultores Orgánico de Chile (Chilean Association of Organic Farmers), AAOCH; Tierra Viva (a network of producers organic and retailers); the Asociación Nacional de Mujeres Rurales e Indígenas (National Association of Rural and Indigenous Women), ANAMURI; and the Red Apícola (Apicultural Network).

However, for this paper we selected the interviews of those organizations that (a) have being more active and visible in the GMO debate; and that are (b) the largest collective, thus best representing the overall civic epistemology of small and medium farmers. These organizations are MUCECH, AAOCH and Tierra Viva, the former representing traditional farmers and the last two organic farming. Seven in depth-interviews were made with representatives of these organizations.[8]

This selection is made at the cost of excluding the voices and agendas of minor organizations. But in turn, by selecting MUCECH, AAOCH and Tierra Viva we concentrate on the most active and extended organizations, thus getting a hold on the most significant farmers' voice within the controversy. In this sense, when we refer to "farmers" in our results we are not intending to represent the heterogeneity of positions and framings within the peasant and farmers' world, but what could be labeled as a "stakeholder farmer": the positions and framings of those farmers represented in the three largest and more vocal national organizations. In the following results section we describe these positions and framings.

5. Making sense of GM crops

When asked to elaborate on their positions regarding GMOs, small and medium farmers, put forward a particular civic epistemology that enacts GMOs as three different objects. One is GMOs as an *economic* object, thus related to market circulations, the nature of the peasant economy and the role of the state regulating them. GMOs are also fleshed out as a *political* object connected to contesting and supporting strategies, consensus-building and power struggles. And finally, farmers also make sense of GMOs as a *scientific* object arising from questions of technical robustness, expertise and data validation. Together, these three objects – with their respective knowledges and framings – constitute the basis of the farmers' epistemology on GMOs. In this section we describe the specific economic, political and scientific framings used by these actors to make sense of GM crops.

5.1. Enabling the market, mobilizing the state: the economic logics of GM agriculture

When they think about the agricultural impacts of GM crops, Chilean farmers *endorse* rather than attack the market. Or better said, when critiquing or praising GM developments, farmers mobilize market-oriented arguments to configure their claims. Market logics are not only accepted, but also taken as an operational framework to which every stakeholder should commit. Thus to be against GM crops doesn't translate into an epistemological revision, akin to the one put forward by the MST. Rather anti-GM farmers confirm and reinforce the validity of the market as the "rules of the game" – and recur to it to justify their position regarding GM crops.

Farmers mobilize and accept a market-based framing to explain the ordering of things – including agriculture and the GM debate. Indeed, the idea of *freedom of choice* and *instrumental rationality* are pervasive in their discourses. An important officer of MUCECH puts it clearly. While he declares to be personally against GM crops, he states that as an association representative he has to defend the interests of its members, and that means letting them *choose* what is best for their businesses: "everyone should do what he wants… if a small [farmer] wants to buy seeds in China, if that suits him, if that seed works well for him, it's ok". Farmers see themselves as calculative agents [38,39], and that calculativeness rest on their possibility of choosing. This is linked to their view of agriculture as "just an economic issue" and as a job like any other. Therefore the search for economic benefits would be a completely *rational* and *natural* decision, an innate human propensity. This is not to say they do not value or perceive agriculture in other terms as well, but rather that this economic view is

[7] This paper is based on the ongoing research "Public perceptions on GMOs and biotechnology in Chile". The research's main goal is to understand the development of Chile's regulatory style, explaining why, after several years, the controversy ensues and identifying the key concerned actors and their framings.

[8] Beekeepers have become a more prominent actor in the public debate after a recent episode of GM pollen contaminating Chilean honey exports to the EU. This event occurred after we had collected and analyzed the data for this paper.

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mobilized to construct and sustain their claims in the GM crop debate. Another MUCECH officer puts it succinctly:

> farmers take a very rational decision; they would say 'if this one [seed] produces more than this other, I buy it'… a farmer's motto [is] if a business is good, the farmer will do it; if organic is a good business, if it is accessible and if he sees he makes money, he'll do it.

Being a rational decision it is also, then, a decision that *every individual* makes. Farmers, they claim, are no different from any other rational agent, thus no one has the right to blame or admonish them for their choice. "Because", as a MUCECH officer indicates,

> I *also* want to make money. If my tractor is wrecked and I have to replace it, who's gonna do it for me? So if they give [a farmer] a transgenic [GM] tomato seed and if he makes money, just try saying to him 'hey, don't, you are screwing the population's health'. He won't care! He will tell you: go take a hike!

These representatives see farmers as a *homo economicus* – and naturalize this human condition. Just as everyone else, they should be free to choose the alternative that maximizes their economic returns and to seize their labor in monetary terms. From this economized framing the notion of *coexistence* emerges naturally among farmers. Within a framing that enables and justifies a market-based rationality, segregation or banning is an anathema. Prohibition of any alternative would be an attempt against economic efficiency. More specifically, farmers claim that any form of prohibition would attempt against the *ordering* capabilities of the market. In the face of increasing controversies and unsolved positions regarding GM crops, they rely on the ability of markets to differentiate niches, distribute economic space for every supplier, and thus create a harmonious coexistence. Interestingly, this position is not held just by pro-GM farmers, but also by organic and anti-GM ones. As one of the founders of the oldest Chilean organic farming network indicates:

> One of the strongest countries in organic consumption is the USA, and GM crops come from there as well… [in New York] there is an organic market in every block, 100% organic, there are sausages, meats, everything organic. You turn around the block, to another supermarket and everything is transgenic [GM]. To give people an opportunity [that's the key]; it is people who determines it [organic production]. If nobody buys from us, we would have disappeared a long time ago, right? To produce or not produce, is determined by the market.

In brief, key Chilean farmers' organizations – whether conventional or organic, anti- or pro-GMOs – frame agriculture and farming debates within a market-enabling understanding. In this frame instrumental rationality is validated as the anthropological background against which farmers' attitudes should be evaluated, and where a harmonious coexistence is assumed as a (positive) market externality. The market is not an entity to be attacked, but an ordering device that has to be naturally assumed and praised. In other words, market logics are not the problem but the solution.

Paradoxically, however, this marketization convenes together with strong claims for state intervention. The market is endorsed both as an anthropological reference and a distributing mechanism. Yet this doesn't prevent demanding to the state economic protection, uncertainty reduction and ethical resolutions. Indeed, vis-à-vis claims that put their trust in market orderings, farmers demand economic, knowledge and ethical security from the state. Competition from international products is an especially sensitive issue for small and medium farmers. Thus reversing the market-based rationality mobilized to justify their right to choose – and to choose 'with their wallets' – these farmers allege that the Chilean state should protect local producers as well as Chilean consumers from foreign products. From their perspective, these products are uncertain entities whose agricultural and chemical characteristics are unknown.

> [The state] doesn't help preventing the entrance of Canadian lentils so our *viejos* [farmers] can produce lentils… Canadian lentils are at $580 y ours at $800 but you don't know what lentil you're eating [when eating Canadian]… I don't know what's the quality of the Peruvian strawberries sold by the *casero* [farmer's market vendor] on the street; we know they're cheaper that the ones produced by our farmers in San Pedro, but we don't know [their quality].

Thus the market should be enhanced, just as the state should intervene every time market logics do not operate as expected. This would balance the unfair economic structure in which Chilean farmers are trapped in, and reduce knowledge uncertainties related to agriculture and GM crops. The free-choice and market-based rationality are suitable for farmers in their productive endeavors but not for consumers in their purchasing ones. Presumably consumers do *not* (and cannot) know what they are buying and hence the state must resolve demand-side uncertainties.

But the role of the state as a centralized device for the reduction of knowledge uncertainties should not be restricted to the demand side. Farmers claim as well that the state – and not the market or other collective arena – should solve scientific controversies over GM crops. Or as an officer of MUCECH indicated:

> A serious debate would be one in which the state regulates and says 'this [GM crop] is approved; it was tested in field trials… the crop didn't cause [the harm] that was said it would.' That's serious… We want the state saying 'These [GM] crops cannot be farmed in Chile because there is no assurance that these transgenic [GM] crops are profitable, or ethically acceptable, but these other yes [can be farmed].' A list. Or to restrict or whatever, but clear information for everyone, not like today.

Thus farmers resort to the market in their search for justifications for their economic-driven rationality, but turn to the state for economic protection and certainties. Moreover, they claim that to fully unleash their instrumental (economic) rationality, the state should free them from any *ethical* burden:

> the state has to have an institution to regulate these [GM crops], because [the farmer] doesn't have to be questioning himself if what he's doing is ethical or

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> not… we [farmers] don't have to be in charge of that ethical discussion… the one that has to decide, I insist, is the state.

In sum, farmers make sense of GM crops within a frame in which the market serves as the template for the desired free and self-interested behavior of actors and institutions, and where the state intervenes to mitigate market asymmetries, protect local producers and decide unilaterally the ethical condition of GM crops.

5.2. GM politics: non-contentious politics within asymmetric networks

Concordantly with the market-based framing mobilized, farmers understand themselves as non-contentious political actors. What is more, they don't see themselves as *political* actors. Indeed, every effort is made to demarcate themselves as *technical* agents. Anti-GMOs organizations like "Chile Sin Transgénicos" are seen as too visceral and argument-less. "Because finally who wins?" asks an officer of AAOCH reflecting on which political strategy they should follow,

> those that are well organized!… if we are not capable of organizing ourselves from a *technical* perspective, no [we won't win], obviously… because the problem here is that the political is mixed in immediately; immediately comes the issue of injustice and that sort of things, issues that can be absolutely valid and real, but I can't live with them, too intangible for a discussion that needs to be necessarily tangible. I need to have technical tools.

Distanced from any political identity, farmers – whether traditional or organic, against or in favor of GMOs – embrace institutionally-based and consensus-oriented political strategies. Collective mobilizations and other forms of direct political interventions are dismissed. "I think that to organize a protest to say no to GM crops won't change reality" concludes an AAOCH officer, "reality is too tough to be changed like that… what is left for us is to support our legislation, which is the only element I have, the 20.083 law [organic production law] and with it say [to GM crop producers] 'sirs, this is my law, a law from the Republic'."

Thus to participate in institutional and government-organized forums and commissions is a valid political strategy for this political community, and not a subjugating exercise in which they lose political agency. Moreover, and attuned with this non-contentious and institutional-led political framing – and with the market-based rationality mobilized by farmers – moratoriums are understood by organic farmers as the best and more effective tool against GM producers. "I don't have the right to say to farmers that want to use GM technologies that they can't" assumes an AAOCH officer, "but I do have the right to say that we need more studies [for the approval of GM crops]". Accordingly, farmers prefer consensus-building strategies. "In a democracy… I have to convince him [the minister]; I have to discuss, to ally myself with others to obtain things, and we have obtained them slowly [with this consensual strategy]." (MUCECH officer). And in this context, *trust* and *trust-building* seem to be crucial. Or as AAOCH officer puts it:

> We have to generate more trust… one has to understand the position of those people that are pro-transgenics [GM] … beyond the fact that one can think these people are wrong, they have a real business, and a business that creates jobs and creates capital and that is legal, within the Chilean law… there are people that are distrustful to the organic sector; they say 'damn, if they know [where I'm located] they can block me, *me pueden funar* [to organize a hostile protest], they can surround me with an organic ring, they can oblige me to get out of there', a lot of distrust… there is distrust on both sides.

In sum, farmers have a liberalized notion of their economic endeavor and concordantly a non-contentious political stance. They aspire to be technical agents – rather than radicalized political actors. They look for government-based arenas for discussion, prefer consensus- and trust-building strategies and, when against GM crops, embrace moratoriums as the most efficient tactical tool.

But this non-contentious politics co-exists with the acknowledgment of profound power asymmetries. Or put differently, they recognize violent economic and political inequities, particularly in their capacity to influence on government bodies, but this does not encourage farmers to take more direct and contentious political strategies. Indeed, despite their consensual political approach, farmers are concerned with issues of power concentration and imbalances in the crop production sector. For example, an AAOCH officer points out the problematic situation generated by government policies promoting increased private sector involvement in research, particularly for public research entities such as the National Institute for Agricultural Research (INIA), which should respond to the needs of all producers. Key public grants in agriculture now require private matching funds and this has pushed INIA to search for funding in the private sector: "and who is the 'private sector'? Big corporations! Then they obligated INIA to undertake research on issues that are only relevant to those that have the dough, to big corporations". Similarly, a MUCECH officer explains how economic power is, finally, the last word in the GM crops controversy:

> Some say they [GM crops] are good, other that they are bad; there are studies that have demonstrated with prestigious scientists that they are bad, and there are others that say they are not bad. Then like in everything else in a globalized world controlled by an economic model of neoliberal development that absorbs families into the economy, here the biggest dog wins, the strongest animal.

Trapped in a situation where economic (thus political) power is unequally distributed and 'big dogs' always win, farmers – and especially organic farmers – are wary of conspiracies against them. A member of Tierra Viva told us how a program on GM crops aired in a popular TV program was not uploaded in the program's website and was subsequently erased from YouTube. "Damn, why?" he asks, "It is not a coincidence… phone calls here, phone call there and the coverage was lost."

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5.3. Between scientificism and experiential empiricism

Whether against or in favor of GM crops, farmers are not averse to technology. On the contrary, technological innovation is as seen as an *achievement*. Thus in contrast to disenchanted and dystopic visions where technology is construed as a source of infinite uncertainty [29], farmers praise technology as a supplier of securities: technologies, because a scientific achievement, have to be trusted. "When I buy a medicine… I have absolute security that that medicine does what it says" assures an officer of MUCECH.

At the basis of these certainties rest an understanding of technology as an integral part of human development. Science, in this sense, is seen as a driver of progressive change. For farmers this is, in part, due to the inevitable development of technology: we cannot (and should not) resist technological change. More profoundly, technology would be an integral part of human nature. Humankind has evolved together with – and thanks to – its technological innovations. From this perspective ethical contestations to DNA recombination would be an exaggeration: its *utilization* can be challenged, but not the innovation per se. For example, an officer from AAOCH explains:

> I cannot make an ethical critique of transgenics. That's the *nature* of humankind. I insist, once men moved and roam the world by horse, he overpowered the horse. Then he invented the wheel and tomorrow it will be something else, is part of our evolution as specie.

Thus even if an anti-GMOs stance is held, we, as humankind, should not be ontologically against technology. An AAOCH officer explains the synthesis:

> What would I accomplish by saying 'no' [to DNA recombination], I would just distance myself from this [technology], marginalize myself from this, and lose the possibility of knowing what is going on, because I insist, it would be really interesting having plants or groups of plants in an organic system with minimum input requirements.

But farmers not only believe in technological innovation; they also frame the GMO debate in *technical* terms. More specifically, and linked to their aversion to political rhetoric as a mode of collective action, farmers explain their failures – indistinctly to their objectives and motivations – by their lack of technical skills and, specially, 'hard data': "the biggest weakness of the anti-GM movement is that it lacks hard data, *real* data, research and things like that", concludes and AAOCH officer. In other words, success will be accomplished once capable of *scientificizing* their resources, evidences and arguments.

> We don't have technical arguments, and in front of technical discussions you cannot present yourself just with political arguments. 'Sirs, this is my proposal, here it is, point 1, 2, 3... 10 points; this is how it will be done, it will take these many years, we want this moratorium and then we want a plan'… in this world you have to have ideas, and concrete ideas.

But this scientificization is complemented, paradoxically, with its opposite. The same AAOCH officer that calls for more "hard" and "real" data sustains many of his arguments in experiential evidence and intuition-based assessments. For example, a critical debate between crop producers and organic farmers is whether Chile has illegal GM farming. And although official data denies illegal GM farming, for organic farmers "hard" data is not trustful, since it would contradict situated and hands-on knowledge. "What you see in *reality*", says the AAOCH officer contesting the claim that GM farming is banned, "you may go to small seed distributers and [you can see how] farmers go 'hey, I want the transgenic one'". An officer from Tierra Viva confirms this suspicion, and also based on his observational evidence:

> There are people that produce transgenic sunflower for Monsanto, just for seeds, and they are asked for 2000 kilos [of seeds] and they export them but they produced 2,500, and *we know* that those 500 kilos are being commercialized in local *tostadurías* [grain and cereal retailers] and mills".

This experiential knowledge about GM crops is aligned with what farmers see as an inherent farmer epistemology: a highly empirical, pragmatic and realistic way of understanding things – including the GM debate. As an officer from MUCECH explains, "the farmer is thoughtful, and agriculture is *empirical*, you learn by doing". Another member of MUCECH also resorts to his applied and embodied knowledge to reject the questionings against GM crops: "I have a solid opinion about transgenics… I've been next to them, I've planted on top of transgenics, so I have *empirical* experience". This is also "hard" data, but not the kind one might find in scientific research or official reports: it would be a *better* kind of evidence. Nothing can contest this embodied knowledge, no technical argument, data or piece of evidence can beat direct experience or the intuitional savvy derived from a long-standing and intimate relation with the land. An officer from MUCECH, explaining why he knows GM crops are being farmed in Chile, expresses: "Damn, how beautiful varieties grow in [the land of] our next door farmer that has more dough than us, how could he do that, wouldn't the crop be genetically modified?"

6. Concluding remarks: hybrid (civic) epistemologies

In this paper we applied Jasanoff's notion of civic epistemologies to a subnational, controversy-based political community. We found that the salient dimensions of farmers' civic epistemology could be understood as a web of meaning assembling GM crops as an economic, political and scientific object. The particularity of the civic epistemology mobilized by Chilean farmers rests on the amalgamation of contrasting and even conflictive frames, regardless whether GM crops are fleshed out as an economic, political or scientific object (Table 3).

In her now classic enquiry on the civic epistemologies in the United States, Britain and Germany, Jasanoff [28] detected three national styles, each one responding differently to how publics engaged in scientific policy-making. Although Jasanoff swiftly recognizes that these national styles represent, at most, deep-seated patterns and not

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Table 3
Chilean small and medium farmers' civic epistemology.

GM crops as economic object	GM crops as political object	GM crops as scientific object
Freedom of choice and instrumental rationality + State intervention	Consensus-building strategies + Injustices and power inequalities	"Hard" data and technical arguments + Embodied and experiential knowledge

"rigidly fixed, uncontested, changeless" schemes ([35] p. 259), she identifies a well-demarked and internally cohesive typology. After recognizing six dimensions of civic epistemologies, on each of which cross-national differences proved salient, Jasanoff relates the USA with a *contentious* civic epistemology, Britain with a *communitarian* civic epistemology, and Germany with a *consensus-seeking* one.

We found that well-defined styles – similar to Jasanoff's – cannot be applied to Chilean small and medium farmers. We are not claiming that a fourth style has emerged. We are rather suggesting that styles may be structured around conflictive, heterogeneous and non-coherent elements. Or better said, if Chilean farmers have an epistemological style, this is based on the *hybridity* of styles.

Confronted with the GMO debate, Chilean farmer representatives mobilize a particular way of producing and deploying knowledge regarding the nature, function and effects of GM technologies. Chilean farmers frame GMOs as an *economic* object that validates a neoliberal understanding based on the freedom of choice and instrumental rationality, but also as one that requires more state intervention. Farmers also assemble GMOs as a *political* object that has to be managed with non-contentious political strategies, consensual sensibilities and an anti-political sentiment – but that elicits, at the same time, severe injustices and power inequalities, distrust in large corporations and fears of conspiracy. Finally, farmers articulate GMOs as a *scientific* object sustained by their confidence on "hard" data and technical arguments, yet their claims also deploy the importance given to embodied and experiential knowledge.

More research is needed to so see if this epistemological hybridity is exclusive of farmers or if other Chilean actors engaged in the controversy are characterized by a similar pattern. Moreover, it remains to be seen if this hybridity is embedded in a national exceptionalism, or if this mixture can be found in other national realities. Our aim is not to define a fixed, unitary and self-sustained epistemic framing or "style". Instead we wish to acknowledge the complexities involved in knowledge production, assessment and sensing. In this sense we are opening a way to revisit the adequacy of the very idea of "style". Our claim is that when analyzed at the micro-level of discourses and practices, epistemologies are never bounded and congruent but complex worlding processes meshing and entangling heterogeneous webs of meaning.

Our results also evidence the *epistemological* impact that neoliberalism has had in the Chilean agricultural sector. The Chilean neoliberal experiment [32,53,55] has been well documented, and it has been primordially studied from the perspective of the economic transformation experienced by different markets or sectors of the Chilean economy. This is also true for agriculture. The economic impact of neoliberalism in the Chilean agricultural sector – the expansion of export-stimulating policies, the privatization of natural resource and the landing of large-scale private corporations – has been thoroughly investigated. Little has been said, however, about how neoliberalism transformed epistemic cultures, and how neoliberalism is itself a form of knowledge. For the hybridity of farmers' epistemologies has one common thread: the pervasiveness of what Nikolas Rose has called the political rationality of advanced liberalism. For Rose, neoliberalism would be fundamentally the emergence of a new governing template based on the marketizing of economic life, the expansion of accountability and the "audit society", and political prudentialism [47,48]. These (neoliberal) elements match our results: farmers embrace – at least partially – a market-based understanding of GMOs, non-contentious or prudent political strategies, and a scientificized framing that prioritizes accountable, formal and "hard" information. Thus neoliberalism did not just transform the economic structure of the Chilean agricultural sector, but it also changed the ways farmers understand and make sense of GM crops as an economic, political and scientific object. In this sense, we follow Plehwe ([45] p. 2) when he asserts that "Neoliberalism must be approached primarily as a historical 'thought collective' of increasingly global proportions", this is "a set of shared values and principled beliefs." ([45] p. 35).

Our results suggest that neoliberalism, as an epistemological template, has percolated into Chilean political culture, and particular into farmers' collective ways of knowing. We are not implying, however, that neoliberalism *explains* the civic epistemologies of Chilean small and medium farmers. Rather the contrary, we have shown that farmers' epistemology is mixed and non-coherent, and that neoliberal templates co-exist with forms of knowledge that attack them. But the hybrid nature of farmers' epistemology cannot be understood without the impact of neoliberalism as a "thought collective". Thus our findings do not reject a crucial element in Jasanoff's account on civic epistemologies, namely that national trajectories and expert cultures shape them. But for the case of Chile, we emphasize the need to approach civic epistemologies as complex processes in which neoliberalism is enmeshed with – and cannot be explained separately from – the mixed knowledge orderings put forward by actors engaged in situated controversies.

Finally, these results – as preliminary as they might be – call for more fluid and non-essentialist approaches to farmers, especially in Latin American and the developing world where idealized categories are usually deployed. This is not to say that farmers are unable to mobilize differentiated and contesting/contentious knowledges, political strategies and practices, but a call for the recognition of the complexities involved in contemporary Latin American farming communities. As economic challenges change, new technologies are introduced and democratic institutions expand, the ways farmers understand and perform their world mutate. To anchor the role played by farmers in the GM crop debate in a naturalistic and static definition of their identities and expectations may hamper a sound

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understanding of how agbio technologies travel to, land in and are implemented within Latin American countries.

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