Scienticity and the Construction of Risk: The Case of GMOs Regulation in Argentina

Su Yeone Jeon
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I. Introduction

With the rise of globalization and advances in biotechnology over the past few decades, the global food system has undergone a major revolution. Genetically modified organisms (GMOs) are one important part of that transformation. GMOs differ from traditional forms of crossbreeding in that they use transgenic technology to produce crops that are herbicide-incorporated, superweed-resistant, drought-tolerant, etc. (the Non-GMO Project, n.d.). These technological innovations in agriculture have important implications for the global governance of food safety because of the technology's uncertain effects and a consequent lack of consensus regarding their potential risks to human health, the environment and/or cultural values.

One of the key sources of contention in this field is the regulatory disjuncture between the United States and the European Union. Specifically, while Europe takes the so-called "precautionary approach" to GMOs, focusing on their generally uncertain impact on human health and the environment, the U.S. follows the "liberal science-based" model that prioritizes narrowly defined safety and efficacy measures, claiming that there is no substantive difference between GMOs and conventional food (Brankov and Lovre 2013; Kleinman et al. 2009; Klinke and Renn 2002; Lynch and Vogel 2001). The "US-EU debate" over GMOs resonates well beyond these two regions, exerting a broad effect upon the global food trade and the global political economy of agriculture.

The Sanitary and Phytosanitary Measures (SPS) institutionalized by the World Trade Organization (WTO) essentially encourage member countries to rely on a science-based (in the sense of clearly quantifiable/measurable) risk assessment policy as laid out in the *Codex Alimentarius Commission.* The Codex, a joint project of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), establishes the basis for the science-based risk assessment policy that the SPS establishes as the standard for permissible regulation and/or restrictions on trade. In essence, the recommendations of these international bodies largely

reflect the U.S.'s risk management approach. This is because the WTO inherited from its predecessor, the General Agreement on Tariffs and Trade (GATT), the unitary governing value of prioritizing economic efficiency and gains by reducing trade barriers of all kinds. That means that "social, moral or cultural logics of regulatory action" – considerations given real weight in the EU – are cast as unjustifiable barriers to trade (Epstein 2017). The WTO, then, which oversees the international trade system, promotes the U.S. model, often associated with "scientization," making this the dominant or hegemonic approach to food safety and GMO regulation in international trade. To clarify, the primary meaning of "scienticity" here is the desire for clarity and respect for scientific processes that motivate an aspiration for "scientifically" clear and unambiguous points of measurement and criteria.

Given that the decision-making process in both the WTO and the Codex relies on consensus rather than a one country/one vote mechanism (as in the United Nations or the International Monetary Fund), countries in the global South are largely marginalized in the risk regulation debate. The consensus-based model, however, more or less forces less influential countries to side with one or the other of the dominant positions—the U.S.'s or the EU's. And given that the primary purpose of the WTO and the Codex is to facilitate international trade, these institutions urge less dominant states to accede to the prevailing U.S. approach, which appears to be more rational and scientific, and which provides for a lesser hurdle to trade overall. Developed countries and international organizations, moreover, generally treat developing countries as lacking sufficient scientific knowledge or the relevant tools for appropriate risk assessment; consequently, their arguments have been neglected as "inarticulate or irrelevant" (Winickoff and Bushey 2010:364).

Research shows that trade-related economic factors (the frequency of trade with given partners, trade volume, the number of trade agreements, etc.) that often create a spillover effect between trading partners, have a significant impact on a country's regulatory decisions.

Specifically, to facilitate trade and market access and to reduce transaction costs, trading countries tend to adopt similar standards (Henson and Reardon 2005; Hoekman and Mavroidis 2015; Jaffee and Masakure 2005; Pollilo and Guillén 2005; Polillo 2018). Other scholars emphasize more historical and political factors, such as the lingering effects of colonialism, in influencing regulatory policy in many developing countries (Mahoney 2010; Paarlberg 2008).

Thus, prevailing explanations for regulatory decisions in developing countries might predict that countries like Argentina would adopt the EU precautionary approach (e.g. a stringent set of labeling and traceability requirements), since Argentina identifies the EU as its main export market (Goldfarb and Zoomers 2013), and given its cultural proximity to Europe and its experience of Spanish colonization. Instead, it has chosen to follow the U.S. approach to risk assessment. Not only did Argentina become the first Latin American country to approve and cultivate GMOs (in mid 1990s), but it is now one of the world's top GMO-exporting countries, and since the early 2000s, has been home to a rapidly growing agrobiotechnology sector (Haar and Rodriguez 2016).

To better understand Argentina's early enthusiasm for GMOs and its acceptance of the "scienticity" of the U.S. approach to biotech, even when it did not yet have its own thriving biotech industry, more research on the domestic Argentine context is crucial. The research proposed here, therefore, aims to examine the role of science – and attitudes towards science – in the implementation of biosafety and food regulation. Thus, my fundamental research questions are:

1. *How do domestic stakeholders in countries in the global South understand and explain regulatory decisions regarding GMOs?*
2. *How do domestic stakeholders interpret risk in thinking about GMO policy?*
3. *What external influences, if any, have shaped stakeholders' views and/or perspectives?*

In section III (starting at page 12), I will pose additional working questions that arise in the course of investigating these basic research questions, as I work to explain case-specific puzzles. I plan to address these sub-questions, too, when I visit the field site this summer, through the methods I propose in section IV.

In the following section, I examine sociological studies relevant to a consideration of how scientization diffuses across the global South, what explains the divergence in the regulatory frameworks over GMOs, and how domestic actors come to choose one regulatory approach over other. I then provide a detailed background of what makes Argentina a particularly interesting case, as compared to other countries in the global South. Finally, I discuss the methods to be used to answer my research questions.

II. Perspectives on the Role of Scientization in the Interpretation of Risk and the Governance of Food Safety

In this section, I consider several prominent literatures relevant to biotechnology, which, among other things, present scientization as a key factor leading to an overall dynamic favoring the U.S.-driven approach to biotechnology, as various countries institutionalize this "scientized" perspective as the core of their risk assessment philosophy.

World polity theory argues that there has been a rising global consensus in which science has come to constitute a kind of standard that political actors reference in making and explaining decisions (Boli and Thomas 1999; Drori et al., 2003; Drori and Meyer 2006; Schofer 2004). Due to its asserted universal and value-neutral characteristics, science functions here as a kind of "cultural canopy" that diffuses cross-nationally; a country's embrace of a scientific worldview denotes its status as a modern, developed nation. World polity theory presumes that this diffusion operates via mimetic isomorphism rather than coercive mechanisms. "The expansion of science provides a basis for agentic actorhood in every arena of social life"

(Meyer 2010), the argument goes; followers generally accept policy models willingly, therefore, because their adoption confers legitimacy (Meyer and Hannan 1979; Meyer et al. 1997; Strang 1991). Many countries (particularly in the developing world) thus more or less follow the U.S. model, because it is seen as "more scientific" and thus provides a greater aura of "scientific" legitimacy.

Political economy scholars, on the other hand, view scientization as a process coerced by powerful actors (multinational corporations and/or core states) whose goal is to entrench their dominance in the global economy (Bunker and Ciccantell 2005; Cooper 1972; Smith 1993; Wallerstein 1974). Like the world polity theorists, scholars in this tradition recognize the global shift toward valuing scientific knowledge and procedure as the emergence of a universal norm (Lee 2000, 2007; Schott 1998; Wallerstein 1995; Wuthnow 1979). Yet they argue that world polity theorists pay too little attention to how political-economic power shapes world culture (Beckfield 2003, 2008, 2010; Finnemore 1996; Hughes et al. 2009; Schwarzman 2006); they believe instead that growing scientization reflects and reinforces a pre-existing structure, and the domination within that structure of the most powerful actors (Quark 2012).

For instance, many developing countries that rely on the U.S and/or EU, as well as international organizations (e.g., the IMF, World Bank, or the WTO), for trade, foreign direct investment, aid, and/or loans, have reason to shape their policy mechanisms to meet the preferences of these entities; often, in fact, they are required to do so, as a "conditionality," in the form of structural adjustment programs (SAPs) or other requirements putatively aimed at the elimination of trade barriers that are imposed as a prerequisite for accessing financial assistance (Babb 2005; Chorev and Babb 2009; La Ferrara 1994; Mosley et al. 1995; Portes and Roberts 2005; Woods 2006). Thus, scholars in this group argue that what appears to be convergence toward scienticity is, in fact, the hegemonic diffusion of ideas promoted by powerful external actors, largely through preferential distribution of funding.

Many political economy scholars also contend that the coerced diffusion of scienticity is itself evidence of a state of affairs generally called *the global corporate food regime* (McMichael 1995; Otero and Lapegna 2016). Most food today contains GMOs, in the sense that it is produced from patented GM seeds owned by multinational biotech companies. As a result, power in the global agrifood system is concentrated among patent holders from the U.S. and the EU (Kloppenburg 2006; Pechlaner 2010). McMichael (2000) argues that the corporate regime is institutionalized in the Codex and WTO rules, and that, as a result, the regulation of and legal proceedings concerning GMOs inevitably privilege intellectual property rights (IPR) holders over users. Ultimately, what these scholars predict is a global regulatory convergence toward a particular neoliberal Anglo-American set of policies that benefit and protect winners (those with IPRs).

Thus, the outcome of regulatory convergence toward scienticity – towards the rational, science-based system that the Codex presumes – is consistent with both world polity and political economy perspectives, even if these approaches provide different explanations for this phenomenon. The very existence of a US-EU divide over GMO regulation, however, challenges both world polity theory and political economy scholarship. By assuming that dominant states in the core arena have more or less the same interests and share a relatively uniform "western perspective" (and also by implicitly asserting a generalized political stand-off between dominant and less dominant actors), such accounts are bound to have difficulty accounting for why the major fault line in food safety regulation lies between the two most powerful actors in the global political economy —the U.S. and the EU.

To attempt to meet this challenge, scholars in the cultural economy camp sometimes appeal to a variety of different cultural values and meanings that countries attribute to or associate with food as possible explanations for the divergent attitudes towards GMOs in the U.S. and Europe (Marcussen 2000; Voß and Freeman 2016). As a result, these scholars argue,

the U.S. and EU perceive safety differently, and have different views regarding regulations such as labelling. The EU considers labelling products containing GMOs necessary in order to inform risk-averse consumers, while the U.S. dislikes the practice, regarding it as a barrier to trade, given that the U.S. considers GMOs and non-GMOs as substantially (among other things, ethically) equivalent (Herrick 2005). In part, this divided perspective reflects the fact that labelling policy in the U.S. tends to be "supply-driven" (reflecting the interests of biotech industry), while in the EU it is consumer demand that pushes the need for labelling of GMOs (Nelson et al. 2001).

In their study of why the anti-GE (genetic engineering) movement was more successful in Great Britain than in the U.S., Schurman and Munro (2009) similarly emphasize how differing cultural values can lead to divergent interpretations of the implications of GE technology, shaping public discourse in contrasting ways. These scholars also suggest that countries that are primarily importers of agricultural products tend to take greater precautions than exporters; since GMO-exporting countries tend to be heavily dependent on GM crops and seeds, they have a serious stake in promoting a perception of GMOs as inherently safe to use. Since importing countries do not have a similar economic interest, they are more likely to be swayed by anti-GMOs groups emphasizing the risks of GMOs and arguing that this technology is a threat to the country's food system.

Scholars in the neo-Gramscian tradition also provide an explanation for why the U.S.-driven regulatory model trumps the precautionary principle more often than not. Taking Gramsci's conception of cultural hegemony, where the ruling capitalist class uses ideology, rather than coercive force (military/physical), to instill values to maintain the social and political order (Bieler and Morton 2003; Femia 1983; Lukes 1974), these scholars argue that the U.S. has effectively constructed and institutionalized a (supposedly) scientifically-oriented risk-assessment narrative by incorporating it into the charters, rules and functioning of

international bodies, including the WTO and the Codex (Bonneuil and Levidow 2011; Feintuck 2005; Winickoff 2015). Some scholars conceptualize these forms of global governance as "epistemic hegemony"[1] (Epstein 2017); others describe them as amounting to a process of "Americanization" (Antonio and Bonanno 2000; Apeldoorn 1998; Banerjee 2008; Bieler and Morton 2003; Djelic 2002; Robinson 2008; Sassen 2010), claiming that what world polity scholars might regard as the global diffusion of norms is, in fact, the spread of a "US version of [ideological] empire" (Djelic and Quack 2018). Overall, neo-Gramscians emphasize that the U.S.-based risk management approach is the result of moral and intellectual leadership that is achieved through consent, rather than through coercion, even if that consent ultimately rests on and reflects U.S. power (Gramsci 1971; Cox 1987; Burawoy 2003).

The production of this cultural hegemony also occurs in the domestic realm. Newell (2009), for instance, coined the term "biohegemony" to describe the imposition of corporate influence on the political economy of Argentina via the application of material, institutional, and discursive power. He describes how the alliance of interests between state and capital not only enabled the creation of a consensus among various stakeholders, but also effectively deflected any form of opposition or alternate framing of the GMO issue that might have weakened support for biotechnology. As many neo-Gramscian scholars would argue, what produces consent and maintains the status quo of the ruling bloc is thus the successful articulation of a particular ideology that convinces people to believe that they will be better off under the governance of a corporate dominated food regime. The neo-Gramscian analysis has also been applied to the Ugandan case, where the constellations of power align to maintain biohegemony; however, the dominant biotech bloc continues to be "more fractured and less entrenched" in Uganda than it is in Argentina (Schnurr 2013).

[1] Global ideological agreement around a particular form of science and politics, that is inscribed in international law and standards (Epstein 2017).

Schnurr argues that the apparently less successful biohegemony in Uganda was due primarily to the government authorities' continued ambivalence toward GMOs. The prolonged delay in passing the biosafety bill (until the passage of which no GMOs could be legally released to the environment), as well as an unpredictable domestic political situation—including cabinet shuffles and national elections—also contributed to a stalled expansion of GMOs in Uganda.

More importantly, however, the Ugandan case raises the question of whether biohegemony can provide an adequate account of Argentina's approach to GMOs. This is because an assumption that corporate capital sustains biohegemony does not in and of itself provide a valid explanation for the Argentine case. An approach that tends to treat all actors favoring GMOs as a single biotech bloc has obvious difficulty accounting for how the diverse group of stakeholders really understand biotechnology.

The final body of scholarship, known as Science and Technology Studies (STS), supplements the other literatures discussed here by offering insights into how scientization actually came to prominence. Scholars in this tradition are generally concerned with questions such as how society, politics, and culture affect scientific research and/or technological innovation and, simultaneously, how these affect the overall sociopolitical system (Law et al. 1999; Yamaguchi and Suda 2010). Treating science as a social activity, STS research seeks to discern why certain types of scientific views and technological innovation thrive and prevail, and how they, in turn, impact overall societal views of science and technology. Within the broad field of STS, Latourian actor-network theory and work focusing on governance and regulatory power will be particularly useful.

Developed by Michel Callon and Bruno Latour (1981) for studies of laboratory scientists and pasteurization, actor-network theory suggests that a scientific fact is seen to possess a value of its own that ultimately shapes the interaction between human and nonhuman

materials. In other words, actor-network theorists contend that nonhuman material can be an actor with its own agency, forging ties with various entities, eventually constructing a network of its own (Latour 2017). The emphasis in the theory is on the "flat ontology [of a product] wherein no actor is inherently 'bigger' or 'at a higher level' than any other" (Hirschman and Reed 2014).

Economic sociologists have employed this approach to analyze various phenomena, including what it means to be a trader in global exchange fora where technology provides the media for interpersonal communication (Cetina and Bruegger 2002); how traders use models to estimate the probability of a merger (Beunza and Stark 2012); and how collateral is turned into a financial instrument (Riles 2010). Bockman and Eyal (2002) treat socialism as a "laboratory of economic knowledge" where the discursive network relation between East European economists and economists from the U.S. and Western Europe was forged. Through frequent academic exchanges (held throughout the Cold War period), "the new hybrid discourse of neoliberalism" was produced; and this very knowledge traveled back to the domestic realms in both East and West, affecting local economic institutions in both regions.

Likewise, STS scholarship helps to explain the US-EU divide in their perspectives/skepticism toward the role of science. By tracing socio-technical networks among scientists, institutions, and the research and development process, STS scholars show how science (specifically, scienticity) has become a partial object, contrary to what many presume. This is because scholars in this group describe risk as a socially constructed judgment. Beck (1992), for instance, conceptualizes risk as criterion that conditions the way we want to live and our relations to nature, together with the threshold levels we are willing to tolerate. Our view of risk, as a result, is determined based on our social judgment and scientific knowledge simultaneously (1992:22). These scholars contend that new technology creates new risks that "society has no way of dealing with under existing knowledge system…[as a result] the notion

of risk breaks the scientific monopoly on truth [and] leaves the field wide open to competing actors and their renditions of 'scientific' truth" (Herrick 2005:287). In other words, due to the unforeseen side-effects of new technology, there is a disconnect between what the scientific community deems an acceptable threshold of risk and the socially tolerable level.

The so-called "epistemic communities"—transnational networks of experts or risk assessors who evaluate the appropriate level for the safety threshold—are, as a result, constructed in ways that are deeply political (Lee 2009). In their study of the Codex, Winickoff and Bushey (2009) show how both scientific experts and legal authorities, who would have different understandings and interpretations of risk, are involved in the global governance of the food system (and particularly of food safety regulation). The WTO, which needed to identify an existing international food standard with which it could harmonize its SPS Agreement, designated the Codex as one of the relevant international organizations with which its member states should harmonize their regulations. In this way, the WTO sought to identify itself as a scientifically rational and legally authoritative international body. In result, the WTO transformed the Codex into a global regulatory agency in which a discourse focused upon "risk analysis" produces tension between scientific and legal viewpoints. The actors involved in the standard setting primarily comprise scientific experts (for their scientific knowledge) and legal authorities (for their capability to translate legal texts). Given that scientists and legal authorities have different interpretations of the relevant risks (for their competing motives), the Codex has become (for obvious reasons) a hybrid regime of knowledge and power where competing discourses with differing interpretations of risk arise (Jasanoff 1990; Hajer 1995; Porter 1995).

The STS approach can thus help to discern what the essential problem is (the impact of "scienticity" on regimes called upon to evaluate GMOs), who and what the relevant actors may be, what their interests are, how they negotiate their values, how the discourse is translated in

the network, and ultimately how risk is framed. In other words, it explains how we should take complex networks and nonhuman objects, together, into account to better understand how the current social order is produced.

In the following section, I will demonstrate how global polity theory, political economy, cultural economy, hegemony, and STS literature can all be brought to bear in producing a coherent explanation of the complex Argentine situation with respect to the rise of biotechnology and how Argentina perceives science and knowledge regarding risk.

III. The Case Study: GMO Regulation in Argentina

Among the countries of the global South, Argentina stands out. Not only was it the first Latin American country to approve and produce GMOs, it also remains the third largest GMO cultivator in the world per hectare[2], as well as one of the world's top GM soy exporters. Since approval of commercial GMOs in 1996, the majority of Argentine cropland has been converted to GMOs: 100% for soy, 99% for cotton, and 94% for corn (Motta 2015).

Table 1. Area of Biotech Crops in Latin America (in 2017): by Country

	Country	Area Coverage in Latin America (in Million Hectares)	% of Total GM Cultivation Area in Latin America
1	Brazil	50.2	63.0%
2	Argentina	23.6	29.62%
3	Paraguay	3.0	3.77%
4	Bolivia	1.3	1.63%
5	Uruguay	1.1	1.38%
6	Mexico	0.1	0.13%
7	Colombia	0.1	0.13%

[2] Argentina was the world's second largest GMO cultivating country, after the United States, until Brazil suddenly increased its GMO plantation volume in the early 2010s.

8	Honduras	<0.1	0.11%
9	Chile	<0.1	0.11%
10	Costa Rica	<0.1	0.11%
	Total	~79.67	~100%

*Source: ISAAA 2017 (Table/calculation done by the author)

Table 1 summarizes how much cropland in each country in Latin America has been converted to GMO production, as well as the amount of land as a percentage of total GMO producing land in Latin America. It shows that Brazil and Argentina dramatically outcompete the rest of Latin American countries in volume of land cultivated using GMOs. Additionally, the table indicates the continuous growth in the adoption of biotech crops across many Latin American countries (among the 26 GMOs producing countries, 10 of them are in Latin America).

Table 2. Regulatory Policy Stance towards GMOs Among GMO-Producing Latin American Countries

Country	% GM Soy Coverage (in 2017)	% GM Maize Coverage (in 2017)	% GM Cotton Coverage (in 2017)	Intellectual Property Rights - GMOs[3]	Biosafety Regulation	Domestic Consumption and Labeling	Trade Policy on GMOs
Argentina	100%	97%	100%	UPOV 1978	No strict restriction on the release of GMOs into the environment	No labeling required; most food contains GMOs and public acceptance is high	GM crops promoted (export tax cuts on selective GMOs); no restrictions on imports of GM seeds/crops
Bolivia	100%	N/A	N/A	UPOV 1978	Restriction on the cultivation of GM maize	Pending GM food labeling	Allows import of GM food/feed
Brazil	97%	88.9%	84%	UPOV 1978	The Biosafety Law (2005) establishes safety standards and mechanisms for monitoring activities involving GMOs	Labeling required for food/feed containing GMOs (though there is a lack of enforcement)	GM crops neither promoted nor prevented; imported GMOs treated as substantially

[3] Both UPOV 78 and UPOV 91 protect seed intellectual property. Some fundamental changes were made from UPOV 78 to UPOV 91 – these include: 1) Farmers cannot freely save seeds from protected varieties for their own use; 2) Plant varieties can be patented; 3) Harvest belongs to the breeder; 4) Further breeding is restricted (APBREBES n.d.). Thus, the changes in UPOV 91 further restrict farmers' rights and their control of production systems, limits diversity via extended plant patenting, and more.

					and their byproducts; takes *precautionary* measures for the protection of the environment		equivalent to non-GMOs
Chile	11.1%	58.1%	N/A	UPOV 1978	GMOs substantially *different* from non-GMOs	Prohibits in-country consumption of domestically produced GMOs; only imported GMOs are consumed; No labeling	GM crops neither promoted nor prevented; imported GMOs treated as substantially equivalent to non-GMOs
Colombia	N/A	23%	91%	UPOV 1978	Ratified the Cartagena Protocol; risk evaluation available for both GE crops and GE animal products	Pending GM food labeling	GMO import promoted
Costa Rica	N/A	N/A	91%	UPOV 1991	Registration of new GM traits suspended since 2013 due to a court case against Monsanto	Strong anti-GM campaigns against corporate control of the food supply; No labeling	No restriction on GM maize and soybean import
Honduras	N/A	73%	N/A	N/A	First established a biotech committee in 2017 to monitor and approve new GM traits	N/A	Strong demand for imported GM maize
Mexico	N/A	N/A	100%	UPOV 1978	GM soybean and maize suspended due to court injunctions	Strong consumer/small-scale farmer backlash against GM maize for the need to protect maize biodiversity; No labeling	GM crops promoted; no restrictions on imports of GM seeds/crops
Paraguay	96.1%	42.2%	100%	UPOV 1978	Ratified the Cartagena Protocol but GM maize has been produced illegally	No labeling	Slowly promoting GM crops
Uruguay	98.2%	100%	N/A	UPOV 1978	Complicated application process tends to limit commercializatio n of GMOs; Three years moratorium on sweetcorn	GMOs treated as substantially equivalent to non-GMOs; labeling is voluntary	GM crops promoted; no restrictions on imports of GM seeds/crops

*Sources: ISAAA, 2017; Gilli 2010; Katovich 2012; Paarlberg 2001 (Table created by the author)

As indicated in Table 2, compared to Argentina, other Latin American countries have generally taken a more cautious attitude towards GMOs due to apprehensions about their uncertain health

and environmental implications, as well as concerns about the potential threat GMOs pose to their indigenous culture (e.g., maize farming in Mexico and Costa Rica). Moreover, many of these countries are parties to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, an international agreement that encourages nation-states to protect biodiversity from possible negative effects of "living modified organisms" which are equivalent to GMOs (Sato 2015). Some countries party to the treaty (not in the table), such as Ecuador, strictly prohibit cultivation of GMOs, while allowing GMO imports; Peru and Venezuela ban both cultivation and imports of GMOs (Genetic Literacy Project n.d.).

In contrast, Argentina is not a party to the Cartagena Protocol and, as a result, as described in Table 2, release of commercialized GMOs into the environment faces no strict regulation. This is because, like the U.S., Argentina "reject[s] the idea of GMOs as a distinct category"; in other words, Argentina follows a policy of "substantial equivalence" between GMOs and non-GMOs (Sato 2015). The Argentine government immediately adopted this pro-GMO stance in the mid-90s, even though, at the time, no Argentine company held a single GMO patent. Thus, my first sub-questions are: *How did the biotech industry develop in Argentina? Who were the key investors and how are domestic biotech companies comparable to multinationals?*

More interestingly, this pro-GMO policy generated little public controversy in Argentina, while activism has been pronounced in other Latin American countries including Brazil, Costa Rica, Mexico, and more. Some scholars contend that the hegemony of the biotech supporting bloc has successfully blocked the rise of anti-GM activism (Motta 2015; Newell 2009). Thus, Argentina's approach to GMOs makes it something of an outlier in the Latin American context. Since the government approval of GMOs in 1996, the biotech industry has become one of the largest-growing sectors in Argentina, with an annual growth rate of 13% (Assolombarda 2009).

Research shows that multinational biotech companies like Monsanto first entered Argentina to benefit from its relatively lax regulatory regime (Newell 2009). Similar to other Latin American countries, Argentina underwent waves of neoliberal reform during the 1980s and 1990s; spearheaded by structural adjustment, ports and the energy sector were privatized, and the agricultural sector was reorganized, with multinational companies acquiring national enterprises (Grimson and Kessler 2005). As a result, seed markets have become ever more concentrated. Seeing this as an opportunity, Monsanto began licensing the Round-up Ready (RR) gene in mid-90s to a multinational germplasm firm, Nidera (which acquired the domestic company Asgrow in the late 80s).

Monsanto, however, failed to foresee, or underestimated, aspects of Argentina's IPR law. As Table 2 shows, Argentina's IPR law adheres to the International Union for the Protection of New Varieties of Plants (UPOV) treaty, first enacted in 1978. This law allows farmers to save seed and replant it without paying royalties. As a result, there continues to be a huge black market, known as *bolsa blanca*, keeping the price of genetically engineered soybean seed (Monsanto's Roundup Ready) below global market prices (Newell 2009). Even though many foreign biotech companies, led by Monsanto and domestic biotech companies like Biosidus and BIOCERES, have pressured the Argentine government to sign the 1991 version of the UPOV (which prohibits seed saving), there has not been any progress on this issue and farmers continue to save and replant seeds.[4] As a result, Monsanto and many other foreign biotech companies have stopped selling new GM soy seeds.[5] The Argentine IPR law clearly is a kind of double-edged sword; the lax regulatory system offers a favorable ground for foreign companies since there are few restrictions on them, yet this very flexibility fails to offer robust protection of their IPRs once they have entered the market.

[4] The conflict over intellectual property rights exists even today, as I learned from my preliminary interviews this March.
[5] Even after replanting, GM soy still retains its genetically engineered characteristics; the same process is not possible for maize or sunflower though.

Argentina's existing biotech regulation also requires greater attention, as the decision to commercialize new GMOs heavily depends on the importing country's reaction, often more than on health and environmental issues per se. The three government bodies that oversee biotech regulation are the Comisión Nacional Asesora en Biotechnología Agropecuria (CONABIA), the Servicio Nacional de Sanidad y Calidad Agroalimentaria (SENASA), and the Dirección Nacional de Mercados Agroalimentarios (DNMA). The basic procedure is that, first, CONABIA evaluates and provides consultation on the possible negative impact of new, proposed GM seeds on agricultural production. Upon approval by CONABIA, SENASA then tests for the toxicity of the seed for human consumption and animal feed. After that, the DNMA needs to assess the economic risks associated with the introduction of GMOs. Specifically, the DNMA calculates the effect of the GMOs on the Argentinian export market (which I will discuss further below). When all these procedures have been successfully negotiated, the Ministry of Agriculture, Livestock, Fisheries, and Food (Secretaría de Agricultura, Ganadería, Pesca y Alimentos or SAGPyA) finally authorizes the commercialization of the new GM seeds.

When CONABIA makes its initial decision, it does so on the basis of consensus among a group of experts (much like what we see in the Codex or the WTO). These experts include scientists from biotech companies, economists, independent researchers, staff of government ministries, and more. The negotiation about risk in this domestic epistemic community (and the way its members frame it), as a result, determines the first step in the regulatory process. In fact, scholars argue that a favorable decision by CONABIA acts as a "precursor" to other evaluations; if denied by CONABIA, the evaluation process terminates at that stage (Gilli 2010).

The role of the DNMA also greatly influences the approval of new GMOs and shapes the perception of risk. Scholars argue that, unlike in many countries, governance of GMOs in Argentina takes socioeconomic concerns into account (Gilli 2010; Pellegrini 2013). The

DNMA thus conducts a cost-benefit analysis to predict the reaction of importing countries to GMOs: Argentina's regulatory policy tends to reflect the "GM adoption scenario of importing crop countries." (Newell 2009; Pellegrini 2013). As a result, some argue that Argentina has assumed a so-called "policy mirror"—the DMNA would evaluate positively only those GM crops that are approved in Argentina's primary importing market: Europe.

These seemingly contradictory biosafety regulations and Argentina's consistent long-term acceptance of GMOs thus raise my second question: *Why did Argentina adopt the U.S.-driven standard when it might well have risked its access to or success in its major international market, the EU?*

As emphasized throughout this proposal, the EU takes a precautionary approach to the approval of GMOs. Yet research shows that the EU is one of the biggest consumers of Argentina's GM soy—its soybean oil and soy meal (for feed) (Goldfarb and Zoomers 2013).[6] Again, this puzzle raises a third set of questions: *Are the distinctions between substantial equivalence and the precautionary approach overstated? Are these models inadequate to explain what we see in reality? To what degree and how is the precautionary approach reconciled with or related to scienticity?*

In addition, Argentina is in the process of seeking approval for the first drought-resistant GM wheat event in the world. According to the head economist at Buenos Aires Grain Exchange, all three agencies have approved the event, yet the authorization of the Ministry remains pending. This ongoing commercialization process requires further study because we can better learn: 1) how scientific was the decision-making process of each of the organizations involved in Argentina's multi-step GMO approval process; 2) how scientific was the approval process—what were the issues tested for and the threshold criteria for the approval of GM wheat; 3) what hinders the delayed approval of the Ministry of Agriculture. By interviewing

[6] My preliminary interviews with representatives at biotech companies (BASF, Pioneer, Bayer) and germplasm company (Don Mario) during AgroExpo also confirmed this.

experts who are directly or indirectly involved in the commercialization of this new seed, we can better learn how each of them frames risk, what the motives of each actor are, and how the regulatory decision-making is accomplished. Thus, this research is more timely than ever.

IV. Research Design and Methods

To answer my research questions, I plan to employ interviews, ethnographic methods, and archival analysis. After gaining approval from the University of Virginia's Institutional Review Board, I will travel to Buenos Aires, Argentina, in the third week of May 2019. I will remain there for six weeks, until the end of June, conducting interviews with experts from government agencies, seed companies, distributors, and universities, as well as with representatives of various NGOs. I also plan to attend a conference on maize crops that will be held at the end of May, where I hope to observe what type of GMO-related information is disseminated. Finally, I plan to gain access to publicly available archival data.

Methods

Interviews

Prior studies and my preliminary interviews show there are multiple actors involved in GMO distribution, and that each one of them has effective authority to influence the regulation of biosafety. Moreover, there are important differences among the actors involved in the regulatory decision-making—how each actor in the epistemic community perceives risk, what encourages some or all of them to feel confident about the safety of GMOs, and whether and how they are swayed by 1) the domestic discourse, 2) international standards, and 3) trade activities, and more.

To fully understand how these stakeholders shape perspectives on risk and influence the biosafety governance, it is important to establish the perspectives of each. For this, I plan to conduct strategic semi-structured interviews with key actors, including: 1) policy makers in

Argentina, including civil servants at the federal level; 2) science experts at biotech and germplasm companies; 3) economists at the DNMA, commodity exchange marketplace, and in rural organizations, who evaluate the trade impact of particular GMOs; and 4) civil society groups active with respect to biotech (e.g., Greenpeace, which is active in Argentina, and certain consumer organizations). All four sets of stakeholders either directly or indirectly affect biosafety regulations; in addition, groups 1) through 3) are presumed to have shared interests and perspectives on GMO safety, whereas group 4) is likely to provide a contrasting view.

I have an initial contact, the Chief Economist at the Buenos Aires Grain Exchange; he referred me to potential interviewees, including seed providers, policy makers and scientists. Another contact helped me reach university professors in the area of social movements. As a result, since February 2019, I have been in contact with potential interviewees to schedule meetings. I will also use a snowball sampling to ask my informants to recommend additional individuals who else I can speak to, so that I can interview as many people as possible, at least until I achieve saturation for a particular set of stakeholders. Overall, I anticipate conducting approximately thirty interviews.

So far, I have confirmed seven interviews,[7] most of which will take place in the interviewee's office. For those without private offices, I asked for convenient places for them to meet (e.g., a quiet café). All interviews will be recorded, and I plan to employ an interpreter in one or two interviews, both to facilitate the process and to validate (or challenge) my assumptions and understanding of the interviews. I have asked permission for this from the relevant interviewees. Moreover, I will adopt all the procedures laid out by the IRB to prevent and minimize any anticipated risks for the participants (e.g., masking their identities and organizations).

[7] Confirmed interviewees include: Former Secretary of Agriculture and Alternate Negotiator for Argentina in the Uruguay Round of the GATT; General Manager at Asociación de Semilleros Argentinos; Executive Director at ArgenBio; Chief Economist at Sociedad Rural Argentina; Chief Economist at Cámara de Exportadores de Argentina; Chief Economist at Buenos Aires Grain Exchange; Sociology Professor at La Universidad Nacional de San Martin

Interview questions include: 1) In implementing biosafety regulations, who influenced Argentina's policies most, and why? 2) Why do you think many regions around the world, including Europe, abstain from cultivating GMOs, and what is your opinion of their reasons? 3) What are the most important criticisms of GMOs? How do you handle/surmount these concerns? A list of potential interview questions is provided in the Appendix I.

Ethnographic Observation

I plan to attend the *Congreso de Maizar*, an annual conference focused on Argentina's corn industry. Key issues on the agenda include the use of biotechnology for pest management, new frontiers of corn, challenges for the cultivation of sorghum, innovations, bioenergy, risk management, agribusiness in the blockchain era, and political proposals in the upcoming election year. I will take detailed field notes and examine how various panels address these issues, as well as how presenters and participants communicate an image of GMOs, and interact with other attendees. Through observation, I can learn who is part of the conversation (who the insiders are), what the discourse surrounding GMOs is, and how the attendees frame risks associated with GMOs. Observations at this event may provide an "insider" or "everyday" view that is different from the data generated through interviews. Additionally, I will compare the field notes from this conference to what I observed during ExpoAgro[8], which I attended in March 2019. To conduct preliminary research, I travelled to San Nicolás, Argentina, where the world's biggest annual agricultural expo was held. This three-day event gathers all industries in Argentina's agricultural sector, which includes the biotech industry, germplasm companies, distributors, farmer's associations, members of futures and options exchanges, mainstream media, etc. Here, I was able to interview representatives of multinational biotech companies (Bayer, BASF, Pioneer), as well as an Argentine germplasm company (Don Mario). By juxtaposing the field notes, I attempt to ascertain whether there is a consensus among the

[8] Photos taken at the ExpoAgro available in Appendix II.

narratives and how, if at all, dissonances are modified and deflected by practitioners running these programs.

Archival Analysis

Finally, I will supplement my interview and ethnographic data through archival analyses. To learn about the historical element of biotechnology-related decision-making and how it has evolved, I plan to search for records of congressional debate, voting patterns of politicians, and authorized GMOs events from the SAGPyA. If possible, I hope to get records on disapproved GMOs (which may not be publicly available) to learn about why they may have failed to achieve a consensus among the experts in CONABIA, SENASA, and/or DNMA.

While scheduling interviews, one of the interviewees (who was involved in the first GMOs approved in Argentina in the late 90s) provided a document published in 2003 that evaluated the impact of GMO cultivation on Argentine agriculture. The document includes not only the economic analysis of the aggregate impact of RR soy and BT cotton production on the overall Argentine economy, but also the development of the agricultural biotechnology regulatory framework—how GMOs were integrated into the existing regulation regarding plant, seed, and animal health protection. Taking this as a starting point, I will trace the political process of risk framing and investigate general patterns associated with biosafety and international trade.

Before I leave for Buenos Aires, I also plan to explore publicly available information on the websites of the Argentine Camara de Diputados (equivalent to the U.S. House of Representatives) and the Comisión Nacional de Alimentos (National Food Commission or CONAL). On the Chamber website, I found at least forty bills related to the handling of GMOs, GMO labeling, consumer protection, etc.; most summaries include the results of congressional hearing, which states adopted the reform, and who blocked the bill (e.g., the Justicialist Party or the Radical Civic Union Party). Analyzing legal documents related to biosafety regulations

will allow me to examine the kind of language policy makers use to validate their claims and how those claims are incorporated and diffused. From the CONAL website, I can access consumer protection law, MERCOSUR standards, and other domestic food regulations (e.g., the Argentine Food Code). Aside from these national sources, I will look at the Food and Agriculture Organization Legislative and Policy (FAOLEX) Database, the Library of Congress, and other international websites.

When I arrive in Buenos Aires, I plan to visit the Mariano Moreno National Library of the Argentine Republic and the General Archive of the Nation, to seek assistance from the librarians to find voting patterns and trade policy documents. Although I browsed through their websites, there was no publicly available data, mostly because they require written consent forms. But I anticipate finding resources relevant to the historical record (timeline) of the emergence of the biotech sector. In textual analysis, I will triangulate this archival data against the data generated in my fieldwork.

These three types of data will eventually provide insight into how GMOs regulation have been formulated, how various stakeholders evaluate, frame, and interpret risk, as well as how those meanings translate into the regulatory frameworks.

Data Analysis

After data collection, I will need to code my ethnographic notes, interview transcripts, and archival/textual documents. Based on my literature review, I anticipate examining four general themes in my data:

- Risk and Safety: To what degree are GMOs considered risky? How is the risk assessed and who is the intended audience?
- Scienticity/Scientization: How are claims about the merits of science produced and eventually affect how policy is made?
- Stakeholder: What beliefs, perspectives or views constitute "epistemic communities" around GMOs? How many epistemic communities can be identified among the stakeholders interviewed? How do they relate to each other?
- Trade Relations: How relevant are trade relations in shaping discussions of risk and regulatory decisions? Is there evidence that stakeholders think differently about importing than exporting?

I plan to employ the "flexible coding" method described by Detering and Waters (2018) instead of conventional line-by-line coding because it will help me find a broader theme or pattern more easily. I will code the three types of data – interviews, ethnographic observations, and archival/public documents – separately. First, after importing the data (e.g. interview transcription) into NVivo, I will skim through and apply index codes to the text; in the next stage, I will apply analytical codes to every paragraph. As the last step, using the qualitative data analysis (QDA) software, I will identify trends across cases.

It is important to emphasize that the purpose of this study is not to develop a generalizable account of the relationship among scienticity, risk and regulation of GMOs. However, it will contribute to identifying mechanisms or processes that are relevant for understanding the formation of GMO policy in other countries.

V. The Intellectual Merit and Broader Impact of the Proposed Research Project

The proposed project will provide comprehensive data on the actor-network relations forged with respect to biotechnology risk assessment, including how constant negotiations shape various stakeholders' perception of GMO-associated risks, and what role each of them plays in decisions regarding a particular regulation.

Given the ever-increasing presence of GMOs in international trade and the global food system, more countries will presumably face biotechnology-related issues and think about reorganizing their regulatory frameworks in the short run. Simultaneously, different approaches to GMOs would also affect their relations with their respective trading partners. Understanding more about how risk is framed by stakeholders such as industry actors, policymakers, and scientists, and how that framing eventually contributes to societal perspectives toward biotechnology can inform better regulations.

Appendix I.

Working interview Guides

For all interviewees:

- Tell me about your role in the organization and how long have you been working here.
- Why did you decide to start working here and what did you do before you worked in this organization?
- When is the first time you heard about GMOs? How did you get interested in/become informed about GMOs?
- Have your perceptions toward GMOs changed at all since you started working here?
- Can you describe what this organization does to promote/combat GMOs?

For government regulators:

- To what extent do you think commercialized GMOs (GM soy/GM maize/GM cotton/etc.) have impacted Argentina's economy?
- What do you think are the biggest challenges for farmers in Argentina? For consumers?
- To what extent do you think the current biosafety regulation on GMOs is effective?
- If given an opportunity to amend the existing biosafety bill, what would you change/include/exclude?
- How do you think the risk(s) associated with GMOs is governed? What do you find to be the most necessary criteria for the risk assessment?
- What is your view of the new drought-resistant GM wheat? Why do you think the Ministry of Agriculture is delaying the approval process?
- How would you respond to those concerned with pesticide drift or other forms of GMO contamination over arable lands?

For scientists:

- To what degree are GMOs considered risky? How is the risk assessed and who is the target in the assessment?
- How are the members of the epistemic community selected? What is considered "consensus" when new GM seeds are approved?

For economists:

- How did commercialized GMOs (GM soy/GM maize/GM cotton/etc.) impact Argentina's economy?
- What countries affect Argentina's trade patterns the most? Has there been any important changes in Argentina's list of trading partners?
- What are the examples of GMOs that the DNMA has disapproved in the past? Why did they fail to get authorization?

For seed providers:

- Which biotech company do you work with? For how long and why did you decide to conclude a contract with this particular biotech company, as opposed to others? How long are your contracts?
- How would you characterize the relationship between seed providers and biotech companies?
- How do you balance the demands of farmers – those who want to plant GMOs on their own, and those who solely want non-GMOs seeds?

For civil society group representatives:

- Who/what comes to mind when you think about GMOs and their impact?
- Why do you think Argentina has a relatively low level of resistance to GMOs? Even if the approval of GMOs in 1996 was done swiftly, why hasn't there been any notable movements against GMOs, similar to what we see in Brazil, Paraguay, Peru, and other parts of South America?
- What activities have you promoted to raise consumer awareness?
- What do you see as the biggest challenge posed by the Argentine agricultural sector?

Appendix II. Photos from ExpoAgro March 2019

GM Maize from Pioneer:

****P1815VYHR stands for: P(pioneer);181 days of maturity; YHR(technique type)**

GM Soy from BASF:

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