Family Farming and The Emergence of an Alternative Sociotechnical Imaginary in Argentina

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In this article, we analyse the mechanisms by which family farming established itself in Argentina over the 2004–2016 period as a legitimate solution to the food security challenge. We show that this process has played a role in the emergence of an alternative sociotechnical imaginary built as a counter-model to the one associated with industrial agriculture. We highlight the importance of the processes of demarcation and detachment at the heart of this shift, in the political, techno-scientific and agricultural spheres. The actors involved in the promotion of family farming associate this alternative approach to the development of the agricultural sector with the implementation of an alternative practice and organisation of science and technology. These shifts correspond to a narrative and mode of political action that put the emphasis on the production of a national future liberated from the mistakes and injustices of the past, in which science and technology play a central role. By highlighting the tensions at the heart of this dynamic, between the establishment of new boundaries and the challenging of existing ones, the article contributes to the analysis of the formation of alternative sociotechnical imaginaries, and in particular the underlying mechanisms of co-production between science and politics.

Keywords: Sociotechnical imaginary, alternatives, boundary work, family farming, Argentina

At a time when the techno-scientific sector is increasingly being required to demonstrate its relevance (Foray, Mowery, & Nelson, 2012; Hessels, Van Lente, & Smits, 2009), food security has become an inescapable societal challenge for agricultural research (Wright, 2012). In fact, the perspective of a growing world population, which will generate increasing food needs (Tomlinson, 2013), has turned into a very powerful argument for encouraging and legitimising public and

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private investments in this sector. Yet, while the role that science and technology have to play in providing answers to this challenge is commonly acknowledged today (Maye & Kiwan, 2013), there is no unanimous agreement as to what the best solutions might be (Bernstein, 2014; Reganold & Wachter, 2015). Opinions tend to correspond to either one of two main approaches to agriculture. The first of these, which we will describe as industrial, is based on a productionist vision (Fouilleux, Bricas, & Alpha, 2017) and is in line with the policies of the Green Revolution of the 1960s. It is based on the intensive use of technological inputs such as fertilisers, pesticides and improved or genetically modified (GM) seeds (Cornilleau & Joly, 2014) and is linked to the production of commodities exported to global markets. The second approach, which we will describe as agroecological (Warner, 2007), defends a holistic view of farming, along with holistic solutions to the food security challenge. It therefore promotes practices that are both productive and environment-friendly, and which therefore ensure sustainable food production. In this approach, farmers' local knowledge is valued, along with small-scale farming and local food supply chains (De Schutter, 2010).

The contrast between these two approaches is of course exaggerated here for the purposes of illustration. It is nevertheless a reflection of the fragmentation of the agricultural sector and especially of its relationship to science and technology, marked by the domination of the industrial model in securing government funding (Vanloqueren & Baret, 2009). This article discusses this segmentation and the competing sociotechnical imaginaries underpinning it (Jasanoff & Kim, 2009). We take a sociotechnical imaginary, here, to mean the 'collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects' (Jasanoff & Kim, 2009, p. 120). Some authors have already contributed to highlighting the importance of 'security' in the construction of sociotechnical imaginaries. For instance, in the case of energy in the United States, Tidwell and Smith (2015) showed that the construction of a sociotechnical imaginary can stem from the issue of security per se (Tidwell & Smith, 2015). Our goal here is not to understand or demonstrate that food security and the increase of global food production have become the basis for the emergence of a renewed sociotechnical imaginary. In fact, we can easily consider that, already in the 1950s, it was at the core of the imaginary that supported the industrialisation of agriculture and the Green Revolution. Our objective is rather to understand how alternative agricultural development models, which embody alternative socio-technical imaginaries and claim to provide solutions to the food security challenge, are emerging and seeking discursive and institutional legitimation. In this respect, we agree with the recent reflections of Jasanoff and Kim, considering that 'multiple imaginaries can coexist within a society in tension or in a productive dialectical relationship' (Jasanoff, 2015, p. 4). We seek to account for the dynamics implied by this coexistence and the rapid growth of alternatives.

With regard to this plurality, Jasanoff (2015) recently emphasised that the definition of the desirable futures embodied in sociotechnical imaginaries is strictly related to the definition of futures to be avoided. Yet, little has been said

on the importance and nature of these avoidance mechanisms, or on the struggles between competing imaginaries. Over the past years, in the field of STS, research on technological innovation has nevertheless offered analytical and conceptual resources to address this problem. In line with Schumpeter's seminal work identifying the destructive effects associated with the innovation process (Schumpeter, 1942), recent work has highlighted the nature and importance of detachment (Goulet & Vinck, 2012) and treason (Galis & Lee, 2014) mechanisms in all innovation processes. It shows that the success of an innovation or a novelty is based not only on the robustness and number of ties built around it (Callon, 1986), but also on the rupture of those solidified around the previously dominant practice, technology or institutions. It has thus advanced the idea that the definition of alternatives is based, at the very least, as much on the definition of new obligatory points of passage (Callon, 1986) as on the conversion of existing points of passage into points to be avoided (Goulet & Vinck, 2012). This article therefore aims to extend this analytical approach, originally founded by innovation studies, to the study of plurality and emergence of alternative sociotechnical imaginaries. We will follow the hypothesis that these processes of detachment, avoidance and demarcation or boundary work (Gieryn, 1983) on which they rely constitute the pillar of this emergence, and more broadly of processes of co-production between social and cognitive orders (Jasanoff, 2004).

To this end, this article examines the way in which a sociotechnical imaginary emerged around the family farming figure in the context of post-crisis Argentina in the 2000–2010 period, in alternative to the one that accompanied the expansion of industrial agriculture. We analyse the ways in which this alternative imaginary emerged, primarily through the performing – in order to better move away and detach from it – of an order established around this industrial agriculture and its scientific and technical foundations. We describe the interfaces and intersections between the different spheres of social life concerned by this movement (Frickel & Moore, 2006), from the laboratory up to the nation state level. In the first part of the article, we look at how family farming and social inclusion made their way onto political and scientific agendas. In the second part, we show the importance of the rationales of demarcation that accompanied this shift through the categorical treatment of family farming. Lastly, in the third section, we analyse the challenges to the epistemic and organisational boundaries that accompanied this movement, as well as the tensions characterising the emergence of an alternative sociotechnical imaginary.

Family Farming Between Science and Politics

Family Farming and Food Security in Argentina and Around the World

The concept of family farming rose to power in institutions and Argentinian public debate during the 2000s, in line with a dynamic initiated on the Mercosur level,

especially in Brazil in the 1990s. This movement promoted the activity of small farmers, who often remained on the fringes of public policies, and defended their existence faced with the advance of large latifundian agriculture (Elgert, 2016). From the 1990s, this advance intensified, with the global upsurge of the demand for grain and oil crops such as soy. The exponential expansion of soy farming, along with the development of large farms tied to foreign capital, gave shape to a model called *agronoegocio* (Gras & Hernandez, 2013). This also played a role in Argentina's economic growth in the 2000s, when the taxation of grain exports contributed, at least partially (Teubal & Palmisano, 2010), to the financing of the State and its policies. However, faced with the advance of the *agronegocio*, family farming became a sector with respect to which the States of the region, mainly run by left-wing governments at the time, adopted protection and support policies. This notion of family farming refers to the most modest agricultural households, whose activity is essentially based on family labour, and whose existence would be beneficial to society as a whole. The political framing of family farming took place through the demonstration not only of the threats that the continued expansion of agribusiness constituted for it, but also of its benefits, first and foremost its contribution to food security and sovereignty. This virtue, along with others, is mentioned in the first article of the law enacted in 2015 by the Argentine Parliament to promote and support family farming:

> Family, rural and indigenous agriculture is hereby declared to be of public interest due to its contribution to the food security and sovereignty of the people, due to the fact that it practices and promotes life and production systems that preserve biodiversity and sustainable production transformation processes.

This framing of the virtues of family farming is not found only in Argentina, it is also shared by all of the institutions which, starting in the 1990s, put the defence of small-scale producers on the agenda. Recently, the initiatives working in this direction culminated with the organisation by the United Nations Food and Agriculture Organisation (FAO) of an International Year of Family Farming in 2014 – with a slogan that clearly stated its virtues: '*Feeding the world, caring for the earth*' - and a United Nations Decade of Family Farming (2019–2028).

Science, Technology and Family Farming at the Heart of the National and Popular Project (2003-2015)

In Argentina, in the 2000s, the importance and meaning given to family farming within the political and scientific agenda are tightly entangled with the project put forward during the Peronist presidencies of Nestor (2003–2007) and later of Cristina Kirchner (2007–2015). Called the *National and Popular Project*, it is situated at the confluence of the rise to power of the Latin American left in the 2000s, in a breakaway from the previous decades marked by neo-liberal policies, and a return to the main thrust of Argentina's historical Peronism and developmentalism of the

1950s. Its four main pillars, in each of which science occupies a central role, describe the main features of this political project. They constitute the foundations of the sociotechnical imaginary that it contributed to shaping, in which family farming came to have a place, thus breaking with the previous orders that would have led the country downfall over the past decades.

The first of these pillars, which is closely related to the following ones, is the re-conquest of the nation state as the central authority of society. The Kirchner's rise to power in 2003 took place in a context of unprecedented political, economic and social crises. In 2001, a major crisis put an end to a decade of ultra-liberal policies, during which state interventions and institutions were stripped back to the very basics. The policies implemented from 2003 therefore aimed to give the state a prominent role once again, at times through a certain interventionism: the renationalisation of privatised companies, massive recruitment into a decimated public service (see Pellegrini (2014) for the case of National Institute of Agricultural Technology [INTA]) or creation of new ministries, including the Ministry of Science, Technology and Productive Innovation (MINCyT). Support for family farming was fully a part of this strategy, as evidenced by a speech by President Cristina Kirchner at the FAO's annual conference in 2015, receiving a prize awarded to Argentina for its food and agricultural policies:

> What contributed to Argentina eradicating the problem of hunger was precisely the existence of the State: a State with very active public policies that focus closely on this problem. (…) What I want to say here in Europe, where I hear that adjustment and restriction measures are being applied, is that these measures were applied in Argentina with catastrophic consequences.

The second pillar is national sovereignty and applies to multiple sectors. It is above all political and economic, consisting in the reaffirmation of the country's sovereignty with respect to foreign financial powers, as in 2015 when the government refused to back down before hedge funds in a conflict inherited from the 2001 crisis. The same stance was adopted in the industrial sector through re-nationalisation and the expulsion of foreign companies. It can be found most broadly in the field of technology, with the resumption of import substitution policies developed during the 1950s and the revitalisation of 'techno-nationalism' promoted under President Peron's rule (Picabea & Thomas, 2014). For example, at a conference in 2014, the Ministry of Science and Technology justified investment in this sector on the basis of '*the importance of technological innovation for the defence of national sovereignty*'. The defence of family farming, for its contribution to food sovereignty, was also included within this rationale. This is demonstrated by the director of the Free Chair on Food Sovereignty at the Faculty of Agronomy, University of Buenos Aires, in his answers to questions relating to family farming:

> Attaching the adjective 'food' to the concept of sovereignty seems to give the impression that the latter is left in the background, whereas in the case of

> Argentina, it has always been very important in national history, and pertains to the concept of sovereignty as a Nation – in which sovereignty is related to energy sovereignty, food sovereignty, autonomy in decision-making.

The third pillar of this political programme pertains to the protection and social inclusion of the most vulnerable segments of the population. In line with policies implemented during the same period in other Latin American countries, measures were taken to support vulnerable publics, such as minorities or the poorest households, and repair the negative effects that the recent neo-liberal policies had on them. Family farmers constituted the rural component of these social inclusion policies, as the Argentinian Minister of Agriculture pointed out at an event related to the FAO's International Year of Family Farming in Rome in 2014:

> Argentina has consolidated a State model that makes family farmers visible, because only the State is capable of guaranteeing balance and equality in our societies.

These policies, along with the narratives underlying them, were the subject of a strong criticism in the 2000s. They were denounced for being populist (Richardson, 2009), especially in view of the discourse that contrasted the 'true people', namely labourers and poor people, with political and economic oligarchies (Gidron & Bonikowski, 2013; Jansen, 2011). It was in these terms that a member of parliament belonging to the presidential party described the new law supporting family farming, at the National University Forum for Family Farming in Jujuy in 2015:

> This law is a grain of sand intended to de-colonize our culture, which thinks that the wealth of this country has been created thanks to large corporations rather than by family agricultural workers. (…) This is about the redistribution and deconcentration of the private windfall economy that has been the ruin of our country.

In this context, family farming was thus defined as an alternative to be prioritised with respect to the dominant economic sector of *agronegocio*.

The fourth pillar, which intersects with the previous three, relates to a historical positioning that breaks with past orders. While sociotechnical imaginaries and futures that they embody are certainly often defined through references to the past (Eaton, Gasteyer, & Busch, 2014; Jasanoff, 2015), this aspect is strongly present in here due to Argentina's recent historical turmoil. The themes of historical reparation and memory are therefore central, primarily with reference to the period of military dictatorship (1976–1983) and the ultra-liberal decade of the 1990s. The memorial activity regarding the period of the dictatorship was carried out through multiple initiatives, the most consequential of which was Kirchner's repeal of the Amnesty Laws enacted in the 1990s, a first step in bringing members of the military junta to trial. A more specific undertaking was carried out within research institutes, whose staff had been the target of numerous forced disappearances. The

INTA was the particular focus of a memorial undertaking based on historical research (Gárgano, 2011). With respect to the 1990s, an entire narrative revolving around 'recovery' developed with regard to the mass re-investment made in the research and higher education system, with the increase of research funding and the creation of new universities. A programme for repatriating researchers was also implemented (Spivak L'Hoste & Hubert, 2014), financing the return to the country of around one thousand scientists who had been forced into exile (OECD, 2015). Support for family farming clearly pertains to this rationale of memory and reparation for the neglect or oppression to which small producers were subjected. In this sense, the law enacted in 2015 was given an explicit name reflecting this crossroads between the future and past: The *Law of Historical Reparation of Family Farming for the Construction of a New Rurality*.

Science and Technology for Social Inclusion

The issue of family farming and its inclusion on the political agenda is clearly located at the intersection of these four pillars. In a way, promoting a bright future for family farming is equivalent to defending the role of the state in the society in order to guarantee the sovereignty of the nation and to promote the inclusive development of the most vulnerable population groups, always with a view to break away from the mistakes of the past. The same goes for science and technology, a state's prerogatives erected as a lever to guarantee endogenous and sovereign development, or above all to serve the National and Popular Project's objective of social inclusion. In this respect, multiple initiatives were targeted at helping science and technology contribute to addressing the challenge of social inclusion, and more broadly at bringing science closer to society. While this echoes the fundamental elements of Peronism in the 1950s, which aimed to facilitate the working classes' access to universities, it once again highlights the departure from previous orders. In the presentation brochure for the newly created MINCyT, the former President Cristina Kirchner introduces this new knowledge to be produced:

> This is not isolated knowledge with no relation to society; on the contrary, it is knowledge, science, and technology that interact with the community, the economy, with health (…) within the collective imaginary, science was seen as something remote, that had nothing to do with the daily life of people. We are currently changing this paradigm.

Social inclusion is therefore one of the priorities of this adaptation of science to the needs of society. This is reflected in the words of the Secretary of Planning and Policy on Science, Technology and Productive Innovation within the National Plan of Science, Technology and Innovation, entitled 'Innovative Argentina 2020':

> The consolidation of a national model based on inclusive development demands the contribution of science and technology to improve the population's living

conditions. The concept of inclusive innovation structures actions by tending to orient the creation and use of scientific knowledge, technological production, and innovation toward social development.

Many initiatives support this political will. One of these is the creation of the Procodas – Programme-Council for the Demand of Social Actors – within the MINCyT, which aims to motivate researchers, through specific financing mechanisms, to work with vulnerable groups to resolve the problems affecting their daily life. The programme is more specifically targeted at four types of population or problem: disabled people, social habitat, social and solidarity economy and, last of all, family farming. However, for the latter, the main initiative was the creation in 2005 of a research centre within the INTA, specifically dedicated to this public: the *Centro de Investigación y Desarrollo Tecnológico para la Agricultura Familiar* (CIPAF, Centre for Research and Technological Development for Family Farming).

The Categorical Construction of Family Farming

While family farming is closely entangled with the construction of the alternative sociotechnical imaginary that has been emerging in the 2000s, the breakaway effect that it embodies is strengthened by the categorical form in which it has been placed on the political and scientific agenda. Like all categorisation and classification (Bowker & Leigh Star, 1999), these types of operation involve the establishment of new boundaries, which are the results of demarcation and detachment operations within the organisations or institutions concerned. This undertaking was carried out simultaneously within the political and scientific spheres, as well as within the rural population. The Argentine state first contributed to structuring a unified representative body for family farmers within the FONAF (National Forum of Family Farming). Whereas multiple dispersed organisations had previously defended 'peasant' or 'indigenous' agriculture, their grouping was organised within a single organisation,[1] which became their official representative before the state. Next, a statistical device was implemented in 2007, with the creation of a differentiated and specific agricultural census for family farming, the National Registry of Family Farming (RENAF),[2] which contributed to establishing the population of family farmers in statistical terms.

Among these first initiatives, we find a variety of institutional creations, in every case based on demarcation from the existing institutions. For example, in 2008, a State sub-Secretary for Family farming was created within the Ministry of Agriculture, and elevated to the rank of Secretary in 2014. The Family Farming Commission of the National Agrifood Health and Quality Service (SENAF), the Commission for the Coordination of Family farming, came into existence within the National Food Safety and Quality Service in such a way as to 'include the vision of family farming in general within the organization'. The scientific and technological sectors took on a central role in these initiatives, which would be acknowledged and even confirmed in the law enacted in 2015.[3] In 2012, the Argentine Chamber of

Manufacturers of Agricultural Machinery for Family Farming was created at the behest of the State Secretary, clearly differentiated from the existing chamber, the Chamber of Agricultural Machinery Manufacturers, which gathered manufacturers catering for industrialised agriculture. Most importantly, in 2005, the INTA created the aforementioned CIPAF, a research centre based in Buenos Aires with five regional branches called Institute of Research and Technological Development for Family Farming (IPAF), for the purpose of 'generating, adapting, and validating technologies appropriate for the sustainable development of family farming'.

Whether this separate institutionalisation of family farming takes place within scientific institutions or within organisations related to the exercise of political power, two arguments are put forward to justify it. The first is naturalist: it is the radically different nature of family farmers as opposed to those who got on the Green Revolution train several decades ago that would require separate institutions. This affirmation of specificity is closely related to a critique and demarcation of the institutional landscape as organised up until then, which was supposedly incapable of getting small producers out of poverty. An INTA official who participated in the establishment of the CIPAF in 2005 commented:

> The idea was to say: if what exists hasn't been able to give an answer to family farming, then let's set up something different. I think that it was because of that: we weren't addressing the problems of family farming.

The managers of INTA then made the choice to recruit new agents from outside the institution to the CIPAF, rather than wagering on internal mobility and giving the impression of recycling existing activities or agents. Acting specifically for family farming means proceeding differently from what has been done until now for modernised agriculture, as an agricultural engineer who also participated in the creation of the CIPAF emphasised:

> The difficulty was that every time we wanted to introduce certain technologies, we had to adapt technologies generated for others to a context that actually had other needs. (…) The development of machinery for family farming is not a question of a reduction in scale; these are specific machines.

The second argument put forward to justify these institutional demarcations is of a different nature. It is based on the awareness of the political instability of the past, at the time of defining organisational forms capable of enduring in the future. One of the creators of the CIPAF thus explained the choice of a research institute specifically dedicated to family farming, as opposed to other options such as a multidisciplinary programme spanning the different pre-existing laboratories within the INTA:

> If we had put them within experimental stations, we would have run a risk: the risk that once Cheppi's [president of the INTA who made the decision to create the CIPAF] term came to an end, the next guy would come and say: 'OK, that's

> all very good for family farming, but now it's time to start doing something else, guys. It's good that you're doing things for family farming, but even so, the guy who's working on weeds in family farming is going to work on weeds in wheat production from now on'. Basically, dismantling the teams that we were going to form.

The national director of the INTA at the time confirmed this viewpoint and management, based on the experience of the past, which was aimed at withstanding future changes in political power:

> We told ourselves: 'We're going to lay the foundations to protect these aspects, so that when the day comes and something happens, it will be more difficult to break down these walls which are not just a name or a programme logo'.

Therefore, in both the political and scientific spheres, family farming was recognised in a categorical way, demarcated and even opposed to institutionalised forms of production of knowledge and technology. In the political and historical contexts of Argentina in the 2000s, this process corresponded to a narrative of emancipation and detachment from past orders, and particularly of recovery, following an unprecedented crisis. It is therefore relevant to focus in more detail on the programmes and activities of these groups dedicated to family farming. The challenge is to show how the alternative sociotechnical imagination has materialised within forms of organisation or planning of techno-scientific activities. While, as we will see, the creation of new demarcations was central, the challenging of the demarcations that previously structured the scientific world and its relationship with society constitutes a major component that has led to certain tensions.

Challenging and Maintaining Boundaries

For the promoters and practitioners of a technoscience dedicated to family farming, two main frontlines stand out. The first of these concerns the reconfiguration of the boundaries between science and politics, while the second one surrounds the redefinition of the boundaries between research and extension, or between other entities that structure research occupations. We will see that these boundaries and their maintenance can be important resources when it comes to positioning new organisations and their practitioners within their environment.

Challenging the Boundary Between Science and Politics

The separation between the political and scientific spheres has been the subject of renegotiation on two levels in the emergence of the sociotechnical imaginary associated with family farming. The first level is of an institutional nature, whereas the second is related more to individual commitment. To examine the institutional level, it is relevant first to describe the rather particular relationship that exists

between government and INTA. The institute was created in 1956, in line with other large national scientific institutes. To ensure close proximity with the agricultural world, its activities included both agricultural research and extension, two activities that are most often kept separate from an institutional point of view in other countries. Moreover, a steering committee composed of representatives from farmers' organisations headed it, alongside a national director and president. While the position of national director was awarded following a public call for candidacies, the president was appointed directly by the State President. The position as the INTA president was very often a stage in a political career, prior to a nomination as the Minister of Agriculture, ambassador or other high-ranking positions. The case of Carlos Cheppi, under whose presidency the CIPAF was created, is in keeping with this tradition. In the 1990s, when Nestor Kirchner was appointed the governor of the Santa Cruz province in Patagonia, he became his provincial Minister of Agriculture. Kirchner then propelled him along with himself in his political rise to the presidency of the republic, appointing him vice-president in 2003 and later the president of INTA. Cristina Kirchner subsequently appointed him Secretary of State for Agriculture, and then Ambassador to Venezuela in 2011. Cheppi's choice to create the CIPAF in 2005 was therefore eminently political, and strictly pertained to putting social inclusion on the political and scientific agenda. A CIPAF manager pointed out:

> The importance placed by the State on social equality gave the INTA the opportunity to take on and be actively involved in technological development policy adapted to family farming (…) (Cheppi) did the same thing as Kirchner, but within the INTA.

However, this erasure of the boundaries between political and scientific agendas is not simply the fruit of the circulation of the elite between the two spheres. Among the actors involved in science and technologies for family farming, we find a desire to defend this close affiliation between the activities of an institute such as the INTA and political lines set by the government. For example, the director of the CIPAF defended this link and this domination of political power over an organisation like the INTA, as follows:

> We, the institutes, must not forget that we are nothing more than the instruments of a state policy.

CIPAF agents also defended this viewpoint, challenging the separation between science and politics. This is particularly the case of the following biochemist, who was forced to immigrate to Europe in the 1990s, before returning to Argentina under the national repatriation programme. He defended state-funded science, which he argued should be placed in the service of the public good, as opposed to science enslaved to private interests, which he described by making an analogy to the foreign financial actors threatening Argentina's sovereignty since the 2001 crisis:

> To do science is to do politics; they can't be dissociated from one another. You work for the private sector to the detriment of the State and people's taxes; you turn your back on society by making products for the rich. It's like vulture funds.

Research and Extension, Science and Society, Scientific Specialities: Mitigating Boundaries

The second thrust redefining the sharing of the world established up until now within agricultural research consists in renegotiating the boundaries of its internal components, or those that exist along its periphery. Redefining the boundaries between research and extension is undoubtedly the most important of these tasks. This subject is important within the INTA, whose mandate spans these two activities between which difficulties of articulation have always existed. While the name of the CIPAF implies a research mission, in reality, it is distinctly oriented towards the specialities closest to extension. Initially, the small team that Carlos Cheppi gathered in 2004 to consider the strategy for family farming was composed exclusively of agents originating from extension, or specialising in the management of development programmes for small producers. This significant imprint left by extension endured following the creation of the CIPAF, in particular through its physical and institutional positioning. While all of the research laboratories of the INTA were grouped together within a scientific park in the peri-urban region of Castelar, the headquarters of the CIPAF was established in Buenos Aires in the same building as the Department of Extension Services.

This predominance of extension activities is also reflected in the professional profiles of the agents hired, most of whom are from an extension background and who, on the whole, are rather critical of laboratory research. One of these agents, who was appointed Director of the IPAF in the north-west of Argentina, and who would later become the national coordinator of extension services, explained:

> When I started to work on water in Salta in 2000, I went to see the experimental station and I talked with the water specialists so that they would help me solve the problems of producers. They responded: 'No, no, no… we're in the middle of modelling'. We have to balance modelling with providing solutions to producers! (…) It's a dichotomy that we have here, as we're one of the rare institutions that has the two components. I feel like I'm an extension agent. If I look at myself from the inside, I'm passionate about allowing people to live better. Processes that… that don't change anything make me very… worried.

In practice, although the choice has been made to assert the CIPAF as a research centre, it was nevertheless a certain type of research that was advocated, and which came to challenge the institutional separations established until then within the INTA. For example, it was in this sense that 'participatory action research' was highlighted as the intellectual basis of the CIPAF's activities. This approach was

not radically new in itself, as it was, for example, one of the epistemic foundations of the various programmes that had hitherto been dedicated to small producers, within which several founders of the CIPAF had held important positions. This approach advocates no longer distinguishing research and extension activities from one another, or scientists from laypersons. To promote the emergence of a more 'inclusive' society, it would be necessary for science to include non-researchers in its reflection and its activities. The document introducing the foundations of the IPAF's actions in the Pampas region explained:

> Participatory Action Research develops instances and techniques that must allow producers to fully express their problems, their interests, and their desires, and to build progressively within an authentic communication model alongside researchers and extension agents (who must also provide their knowledge, but without trying to impose themselves or lay claim to a privileged position).

But it is also the boundaries between specialties and scientific disciplines that are being challenged by the founders and members of IPAF, who are seeking to break away from traditional ways of organizing research. Agents hired came from very different specialities: agricultural or mechanical engineers, jurists and even a large number of social science graduates. This plurality, and namely this departure from the demarcations instituted up until then within the scientific world, was highlighted as a way of addressing the specificity of family farming and its 'complexity', which required a '*systemic approach, with the distinction of their elements (without their isolation), their interactions, and their emerging attributes*', thus producing knowledge that is '*pluralist, integrating different ways of understanding the same phenomenon*', as the founding document of the Pampas IPAF stressed. This challenging of existing boundaries nonetheless systematically pertains to a rationale of opposition and demarcation with respect to that which had been done up until then, or with respect to science as executed in the service of *agronegocio*. A mechanical engineer at the IPAF contrasted his job with that of his colleagues from INTA, who work with the manufacturers of large machinery. He challenged the Fordist nature of the latter:

> What they do actually is a lot of diffusing what companies do. Bragaccini [INTA's specialist for large-scale machinery] says so himself: it's companies that have to do this design work. As a family farming research institute, we have to do it in collaboration with companies, but we also have to do the job ourselves. They don't do the development themselves.

Boundaries in Tension

The space for science and technology dedicated to family farming was therefore created through a dual demarcation process. The first was the result of categorical reasoning consisting in the establishment of new organisational boundaries. The

second consisted in challenging or shifting the existing boundaries that had until then structured epistemic or professional equilibriums. In this sense, the entirety of the CIPAF's intellectual undertaking was based on challenging the boundaries between research and development, with a strong inclination to employ specialists in extension work. In practice, however, CIPAF agents demonstrate postures that are less critical of these pre-existing demarcations, even going so far as to re-mobilise them in order to position their actions and institution within their environment. For example, an attempt to establish differentiation with respect to extension teams proved to be crucial initially, while the regional IPAFs were being set up. The 'research centre' label constituted a significant resource to argue for the non-redundancy of extension teams and to facilitate cohabitation. An agent from the NOA region recalled:

> Some people said: a new institute was created to replace ProHuerta [an programme directed at small producers managed by extension teams]. The people that were supposed to be your main allies, ProHuerta, wanted to kill you because they thought that you wanted to get them out.

In daily practice, this siding with the research 'camp' and reification of the difference between research and extension also marginalises certain requests from small producers, which at times are deemed to lack legitimacy. Eduardo, an IPAF agent in the Pampas region, mentioned the first meetings with producer organisations aiming to introduce the CIPAF and its activities:

> Eduardo: 'In the beginning, because nobody had a good idea of what the IPAF was, we had lots of interactions with organizations. They came to ask you… inputs for production. Things… almost social work. Assistance. (…) In the beginning, we set up work groups. There were groups for sales, for agroecology, and within these groups, sometimes we would talk about anything! About manure! Where can you get the cheapest manure? Or what can you do to get assistance?'
>
> Interviewer: And what was your response?
>
> Eduardo: 'We told them that we were a research institute: 'We work on something else that has nothing to do with that, go see so-and-so, go see the extension agent at the INTA, at the Ministry of Agriculture'.'

The tension between opening and closing, between criticising and mobilising pre-existing boundaries, is thus clearly found in CIPAF actors' definition of their activities, somewhere between research and extension. Symmetrical to what has been observed around the notion of basic research (Calvert, 2006), the protagonists of family farming readily present contrasting identities and postures, depending on the interlocutors involved. The public observed here is clearly different to

those studied by Calvert or Gieryn (1983): these are not scientists aiming to mark their difference from non-scientists, but on the contrary actors from the world of extension aiming to establish their place in science. We nonetheless find a similar symmetric tension, for example, between the desire to maintain a certain degree of autonomy with respect to field actors and the defence of researchers working to resolve their problems.

This friction is found, more fundamentally, in the role allocated to science and technology in family farming. The scientific and political framing of family farming has involved a critique of a certain way of organising society and agricultural or techno-scientific sectors. The founding document of the Pampas IPAF announcing the institute's intellectual foundations at the time of its creation thus criticised an '*atomist and/or reductionist view of the world and its knowledge acquisition method*' or even, to cite Habermas (1971), '*a neutralist view of scientific activity*'. It is also a view of agricultural development too closely focussed on a technology that was being denounced:

> The Pampas IPAF considers that the reality of family farming can't be managed by the Dominant Paradigm, which reduces the problem of small-scale family farming essentially to access to technological solutions.

As an extension of Kelly Moore's observations on the mobilisation of US scientists during the Vietnam War (Moore, 2013), this is therefore almost akin to a fight to minimise the power of science and technology in orienting society. Yet, despite this intention, it was effectively a research centre that was created through the establishment of the CIPAF with the purpose of:

> Managing the primary and applied research leading to the generation and development of knowledge on subjects specific to family farming. (INTA, resolution 456/05)

The national director who participated in the creation of the CIPAF mentions this component of bringing family farming into the scientific sphere in order to remove it from the world of extension, to which it had been relegated up until then. It is as if the political emancipation of family farming and its entrance into the world of productive agriculture, from which it had been symbolically excluded up until then, also took place through the entry into the world of science by INTA extensionists, who themselves were symbolically and numerically dominated by their research laboratory colleagues:

> Family farming needed a research centre, because all it had was scattered actors doing extension work. It was all of a sudden necessary to concentrate, and to do it somewhat in isolation from the rest, to give it time to build its strength.

This tension within the techno-scientific world, between distance and continuity, and between the challenging and the re-appropriation of boundaries, has finally taken its place in the landscape of those tensions making up the alternative imaginary built around social inclusion and family farming. These are embodied in particular by the categorical form given to placing social inclusion on the political and scientific agenda. This ambition for inclusion was effectively manifest through a logic of separation, pertaining to what Steven Epstein (2006) described as the 'inclusion-and-difference' paradigm, based on the case of minorities inclusion' in biomedical experimentation protocols. Whereas the idea of including vulnerable or minority groups implies the removal of the barriers preventing them from finding their place within society, this takes place through their allocation to categories whose definition constitutes an eminently political act (Bowker & Leigh Star, 1999). The scientific framing of these issues of inclusion and the sociotechnical imaginary that it embodies are underpinned by similar rationales in which new cognitive orders are reconfigured, between rupture and continuity.

Conclusion

In this article, we have focussed on the mechanisms of the emergence of alternative sociotechnical imaginaries. In the introduction, we put forward the hypothesis that demarcation activities constituted a central component of these mechanisms. We then placed ourselves at the interface of recent research highlighting the plurality of imaginaries that may coexist at a given place and time, and research emphasising the importance of detachment processes in the emergence of innovations.

The case of the placement of family farming on the political agenda in Argentina encourages both the confirmation and relativisation of this hypothesis. It confirms it because it shows that an entire set of proposals that depart from existing and previous orders are aligned behind the rise of this notion within public policy and techno-scientific organisations. This agricultural development model, proposed as a counter-model to *agronegocio*, has effectively established its place both within a political offering, in opposition to those characterising the previous decades, and techno-scientific offering, presented as an alternative to traditional research methods. In this sense, the co-production of the new political and cognitive orders on which the sociotechnical imaginary related to family farming is based is rooted in the challenging of the orders that actors relate to *agronegocio*. Some of the pillars of these orders, the reference frameworks on which they base authority or even some of the categories in which their worldview is grounded are nonetheless reused to establish the authority and legitimacy of the new imaginary. Between the challenging and maintenance of existing boundaries, and between logics of inclusion and separation, the emergence of alternative orders is therefore based on logics in tension.

These observations and their relation to the empirical field analysed in this article open up three pathways of analysis to understand how multiple and divergent

sociotechnical imaginaries can coexist within given spaces and locations. The first of these pertains to the modes of existence of this plurality (Kellert, Longino, & Waters, 2006), which are useful to understand. While in this article we have shone light on the mechanisms of the emergence of alternatives, the formats of their coexistence faced with the models they claim to deconstruct, and the way they are managed in policymaking or within scientific organisations, deserve to be considered. At a time when, for example, in fields such as agriculture (Levidow, Birch, & Papaioannou, 2012) or even epidemiology (Brown, 2007) and medicine (Polich, Dole, & Kaptchuk, 2009), new regimes of proof and new ways of distributing tasks between scientists and lay persons are appearing, it is worthwhile to understand how public policies, organisations and research practices take possession of this diversity in order to regulate, encourage or, on the contrary, restrict it. The second pathway pertains to the importance of reintroducing symmetry in the analysis of the emergence of plurality and alternatives in sociotechnical imaginaries. Many times, it is intuitively more exciting, or perhaps easier, to analyse why and how alternatives are rising, dissecting the arguments they use to denounce what would be a 'dominant' thinking or practice. However, in doing so, research work leaves in the shadows what really is this so-called 'dominant' imaginary, the ways it is transformed by the emergence of alternatives, or the way its protagonists are dealing with the criticism directed at them. It would be interesting to analyse, for example, the incorporation they can make of the criticisms (Boltanski & Chiapello, 2017), or, on the contrary, the counter-criticisms and mobilisations they can wage to defend their position (Agrikolianski & Collovald, 2014), in such a way as to consider dynamically the dialectic that develops between multiple imaginaries. The third and last pathway of analysis pertains to the specificity and opportunities at work for the analysis of sociotechnical imaginaries, in the case of countries characterised by a recent history of instability, or whose trajectories are tied to postcolonial contexts (Harding, 2016). For example, the analysis of the post-crisis situation allows us to clearly convey the production of sociotechnical imaginaries and the way in which futures are constructed, between emancipation from and the rehabilitation of the past. It also opens up the possibility of understanding how imaginaries are constructed at the same time that nation states are (re)built, without considering the latter to be background elements whose existence is self-evident, but rather instead considering them to be entities in formation.

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NOTES

1. Certain organisations nonetheless refused to participate in this, claiming that the state wanted to control social movements through a system based on patronage (Craviotti, 2014; Lapegna, 2013). The FONAF asserted its alignment with the government, presenting, in an institutional document from 2013, family farming as a '*social and economic alternative that deepens and accompanies government measures*'.
2. Around 100,000 family farmers were registered in 2014 within the RENAF, out of an estimated total of around 250,000 units.
3. Article 25 of the law states that '*As a part of the priorities of public policies, the Ministry, the INTA, and the national science and technology system will prioritize productive research for the development of family farming and its diversified products*'.

REFERENCES

Agrikolianski, E., & Collovald, A. (2014). Mobilisations conservatrices: Comment les dominants contestent? [Conservative mobilizations: How the dominant dispute?] *Politix*, *2*(106), 7−29.

Bernstein, H. (2014). Food sovereignty via the 'peasant way': A sceptical view. *Journal of Peasant Studies*, *41*(6), 1031−1063.

Boltanski, L., & Chiapello, E. (2017). *The new spirit of capitalism*. London, UK: Verso Books.

Bowker, G., & Leigh Star, S. (1999). *Sorting things out. Classification and its consequences*. Cambridge, MA, London: The MIT Press.

Brown, P. (2007). *Toxic exposures. Contested illnesses and the environmental health movement*. New York, NY: Columbia University Press.

Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of the St Brieuc Bay. In J. Law (Ed.), *Power, Action and belief: A new sociology of knowledge?* (pp. 196−223). London, UK: Routledge.

Calvert, J. (2006). What's special about basic research? *Science, Technology & Human Values, 31*(2), 199−220.

Cornilleau, L., & Joly, P. B. (2014). La révolution verte, un instrument de gouvernance de la 'faim dans le monde'. Une histoire de la recherche agronomique internationale [The green revolution, an instrument of governance of "global hunger'. A history of international agricultural research]. In D. Pestre (Ed.), *Le gouvernement des technosciences* (pp. 171−201). Paris, France: La Découverte.

Craviotti, C. (2014). La agricultura familiar en Argentina: Nuevos desarrollos institucionales, viejas tendencias estructurales [Family farming in Argentina: New institutional developments, old structural trends]. In C. Craviotti (Ed.), *Agricultura familiar en Latinoamérica: Continuidades, transformaciones y controversias* (pp. 175−204). Buenos Aires, Argentina: CICCUS.

De Schutter, O. (2010). *Agro-ecology and the right to food*. New York, NY: Human Rights Council, UN.

Eaton, W. M., Gasteyer, S. P., & Busch, L. (2014). Bioenergy futures: Framing sociotechnical imaginaries in local places. *Rural Sociology*, *79*(2), 227−256.

Elgert, L. (2016). 'More soy on fewer farms' in Paraguay: Challenging neoliberal agriculture's claims to sustainability. *Journal of Peasant Studies*, *43*(2), 537−561.

Epstein, S. (2006). Institutionalizing the new politics of difference in U.S. biomedical research: Thinking across the science/state/society divides. In S. Frickel, & K. Moore (Eds.), *The new political sociology of science. institutions, networks, and power* (pp. 327−350). Madison: University of Wisconsin Press.

Foray, D., Mowery, D. C., & Nelson, R. R. (2012). Public R&D and social challenges: What lessons from mission R&D programs? *Research Policy*, *41*(10), 1697−1702.

Fouilleux, E., Bricas, N., & Alpha, A. (2017). 'Feeding 9 billion people': Global food security debates and the productionist trap. *Journal of European Public Policy*, *24*(7), 1658−77.

Frickel, S., & Moore, K. (2006). Prospects and challenges for a new political sociology of science. In S. Frickel, & K. Moore (Eds), *The new political sociology of science. Institutions, networks, and power* (pp. 3−31). Madison: University of Wisconsin Press.

Galis, V., & Lee, F. (2014). A sociology of treason: The construction of weakness. *Science, Technology & Human Values*, *39*(1), 154−179.

Gárgano, C. (2011). La reorganización de las agendas de investigación y extensión del Instituto Nacional de Tecnología Agropecuaria (INTA) durante la última dictadura militar argentina (1976−1983) [Reorganization of the National Institute of Agricultural Technology (INTA) during the last Argentine military dictatorship (1976–1983)]. *Realidad Económica*, *258*, 120−149.

Gidron, N., & Bonikowski, B. (2013). *Varieties of populism: Literature review and research agenda* (Working Paper Series No. 13−0004). Harvard, Cambridge: Weatherhead Center for International Affairs, Harvard University.

Gieryn, T. F. (1983). Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. *American Sociological Review*, *48*(6), 781−795.

Goulet, F., & Vinck, D. (2012). Innovation through withdrawal. Contribution to a sociology of detachment. *Revue Française de Sociologie (ENGLISH)*, *53*(2), 117−146.

Gras, C., & Hernandez, V. (Eds.). (2013). *El agro como negocio*. Buenos Aires, Argentina: Biblos.

Habermas, J. (1971). Technology and science as 'ideology'. In J. Habermas (Ed.), *Toward a rational society: Student protest, science, and politics* (pp. 81−122). London, UK: Heinemann Educational.

Harding, S. (2016). Latin American decolonial social studies of scientific knowledge: Alliances and tensions. *Science, Technology & Human Values, 41*(6), 1063−1087.

Hessels, L., Van Lente, H., & Smits, R. (2009). In search of relevance: The changing contract between science and society. *Science and Public Policy, 36*(5), 387−401.

Jansen, R. (2011). Populist mobilization: A new theoretical approach to populism. *Sociological Theory*, *29*(2), 75−96.

Jasanoff, S. (2004). *States of knowledge: The co-production of science and the social order*. London, New York, NY: Routledge.

Jasanoff, S. (2015). Future imperfect: Science, technology, and the imaginations of modernity. In S. Jasanoff & S.-H. Kim (Eds.), *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power* (pp. 1−47). Chicago, IL: Chicago University Press.

Jasanoff, S., & Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva, 47*, 119−146. Retrieved from https://doi.org/10.1007/s11024-009-9124-4

Kellert, S. H., Longino, H. E., & Waters, C. K. (Eds.). (2006). *Scientific pluralism*. Minneapolis: University of Minnesota Press.

Lapegna, P. (2013). Social movements and patronage politics: Processes of demobilization and dual pressure. *Sociological Forum*, *28*(4), 842−863.

Levidow, L., Birch, K., & Papaioannou, T. (2012). Divergent paradigms of european agro-food innovation. The knowledge-based bio-economy (KBBE) as an R&D Agenda. *Science, Technology & Human Values*, *38*(1), 94−125.

Maye, D., & Kiwan, J. (2013). Food security: A fractured consensus. *Journal of Rural Studies*, *29*, 1−6.

Moore, K. (2013). *Disrupting science: Social movements, American scientists, and the politics of the military, 1945−1975*. Pinceton, NJ: Princeton University Press.

OECD. (2015). Argentina. In OECD (Ed), *Science, technology and industry*. *OECD perspectives 2014*. Paris, France: OECD Publishing.

Pellegrini, P. A. (2014). Argentina: Evolución del presupuesto y del personal del INTA (1958−2010) [Evolution of INTA's budget and staff]. *Realidad Económica*, 285, 99−122.

Picabea, F., & Thomas, H. (2014). *Autonomía tecnológica y desarrollo nacional. historia del rastrojero y la moto Puma* [Technological autonomy and national development. History of the stubble

cultivator and the Puma motorbike]. Bernal: Centro Cultural de la Cooperación, Universidad Nacional de Quilmes, Cara o Ceca.

Polich, G., Dole, C., & Kaptchuk, T. J. (2009). The need to act a little more 'scientific': Biomedical researchers investigating complementary and alternative medicine. *Sociology of Health & Illness*, *32*(1), 106−122.

Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants*, *2*(2), 15221. Retrieved from https://www.nature.com/articles/nplants2015221

Richardson, N. (2009). Export-oriented populism: Commodities and coalitions in Argentina. *Studies in Comparative International Development*, *44*(3), 228−255.

Schumpeter, J. (1942). *Capitalism, socialism, and democracy*. New York, NY: Harper & Row.

Spivak L'Hoste, A., & Hubert, M. (2014). Volver a casa. Apuntes sobre el programa argentino de cooperación y repatriació de científicos [Back home. Notes on the Argentine program]. In M. Kleiche-Dray, & D. Villavicencio (Eds.), *Cooperación, colaboración cientifica y movilidad internacional en América Latina* (pp. 119−137). Buenos Aires: CLACSO.

Teubal, M., & Palmisano, T. (2010). El conflicto agrario: Caracteristicas y proyecciones [The agrarian conflict: Characteristics and projections]. In N. Giarracca, & M. Teubal (Eds), *Del paro agrario a las elecciones de 2009: Tramas, reflexiones y debates* [From agricultural blocking to the 2009 elections: Plots, reflections and debates] (pp. 193−252). Buenos Aires: Antropofagia.

Tidwell, A. S. D., & Smith, J. M. (2015). Moral, materials and technoscience: The energy security imaginary in the United States. *Science, Technology & Human Values*, *40*(5), 687−711.

Tomlinson, I. (2013). Doubling food production to feed the 9 billion: A critical perspective on a key discourse of food security in the UK. *Journal of Rural Studies*, *29*, 81−90. Retrieved from https://doi.org/10.1016/j.jrurstud.2011.09.001

Vanloqueren, G., & Baret, P. (2009). How agricultural research system shape a technological regime that develops genetic engineering but locks out agroecological innovations. *Research Policy*, *38*(6), 971−983.

Warner, K. (2007). *Agroecology in action. Extending alternative agriculture through social networks*. Cambridge, MA: MIT Press.

Wright, B. D. (2012). Grand missions of agricultural innovation. *Research Policy*, *41*, 1716–1728.