

TRANSFORMING AGRICULTURE FOR SUSTAINABLE DEVELOPMENT: AN EXPLORATION OF ALTERNATIVE PRACTICES IN ARGENTINA

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ABSTRACT

A dominant perspective within the field of development economics is that natural resource-based industries, such as agriculture or mining, cannot support a broad process of development. The advice has long been to encourage structural change away from primary industries. In this paper we ask whether and how structural change within natural resource-based industries might foster more economically successful, socially inclusive and environmentally benign forms of development. To do so we combine insights from economic and innovation studies of development about structural economic change and technological learning with ideas from socio-technical transitions studies about system innovation. Empirically, we analyse two cases of 'alternative agricultural ventures' in Argentina which we define as initiatives that are experimenting with alternative socio-economic and technical practices and that aim to address some of the economic, social or environmental challenges generated by the dominant agricultural sector. The aim is to begin to understand the different ways in which distinctive types of alternative ventures might contribute to novel trajectories of change within and out of the conventional agricultural sector.

1- INTRODUCTION

For over sixty years, development economics has been concerned with structural economic change (Prebisch 1950; Hausmann and Rodrick, 2003). The low rates of productivity growth, low levels of employment generation, high levels of inequality, and other problems typical of developing countries have been understood as primarily a consequence of their specialization in industries with low levels of demand growth and poor opportunities for knowledge application and learning; typically activities such as agricultural commodity production, mining, and other natural resource (NR) based activities (Hirschman, 1958; Singer, 1974; Sachs and Warner, 2001; Auty, 1990; Gylfason et al, 1999). The response, since the 1950s, has been to encourage structural change to more modern manufacturing and service industries, which are supposed to be more dynamic and knowledge intensive, and to therefore provide far greater opportunities for sustained growth and employment. Yet, despite those ambitions most developing countries have continued to specialise in NR-based activities. The share of total exports in Latin American economies, for instance, that are explained by NR-based industries has averaged about 75% over the last three decades, with that proportion increasing rather than decreasing over that time period (ECLAC, 2013; Ocampo, 2017)

A complementary, and important question is therefore to ask whether there is potential for structural change *within* rather than away from NR-based industries, in ways that enable them to play a more progressive role in development; one that simultaneously supports improved economic and innovation outcomes, social inclusion and environmental performance. In other words, more sustainable forms of development.

We focus on the agricultural sector. The sector is very important for the structure of most developing country economies – explaining on average more than 25% of total GDP of those countries, and for many a high share of exports too. In Argentina, for instance, agriculture and related activities account for about 60% of total exports. Furthermore, even though countries might aim to reduce the weight of the agricultural sector as a proportion of exports, they cannot abandon it completely given its critical role in supporting livelihoods and food security. Rather than asking how to move away from this sector, it seems crucial to explore the prospects for transforming that sector so that it can support a broad conception of sustainable development.

To do so we complement insights from economic and innovation studies of development about technological catch up and learning with ideas from socio-technical transitions studies (Kemp et al 1998; Smith et al 2005). The latter body of work is concerned with understanding the dynamics of stability and change in entire systems of sociotechnical practice. In line with the innovation literature, transition theory gives a prominent role to novel technological and organizational practices in processes of radical change. However, it emphasises how a range of social, political and cultural processes beyond markets and science shape the selection of new technologies and practices. A more contingent view of the unfolding of socio-technical progress is provided from this perspective; one that emphasises the value of experimentation with diverse technological and social practices, the existence of competing possible trajectories of change; and of the key role that human agency, power and institutions play in variously hindering or enabling those possible trajectories.

We suggest that these analytical developments are crucial for thinking about the possibilities of transforming agricultural practices in developing countries because they help to get away from the typical dichotomies in development economics that are used to characterise practices as variously low vs high productivity, modern vs traditional, or laggard vs vanguard (Kim, 1998; Bisang et al, 2008; MAGyP, 2010; Trigo, 2016). Instead, different kinds of agricultural ventures that might be pursuing different objectives to mainstream practices, or experimenting with alternative technologies and social forms of organization, might be recognised as potentially transformative, rather than (currently) low productivity ventures that ought to be 'modernised'.

This paper has two objectives. The first of these is to encourage a dialogue between economic and innovation studies of development and transitions studies. Both, we argue, can benefit from a broadening of their perspectives by addressing common problems. In particular, in relation to sustainability ambitions, what does transition theory imply for core ideas about structural economic change and technological upgrading within economic and innovation studies of development? And how might transition studies better take into account issues such as knowledge intensification and productive diversification as a normative goal in analysing - and modulating - the dynamics of structural change in entire socio-technical regimes? A recent review of transitions studies in developing countries points to the need to work more on the connections between transitions and development studies (Wieczorek et al, 2018). Our study aims to contribute in this direction.

The second objective is to illustrate empirically how these two perspectives might be used in conjunction and how both might be enriched in the process. To do so we outline an empirical approach that combines insights from both approaches; one that explicitly incorporates the economic development pillar of sustainability as a normative goal, along with its environmental and social justice/inclusion pillars. We select and explore two distinctive cases of 'alternative agricultural ventures' in Argentina, which we define as initiatives that are experimenting with alternative socio-economic and technical practices and that aim to address some of the sustainability challenges generated by the dominant agricultural sector. We analyse the socio-economic-technical practices of those alternative agricultural ventures, relative to the typical, dominant agricultural practice in the country, and identify the kinds of actions those alternatives are performing to expand or succeed in an environment that favours mainstream agriculture. The aim is to begin to understand the different ways in which distinctive types of alternative ventures might contribute to trajectories of change and how these can be supported by policies.

Through doing so, we argue for an adaptation of economic and innovation ideas about development, especially in their application within government policy, so that they consider more centrally the importance of ventures that experiment with alternative technological and social practices as a means to address sustainability challenges, even if they are not as efficient as mainstream practices or have significant markets. We also argue for an adaptation of transition studies to incorporate challenges of economic development as a normative goal, for instance by considering the relative knowledge intensity of alternative technological practices. One consequence of doing so is that transition studies are then able to recognise a pathway of change that is familiar in development economics, but less so in the transition's literature, namely that of 'path creating'. This can occur when entrepreneurs build on existing, problematic practices, but rather than seeking to either incrementally or radically change those practices they take off in an entirely different direction. We suggest that it is only by including

economic development as a normative goal that transitions studies can appreciate that kind of (potentially transformative) pathway of change.

2. THEORETICAL DISCUSSION

2.1 Development economics: moving beyond structural change between sectors

A prevailing view within the field of development economics is that some industrial activities provide more opportunities for enabling sustained processes of growth than others. This is because they are characterised by higher rates of productivity development (Ricardo, 1821), exhibit more dynamic demand, (Prebisch,1950) and offer more opportunities for applying new knowledge, for learning, and for generating spillovers to other economic sectors (Prebisch,1950; Klevorick et al, 1995; Cimoli and Porcile, 2009). Post-Keynesian's identified manufacturing as those key activities, (Kaldor, 1967; Cornwall, 1977) whereas neo-structuralists and evolutionists argued that only certain manufacturing industries will encourage sustained growth at particular times; in particular, those that are earlier in their life cycle, where demand is increasing, and where there are greater technological opportunities. (Klevorick et al, 1995; Klepper, 1997; ECLAC, 2012)

Natural resource (NR) based industries, like agriculture, are not seen as possessing these characteristics. On the contrary, a common view, dating back to the classical development economists, is that primary industries are characterised by stable patterns of demand, low technological dynamism, exclusivity towards low income groups, and limited capacity to create linkages with other sectors (Prebisch,1950; Klevorick et al, 1995; Cimoli and Porcile, 2009; Hirschman, 1958; Humphreys, Sachs and Stiglitz, 2007: p. 4) Consequently, specialisation in NR based industries is strongly associated with low rates of productivity growth and employment generation, limited linkages between economic activities, and high levels of inequality. In Latin America, those arguments became central to the development agenda in the 1950s, underpinning the import substitution industrialization strategy, promoted by the Economic Commission for Latin America and the Caribbean (ECLAC). The strategy sought to tax agriculture and other primary industries oriented to international markets (e.g. mining) and to promote manufacturing by replacing imports of final manufactured products with imports of capital goods and parts - with final assembly performed locally under strong tariff protection. (Perez 2008)

Import substitution industrialization encouraged some manufacturing industries and a large set of other related activities and institutions during the 1950s and 1960s. However, the region was not able to develop a manufacturing sector that sustained growth and the rest of the economy. The emergent sector never became internationally competitive and it continued to rely heavily on inputs of capital goods and parts, imports of which were limited by foreign exchange earnings from the primary sector. Debt-related and other crises in the 1970s and liberalisation during the 1980s and 1990s, subsequently destroyed large parts of the domestic manufacturing sector. By the 1990s, a re-primarization of the economic structure of Latin American countries could be observed. Natural resources had accounted for about 60% of exports in the 1970s (dropping from about 90% at the beginning of the 20th century) but that had climbed back up to 72% by the 2000s and by 77% in 2010 (Cimoli and Porcile; 2011). Even in the most industrialised countries in the region like Brazil and Argentina the share of NR-based industries climbed above 50%. It is important therefore to move beyond mainstream ideas about

structural change and to investigate the possibilities of change *within* problematic NR-based industries, so that they can play a more progressive role in development.

Studies of innovation in developing countries have explored changes *within* industries, but these have focused mainly on how to encourage productivity growth and technological learning along a trajectory mostly defined by existing market leaders (Lall 1992; Keller 2004; Kim 1998, Castellacci, 2002; Bell, 2010). These perspectives could be applied to NR-based sectors, such as agriculture - though such sectors have largely been ignored in the innovation literature (Andersen et al, 2018) - but we are also interested in possibilities for change that enable social and environmental outputs, as well as economic and technological ones, to be improved. The field of 'transition studies' provides a related set of theoretical ideas that is better able to recognise that the wider development potential of a particular industrial sector, such as agriculture, is not necessarily fixed, and is better able to capture our interest in multi-dimensional aspects of performance, not only profits, productivity and technological learning.

2.2 Socio-technical transition theory: new elements to explore within-sector structural change

Transitions theory and research is concerned with understanding how relatively stable *socio-technical systems* such as those involved in providing energy, mobility or agriculture, have undergone radical structural transformation in the past and how such processes of transformation might be deliberately accelerated and guided in the future so as to address environmental sustainability challenges. (Loorbach et al 2017; Köhler et al 2019) A socio-technical system - is understood in this literature as a configuration of technologies, institutions, infrastructures and human behavior whose elements have co-evolved over time to form relatively stable, incrementally innovating 'socio-technical regimes' (Rip and Kemp 1998). Transformations, in this literature, are understood as processes of socio-technical regime *reconfiguration*. (Geels 2002)

A prominent role in such transformation processes is given to radically alternative socio-technical practices that develop in 'niches'. The argument is that novel, niche-based activities provide a source of diversity - of ideas, knowledge, and practice - which incumbent socio-technical regimes may draw on to solve problems, or which may themselves get translated into new embryonic socio-technical regimes. (Smith 2007; Geels and Schot, 2007) Niche activities usually need temporary protection from the regime-generated selection pressures that tend to favour incremental innovation and system improvement over radical innovation and system transformation, for example in the form of subsidies or investments in risk capital. (Schot & Geels 2008) A 'multi-level perspective' has been advocated to help make sense of, and study, the social processes involved in niche-led transition processes. (Geels, 2002; Schot and Geels, 2007; Smith et al, 2005; Smith et al, 2010) This comprises three nested heuristic levels: *niches* (protected spaces where organisations can innovate with alternative ideas and practices), socio-technical *regimes* (stable, institutionally embedded configurations of technological artefacts, practices, institutions and rules), and an exogenous socio-technical *landscape*. Transitions are understood as the outcome of dynamic processes within and between these three heuristic levels.

In analysing such processes, transition approaches draw on evolutionary economics insights into long-term technological change, which stress how new knowledge and technological opportunities drive radical change, but also how most of the time 'technological regimes' change only incrementally and

cumulatively, in path dependent ways. (Foray, 1997; Dosi, G. 1982) These perspectives have been extended by transitions researchers, to incorporate a more sociological conception of technology in which path dependence results not only from the constraints imposed by, for example, the increasing returns that characterize an incumbent technological practice, but also from users' habits and expectations, for instance, or the ways in which institutions and policy -captured by dominant firms in the incumbent regime - privilege certain kinds of technological practice. (Rip and Kemp 1998) Importantly, transition researchers have insisted that neither the generation of innovative variants or selection processes should be understood in overly deterministic ways. Actors have and make choices about the kinds of knowledge and artefacts they wish to develop; they anticipate and influence the reactions of others; and try and increase the chances of survival of the products of their innovative efforts. (Schot 1998)

Building on this 'quasi-evolutionary' perspective, niche actors are therefore seen not only as actively developing alternative technologies and practices but also building wider networks of support and trying to influence prevailing selection environments. (Kemp et al. 1998) For example, niche actors may try to construct new markets for their ideas, influence user preferences, lobby for supporting regulations, persuade financiers to back their new technologies, or represent their novel practices as solutions to changes that are causing problems for incumbent regime activities. (Smith & Raven 2012). In some circumstances, niche practices may become competitive and translate into more mainstream business models and markets. In others niche ideas demonstrate alternative ways of providing goods and services and some of these get appropriated into an adapting regime (Smith, 2007). In many circumstances, niche activities never develop beyond experimental activities.

2.3 Back to development: Towards a dialogue between the development and transitions literatures

Transitions research has focused traditionally on radical technological innovation in relation to norms of environmental sustainability. Whilst that remains the core focus, the field has broadened considerably over the last decade or so (Köhler et al 2019) in ways that are useful in considering its utility for thinking about problems of development. For instance some researchers have emphasised the importance of fostering and protecting socio-technical diversity, on the basis that plural sources of ideas, knowledge and practices are important for future possible structural shifts in a sector, as well as a means of guarding against a tendency amongst analysts and policy-makers to think about transitions processes in overly singular ways (Stirling 2011). On this point, applications of transition studies in the agricultural sector have identified the heterogeneity of practice as a particular feature of this activity. There still exist a great variety of farming practices, despite trends towards uniformity. This, researchers stress, is an important resource for achieving evolutionary change, although, as Van der Ploeg et al (2009) note, farmer's diverse innovative efforts "*mostly remain as 'hidden novelties' because the prevailing scientific regime does not yet recognise that such novelties are the key to effective innovations rather than a nuisance that distracts from the grand-designs that have been constructed scientifically, following the established regimes*" This is perhaps particularly the case in developing countries where much of this variety is often considered a manifestation of a lack of modernisation. (Bielschowsky, 2009; Cimoli and Porcile, 2011)

Transitions research has also increasingly addressed normative issues of social justice and equity alongside the more traditional focus on environmental sustainability (Newell & Mulvaney 2013). It has recognised processes of organisational and institutional innovation as well as technological novelty; it has examined discrete sustainability experiments as well as wider processes of niche development; (Berkhout et al 2010) and it has researched grass roots or civil society-led forms of innovation, as well as firm-led novelty. (Seyfang & Smith 2007)

This more plural view of sustainable innovations and transition norms has helped inform a growing body of work exploring transitions processes in developing country settings (Hansen et al 2018; Wieczorek 2018) which in turn has enriched and extended transitions perspectives. Yet the application of transitions frameworks in the global South has not prompted the inclusion of economic and technological development as a key normative issue in thinking about processes of long-term socio-technological reconfiguration.

Our normative interest in a broad conception of development means that we are interested in alternative socio-technical practices in the agricultural sector in terms of their economic qualities and potential, as well as those that have the potential to increase social inclusion and improve environmental performance. One way of thinking about the economic potential of alternative practices is in terms of their contribution or potential contribution to economic resilience at both the level of the individual firm or venture and at a broader system-level. By this we mean ventures that are individually not only economically viable or even productive but also economically sustainable over time (able to adapt to changing contexts for example) and that also contribute to wider systemic economic resilience. The latter is promoted insofar as such ventures develop differentiated products or services, use knowledge more intensively, and/or promote linkages between different economic and social activities, thus addressing the most common limitations associated with agriculture and other natural resourced based activities from an economic perspective. (i.e addressing challenges of commoditization, low technology and the enclave mode typical of NR-based activities)

This wider normative focus on a 'three pillars' conception of sustainability has a number of implications for empirical identification and exploration of the niche-based activities that constitute the seeds of transformation within transition studies. How can we anticipate and characterise "novel" practices that differ from those typical of incumbent regimes in terms of their potential implications for firm and system-level economic resilience as well as social inclusion and environmental sustainability? A key aspect of the empirical work reported on in this paper is concerned with exploring how we might define, identify and characterise such alternatives and explore the different ways in which they can contribute to trajectories of change. To do so we draw on and combine insights from economic and innovation studies of development and transition studies.

In the following sections we analyse two empirical cases of alternative agricultural ventures in Argentina in order to to begin to explore how transitions studies might enrich, and combine with, perspectives on economic development and innovation in the global South, and how ideas about development might enrich transitions studies

3. METHODS

A firm-level case study research design was adopted for the empirical analysis in this study (Yin, 2009).

This involved collecting qualitative data and the use of qualitative methods of analysis. This approach is useful for providing rich descriptions of new poorly understood phenomena.

3.1 Selection of cases

Initially, a characterisation of mainstream agricultural practice in Argentina, and the sustainability outcomes and problems associated with that practice, was conducted based on statistical and published information about the most extended practices within conventional industrial agriculture in Argentina. (INDEC, 2018; Bisang et al, 2008; OECD, 2018) A provisional list of alternative agricultural ventures was then made based on two criteria. The first was ambitions to improve *some* social, environmental and economic outcomes, relative to the performance of conventional agricultural practice. The second criterion for selection was *provisional* evidence that the kinds of socio-technical-economic practices adopted by candidate alternative ventures were at least partially distinct from mainstream agricultural practice. Improved social, environmental and economic outcomes were defined as follows:

(a) *improved social outcomes* if the ventures sought to expand inclusion in terms of i) social and economic inclusion, via the creation of productive employment, and the development of specialised skills of workers directly and indirectly related to the venture and ii) strategic inclusion in decision making and in the share of benefits; thus addressing social challenges typical of NR-based activities.

(b) *improved environmental outcomes* if the ventures sought to adopt technological practices that diminished damage to biodiversity, use natural resources less intensively, reduced water and soil pollution and public health; thus addressing challenges of environmental degradation and contamination typical of NR-based activities.

(c) *improved economic outcomes* if the ventures sought to develop differentiated products, to create and use new knowledge – both scientific and traditional - and to promote linkages and diversification, thus addressing challenges of commoditization, low technology and the enclave mode typical of NR-based activities.

From an initial selection of eight alternative ventures which appeared to fulfil the selection criteria, open-ended interviews conducted with key informants allowed for the identification of two ventures, one of which was radically different in terms of both sustainability ambitions and socio-technical-economic practice from mainstream conventional agriculture in Argentina and the other more closely aligned. Our selection also took into account how willing key actors within the ventures were to talk and cooperate with us in the research process. The two cases are described in Table 1.

Table 1: Brief description of the two cases

<p>Case 1: COOPSOL is a cooperative that produces honey involving more than 600 families, it has organic and fair-trade certifications, and exports most of its production to Europe and the USA. Intriguingly, the cooperative has managed to successfully combine and realise all three sustainable development norms. Economic, social and environmental performance have been simultaneously improved relative to dominant agricultural activities in the region. It generates: (i) sufficient profits to not only survive but also to continuously expand the business, by</p>
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product differentiation, tapping into growing, value added markets; (ii) social inclusion by creating sustainable jobs for farmers and rural workers in the Great Chaco, one of the poorest regions in Argentina, involving them directly in key decisions such as productive routines and profits distribution and contributing to their skills enhancement, and (iii) positive environmental positive effects by promoting organic beekeeping and productive diversification of farmers away of charcoal in an area very rich in environmental resources - the second richest after Amazonia- but at risk of deforestation because of the expansion of industrial agriculture.

Case 2: Don Mario develops seed varieties of soybean, wheat and maize using advanced biotechnological and bioinformatic tools. The company has been very successful in Latin America (e.g. holds 40% of the total market of soy seeds) with an open source model of innovation. This is striking in a market dominated by a few large corporations that use strict forms of property rights like patents. Don Mario makes an important contribution towards improving economic outputs by developing a highly differentiated product that attends the needs for diverse adapted seeds in the region. It also contributes to environmental outputs in at least three ways: (a) with a process of production knowledge rather than resource intensive, that relative to standard agricultural practice reduces significantly pressures on the natural resource, (b) using (and demonstrating) a model of innovation that preserves free access to germplasm in a global context where the use of strict forms of IPR by large MNCs is threatening innovation and biodiversity and, (c) Innovating with non transgenic approaches to breeding allowing the firm to provide different forms of agriculture, like organic under supplied currently. Contribution to social outputs are mostly related to training and skills formation.

3.2 Case study analysis: defining socio-economic-technical practice dimensions

Analysis of the two cases subsequently focused on our two main empirical objectives, namely to characterise those sustainable alternatives in terms of their socio-economic-technical practice dimensions and to understand the kind of actions they are performing to expand or succeed in an environment that favours mainstream practices. To address the first objective, we defined 14 practice dimensions, drawing on the literature on both transitions and the broader field of management and innovation studies.

In analyses of transitions processes researchers have analysed the socio-technical practices that are characteristic of incumbent socio-technical regimes along seven dimensions. These are: (i) *guiding principles*, (ii) *knowledge base*, (iii) *favoured technologies*, (iv) *industrial organisational models*, (v) *markets and user relations*, (vi) *policy and institutional support* and (vii) *cultural meanings*. (Geels 2002; Smith 2007) These seven dimensions can then be compared and contrasted with the practices associated with alternative emerging niches, so as to explore empirically the degree of 'fit' or 'lack of fit' with an incumbent regime, and therefore, for example, the degree of socio-technical disruption or system transformation that alternatives entail.

At the same time, this kind of characterisation allows analysts to make partially explicit the environmental sustainability and social inclusion ambitions and likely outcomes associated with alternative niche practices, for example in terms of 'guiding principles', 'favoured technologies' and 'industrial organization'. Even in the absence of such a socio-technical characterisation, a desire to improve environmental sustainability or social inclusion are often articulated explicitly by entrepreneurs in alternative ventures (although it is often important to examine empirically whether such expectations translate into actual outcomes). This is less likely to be the case, however, for economic resilience dimensions of sustainability. For example, alternative ventures are much less likely to proclaim that their business seeks to promote linkages with different economic activities than they are to advertise their desire, say, to develop zero or low carbon forms of production or to include

its workforce as co-owners of the firm.

How, then, can we anticipate and characterise socio-technical practices on the part of alternative ventures in terms of their potential implications for firm and system-level economic resilience? We suggest that in addition to comparing alternative and regime-level practices along the traditional seven dimensions used by transitions researchers, listed above, we can also disaggregate the dimension of 'knowledge base' into five subcategories: (i) *focus of innovation efforts*; (ii) *key innovative actors*, (iii) *sources of knowledge*, (iv) *knowledge codification*; and (v) *knowledge appropriability* (Malerba and Orsenigo, 1997). This allows us to characterise whether, for example, actors producing new knowledge are domestic firms, domestic public institutions or global companies, or whether knowledge is created locally or transferred from abroad, or whether it is embodied in machinery or can be shared widely; all factors that are important for characterizing economic resilience in terms of the knowledge intensity of domestic production.

In addition, we can add five further socio-technical-economic practice dimensions that are often utilized within management and innovation studies to produce a description of different kinds of businesses. (Bell and Pavitt, 1995; Tirole, 1988; Teece and Lazonick, 2002; Dutrenit, 2000) These are: a) *the main products and services that are produced*, b) *main production processes*, c) *organizational model*, d) *the market structure within which ventures operate* and e) *geographical area of operation*. These additional dimensions are useful for example, for differentiating between firms that produce commodities from those that produce differentiated products. The latter are generally thought to be more sustainable from an economic point of view, because such companies capture larger rents, face more stable markets, are less dependent on prices, and at the same time require more complex innovation capabilities.

In summary, we characterised the two sustainable alternatives in terms of their socio-economic-technical practice dimensions (our first empirical objective) along the 14 dimensions discussed above, and compared that with a similar characterisation of the practices typical of the mainstream agricultural regime. That characterisation allowed us to understand the degree of disruption implied or entailed by new ventures relative to mainstream practices, and to begin to understand the different ways in which distinctive types of alternative ventures might contribute to trajectories of change.

3.3 Data collection

In order to ensure data triangulation, qualitative information was collected from multiple sources within and beyond the examined sustainable alternatives. That information was obtained during fieldwork conducted in the context of four research projects. In the first of these (2010-2014) we identified and began analysing Coopsol and Don Mario (as well as other cases not included in the current empirical work), as part of a broader project on identifying and characterising transformative alternatives in the agriculture, mining and forestry sectors of Argentina, Chile and Brazil respectively.¹ Semi-structured interviews were conducted with managers and partners of each venture, as well as with other experts located in business associations, universities and government departments. We

¹ Funded by the International Development Research Center (IDRC): "Opening up Natural Resource Based Industries for innovation: New Pathways for development in Latin America"
<https://opcionessustentables.wixsite.com/recursosnaturales/equipo>.

also conducted two group interviews (focus groups) with company managers in each venture and collected evidence from documentary sources to corroborate and complement information from interviews (including company reports, academic articles, and information published in trade magazines and newspapers)

In three smaller subsequent projects we continued to learn about Coopsol and Don Mario. These were: (i) 'Knowledge Intensive Business Services in the seeds industry in Argentina' (2015) during which we continued to analyse Don Mario, interviewing both firm personnel, other stakeholders and relevant civil servants.² (ii) 'Analysing the production of organic cane alcohol' (2016) as part of an initiative to obtain funding for Coopsol from the Ministry of Science and Technology in Argentina. That project required a partnership between CENIT and Coopsol and we accompanied the implementation of the project over two years during which we continued learning about the venture. (iii) 'Private and public strategies for success in modern agri-food markets' (2020), during which we also continued to study both Don Mario and Coopsol involving interviews with the owners, partners and managers of the ventures. Beyond those projects, we have continued to interact with and learn about both ventures, for example, through workshops and public debates (e.g. debates about possible reforms in the seed law in Argentina - with Don Mario, and about the links between the Scientific Council in Argentina and small farm ventures).

4. EMPIRICAL EVIDENCE

In this section we first describe the main socio-economic-technical practices of the typical venture within the mainstream agricultural sector, and the principal sustainability problems that sector creates, which in turn has opened opportunities for alternatives. We then discuss the socio-economic-technical dimensions of the two alternatives, Coopsol and Don Mario.

4.1 Socio-economic and technical practices in mainstream and alternative sustainable ventures

Mainstream ventures: Socio technical and economic practices

Argentina's agricultural sector is dominated by large scale, capital intensive production of a small number of commodity crops. The typical production venture in the sector is a farm of 690 hectares that cultivates soy and maize, principally, and in some cases also wheat. 68% of all cultivated agricultural land is dedicated to these three crops. Soy and maize are almost entirely transgenic varieties, produced using zero tillage techniques and the herbicide glyphosate, that those crop varieties are resistant to. 90% of all agricultural land uses zero tillage techniques, and more than 90% of maize and soya production uses transgenic varieties. Average glyphosate use is 165 litres per hectare, meaning that a typical farm of 690 hectares uses around 10,350 liters per year³ (CNA, 2018, Trigo, 2016). The process of production is capital and input intensive, with very low use of labour in the countryside although it is supported by skilled urban workers. Favoured technologies include

² Funded by the Interamerican Bank of Development (IDB): "Knowledge Intensive Business Services in the seeds industry in Argentina", A paper was published available at <http://publications.iadb.org/handle/11319/6955>.

³ With this level of use Argentina has become the country in the world that uses more glyphosate per habitant (10 liters per inhabitant per year).

agrochemical inputs, GM seed technology and specialised tractors, sowers and sprayers (Bisang et al 2015; INDEC, 2018)⁴.

The farm may be run by its owner, or more typically by contractors, i.e. companies that rent land and machinery (or own the machines) which accounts for 70% of all production. The organisational model is traditional, in the sense that decisions are taken by the owner or the contractor, without the involvement of workers (Bisang et al, 2008). Cooperativism is common in the agricultural sector in Argentina, but within the mainstream segment involves partnerships between different owners rather than between owners and workers.

The guiding principle of the typical venture is to maximise short term profits, more so in the case of farms run by contractors that do not own the land and therefore do not have concerns about its longer-term viability, for example in relation to soil degradation. Production is typically sold in advance - via a one-year contract - to large international or domestic grain and oilseed traders, who then hold the crop to be sold in the international market when it is most advantageous, depending on commodity and foreign currency prices. Most of those exports go to China, Brazil, Vietnam, Malaysia, Algeria and Egypt where they are used mainly as animal feed, as an input to industrial food production or for energy (e.g. biodiesel). The products exported are valued as commodities, and so demand is determined principally by price - the cheaper the better - and by conditions of delivery.

Regarding geographical localization, historically in Argentina, the typical venture is located in the Pampean region, which covers the three richest provinces in the centre of the country, Buenos Aires, Santa Fe and Córdoba, as well as small parts of other surrounding provinces. In recent decades, however, mainstream agricultural production has expanded to other regions in the north of the country, displacing small farmers, alternative models of production, and the production of agricultural products other than grains and oil seeds, many of which were oriented to the internal food market.

Key innovative actors supporting the typical venture within the mainstream sector are input providers, large contractors and intermediary institutions. The former innovates in products such as chemicals, seeds and machinery whilst contractors and intermediary institutions innovate in process and organization. A sizable fraction of the knowledge that is important for mainstream agricultural practice is embodied in inputs and machinery, and is codified and proprietary. This has been developed mainly by foreign firms, although some domestic input providers have gained participation, developing knowledge and innovations in seeds, and some areas of machinery. Process innovations are more difficult to codify and appropriate; they are developed by farmers, contractors and intermediary institutions, both private and public. The latter have also played an important role in diffusing the complementary knowledge and technologies oriented to maximise the potential and implementation of process innovations (e.g. with respect to zero tillage practices). The principal objective of both product and process innovations has been to increase production per unit area and minimize short term costs in a system completely shaped by markets.

The typical venture within the mainstream agricultural sector is supported by an extended network of actors and institutions. The sector as a whole (comprising, for example, farmers, landowners, input suppliers, contractors and commodity crop exporters) possesses significant political power, with

⁴ This description applies to crop production, the activity that explains most of agricultural production in Argentina. Within the 32% remaining there are other activities that operate with slightly different modes of production and technologies. Nevertheless, most (95%) are large scale and input and resource intensive.

representatives in the main conservative political parties; alliances with influential institutions such as the two main newspapers which openly support the interests and perspectives of the sector; and very significant participation in key national regulatory bodies. Regulations related to issues such as chemical use, transgenic crop authorization and seed intellectual property rights are as a result closely aligned with and support the interests of the mainstream agricultural sector. Domestic public scientific and technological institutions like the National Institute of Agricultural Technology direct significant efforts to support mainstream agriculture, by performing research oriented to complementing the efforts of private firms related to the sector or by diffusing their technologies.

Markets for crops have historically been characterised as competitive, because for instance low entry barriers. Changes over the last 20 years in Argentina, which have introduced higher requirements for capital and knowledge, and have therefore increased the minimum profitable scale, are nevertheless transforming crop markets in the direction of oligopolisation.

Table 2 summarises the main socio-technical and economic practices of mainstream agricultural ventures, as well as the two cases of sustainable ventures.

Mainstream ventures: Key challenges

The mainstream agricultural sector in Argentina has been very successful in supporting the domestic economy over the last fifteen to twenty years, principally by providing foreign exchange, and generating wealth, part of which is distributed socially via taxes, but also by providing the basis for a limited degree of diversification toward sectors like agriculture machinery which have benefited from the expansion of agriculture. Nevertheless, the particular way in which that system has developed has created significant economic, social and environmental problems and challenges. The main economic challenge is that of concentration, of three kinds. (i) concentration of production: in 2019, 78% of total agricultural exports (which explain 48% of total Argentinian exports) were concentrated in a few commodity crops - oil seeds, corn, wheat and barley - which together occupied over four fifths of cultivated agricultural land. This concentration involves substantial economic dependency and risk, since commodity prices are highly volatile and their demand, which is external, can change for a variety of reasons; (ii) economic concentration: in 2018, according to the last agricultural census, small and medium size farmers explained 89% of agricultural producers but only exploited 25% of total land, what means that only 11% of total producers exploited 75% of total agricultural land. More striking dynamic measures show that this type of concentration has increased over recent years. One indication is average farm size which has increased from 524 to 690 hectares over 10 years. (iii) concentration of knowledge in a few suppliers of seeds, herbicides and machinery.

The main social problems are associated with exclusion since mainstream production practices require hardly any labour. This is a problem in a country with high rates of unemployment, particularly in rural areas, where most poverty is concentrated. Increased concentration of land is also excluding the majority of farmers from the benefits created by overall agricultural activity, and concentrates in a few factors the key decisions regarding what and how to produce. Environmental problems associated with mainstream agricultural production are present in multiple forms and include soil erosion; deforestation; loss of both natural and crop biodiversity; high water and energy usage; and health problems caused by the increased use of herbicides and insecticides (Oesterheld, M.2008; Pengue, 2009; Zorzoli, 2018).

In this context pressure from civil society for a more sustainable agricultural sector, new knowledge and technological opportunities and a segmentation of both domestic and international markets have contributed to the emergence of agricultural ventures that seek to address at least some of these challenges. We now discuss the socio-technical practices of two of those alternatives. The objective is to understand how much and in which aspects they differ from mainstream ventures and to begin to understand the way in which they can contribute to alternative trajectories of change. This is important not only from a theoretical perspective but also from the point of view of public policy.

Alternative ventures

Our first case study is Coopsol, a venture which proposes a radically different way to do business in the agriculture sector in comparison with mainstream ventures. COOPSOL is a cooperative, based in the north of Argentina, that produces honey, most of which is exported to Europe and the USA, with an annual turnover of US\$ 1.6 million. It has managed to differentiate honey - a commodity - by adding value through organic and fair-trade certification.

The production process is labour and (social) capital intensive; it involves minimal use of external inputs such as pesticides and takes advantage of diversity (biological, productive and cultural) rather than limiting it to gain efficiency. Production favours locally produced artifacts such as hives, since organic certification does not allow the use of standard artifacts provided by the market. To the extent that organic honey is obtained from land dedicated to organic production or that is not used for input intensive agriculture, Coopsol also favours technologies currently marginalised by the dominant system, such as open pollinated seeds (which can be continuously improved by farmers in cooperation with breeding firms) and agricultural machinery that has been adapted to organic production (e.g. that mechanically controls weeds). As these technologies are not provided by concentrated input providers, ventures such as Coopsol support local providers of technology.

The company is organised as a 'first degree' cooperative, which means that all workers are partners of the business and participate in key decision-making processes. They are also a second degree cooperative, since they are associated with other similar cooperatives to pursue specific objectives (e.g. to diffuse organic farming). The company is also closely connected with both national and international NGOs; funding and cooperation agencies; the scientific and technological system; and other companies.

Coopsol's activities are guided by profit making principles, but also those of local development and environmental preservation: "*In addition to taking care of the environment in which we live, we believe in principles such as the active participation of the members in the decision-making process and the fair distribution of benefits. For these reasons we produce healthy and quality products dedicated to Fair Trade markets and responsible consumers*" (See Box 1).

The venture has managed to penetrate the food markets of high-income countries such as Germany and France. They sell mostly to niches of high added value, which pay a premium for environmentally benign and socially just systems of production and that are more stable than mainstream commodity markets. International traders that buy fair trade are required by certification to develop long term partnerships with producers, and to provide technical and financial assistance.

Production capacities are distributed amongst large groups of farmers. Beekeeping does not require very complex skills or large investments in capital, so entry barriers and market concentration are low. However, to be able to produce at a scale that makes the activity profitable, to sell in international markets and develop a recognised brand requires unique resources and complex capabilities. Market concentration is larger in such segments. For instance, five companies concentrate total honey exports in Argentina, although 80% of production is performed by small producers. Coopsol gains scale by distributing production capacities across a large group of farmers and concentrating its efforts in areas such as international trade, research and branding.

The cooperative works in two of the poorest regions of Argentina: Santiago del Estero and Chaco, with 44% and 42% respectively of their populations in poverty, amongst the poorest in Argentina. (INDEC, 2019-1st Sem; INDEC, 2019-2nd Sem) Coopsol is also expanding internationally by beginning to work with producers in southern Paraguay and Bolivia, in regions that are part of the American Gran Chaco, a geographical area which, although economically poor, is one of the richest in the world in terms of environmental resources. The Gran Chaco, is the second largest forested area of the continent after the Amazon and has one of the largest water reserves in the world and a unique diversity of ecosystems. Businesses like Coopsol contribute to preserving it.

Box 1: Combining economic, social and environmental objectives

Coopsol has been economically successful. Driven by its early export orientation, this atypical company, for its region exhibited significant growth over the last decade: In 2010, it had 130 associated families and a turnover of just over US\$ 600 thousand. By 2019 600 families were associated with the venture and its turnover was US\$1.6 million. With 25,000 beehives in production it is now the largest and most inclusive organic honey production value chain in Argentina.

Its objectives extend well beyond that of being economically successful. Coopsol also aims to preserve Chaco's rich environmental resources and is doing so by promoting beekeeping in areas where the alternatives are either large-scale farming or, for small producers, charcoal production in forest, both of which involve deforestation. In the Argentine Chaco, the annual rate of deforestation until 2015 was between 1.5 and 2.5%, while the average for Latin America was 0.5% at most. Deforestation not only results in irreversible environmental damage, but is also an impediment to producing honey as well as many other productive activities. By promoting and supporting beekeeping activities, which require the resources provided by the forest but which also preserves them, Coopsol makes a significant contribution to maintaining key resources for the development of other productive activities.

Coopsol also makes an important contribution to social goals by addressing some of the most important challenges faced by the 600 families associated with the cooperative. One is to generate incomes from economically viable and environmentally sustainable activities. Small scale beekeeping is not sufficient to support a family, so Coopsol works in NGOs such as *Gran Chaco* and *El Futuro está en el Monte* to support small beekeepers in the diversification of their production, towards other complementary activities such as animal husbandry, artisanal activities and agroforestry. This work involves obtaining access to financing programs, some of which are administered by Coopsol and the organisation of joint commercialization strategies. Another is connectivity, most of the farmers working with Coopsol live in rural areas with not access to internet or even telephone lines. The cooperative is working with the International Bank of Development (IDB) to build the infrastructure required to solve this problem. Poor skills are also a significant challenge. Fair trade certification requires the participation of small farmers in decision making processes and this has an impact on skills, required training of farmers in management and communication skills, which are required by any business.

Key innovative actors are local cooperatives, small farmers and public research institutes (though international donor institutions and certifying institutions are also key). Cooperatives and small farmers innovate in social technologies, and make incremental product and process innovations, research institutions by developing specialised knowledge to support product differentiation (e.g. Coopsol has an agreement with researchers of public institutions to examine whether there is evidence that one of its mono-flower honeys has anti-inflammatory properties, as local knowledge suggests). The new knowledge generated is public and dispersed. Some of it is tacit and so difficult to codify and transmit.

Ventures like Coopsol in Argentina are not represented in mainstream institutions related to the agricultural sector and existing regulations in general do not favour their activities. Argentina is the second country in the world with most acreage land dedicated to organic production. As a share of total agricultural production, however, organic still represents a small percentage (no more than 2%). The country has established internationally harmonised regulations which facilitate exports, nevertheless, there are no domestic policies that help with transitions to organic production or make it more affordable for small and medium size producers to certify their production - an expensive requirement. Nor are there any policy measures to protect organic production from the diffusion of input intensive agriculture which makes it difficult for organic producers to obtain or maintain the distances required by regulations to certify production. National institutions of agricultural technology do not have sufficient resources and professionals to support organic production, and technology and input providers do not serve this market well, given that it remains marginal compared to mainstream agriculture. As a result, companies like Coopsol have to invest significant efforts to create their own knowledge, and networks of support to help the company to become established and to expand (see Box 2).

Box 2: Coopsol: Actions required to succeed and expand

In the absence of support from domestic agricultural institutions and regulations, Coopsol has developed alliances with national and international actors that are key to developing the conditions in which it has become a profitable business and is able to expand. These alliances have been particularly important around financing and technical issues, R&D, territorial work and advocacy.

Coopsol began with financial support from funders and donors, such as the Italian NGOs Fondazione Sipec and, the Institute for Peace, Development and Innovation of Italian Christian Workers' Associations and the US Inter-American Foundation, all of which are oriented to supporting sustainable ventures. With time the company became profitable mostly based on income from markets, but it has continued to obtain financial support from donors to implement major changes and innovations. For example, in 2008 obtained funding in cooperation European partners funding from the European Commission to fund the expansion of the Cooperative through associating domestic honey producers; in 2015 it received funding from the Argentinean Ministry of Social Development to purchase a fractionating machine, and it is currently working with Inter-American Development Bank funding to finance a connectivity program for farmers associated with Coopsol who do not have access to the telephone network or internet. They need to be connected to participate in the traceability project.

Coopsol's territorial work with farmers in the Gran Chaco is undertaken in association with two local NGOs: El Gran Chaco y el Futuro está en el Monte, that focus on the preservation of the resources and culture of the area. Coopsol also created the Consorcio of Cooperación WAYRA – Consorcio Bio del Norte Argentino - to link the efforts of producers to pursue common goals; in particular a collective organic and fair-trade certification. This type of certification had never been implemented previously in Argentina.

An R&D project on the nutritional and medicinal characteristics of unifloral honeys is also being conducted on

the basis of an agreement with the Biochemistry Faculty of Santiago del Estero and the Pharmacy Faculty of the National University of Tucuman. Finally, international purchasers within fair trade networks also provide important support for marketing.

Our second case study is Don Mario, a seed firm, which also differs significantly with respect to the typical agricultural venture, although it does so in a very different way to Coopsol. Don Mario develops and sells seed varieties of soy, maize and wheat. Unlike the production of commercial crops, which are essentially a commodity, the seed varieties developed by Don Mario are a highly differentiated, knowledge intensive and dynamic product. Their seed varieties regularly incorporate new characteristics so that they work well in different environments and under changing conditions (e.g. climate). They differ from the seed innovations developed by large multinational agro-chemical companies, which normally capture global markets by providing standardised innovations, i.e. genetically engineered constructs that work well in multiple locations, such as resistance to herbicides.

Don Mario relies on a knowledge and skills intensive production process. It specialises in seed development, rather than the multiplication (i.e. volume production) of seeds for subsequent sale. The company does not use transgenesis, the technological approach favoured by multinational agro-chemical companies to earn rents. Instead, it relies on traditional cross breeding approaches, supported via advanced biotechnological tools (e.g. molecular markers) and bioinformatics. This approach relies to a significant extent on an open source model of innovation, unlike the patent-based business models adopted by the large multinational agro-chemical companies, demonstrating that firms can capture rent with free flows of knowledge (see Box 3).

Don Mario is a traditional medium size company with 700 employees, in which decisions are made by managers designated by the owners. It is a highly professionalized firm, 80% of whose workers are skilled, nearly half of whom are dedicated full time to R&D.

The guiding principle of Don Mario is to maximise long term profits, and in this respect differs from mainstream ventures in the agricultural sector that favour short-term profits. Profit making strategies based on innovation require relatively long-term investments and involve substantial risk. The development of novel seed varieties requires multiple experiments and testing, with a minimum of five years development time to obtain a product. The company also privileges its autonomy and independence over short term benefits because it has declined several offers to be purchased by the handful of multinational agro-chemical companies that have taken over hundreds of independent seed firms across the globe in the last couple of decades.

Don Mario began by supplying the Argentinean market, but now exports to 16 countries (among the most important are Brasil, Paraguay, Uruguay, Bolivia, Canada, the United States, South Africa, Ukraine, Russia, and China). It also has subsidiaries in Brazil, Uruguay, Paraguay, Bolivia, South Africa and the United States. Although the company's seeds are largely aimed at conventional farmers, the technological approach favoured by Don Mario allows the company to supply different forms of agriculture, such as systems that do not use genetically modified varieties, or agrochemicals. Given the challenges facing conventional agriculture in Argentina, such as soil degradation, a significant drop in the effectiveness of the most widely used pesticides, and greater pollution and costs, the company is developing seeds adapted to other agricultural systems such as organic or regenerative farming.

A large part of the knowledge required by Don Mario to innovate is developed in-house, within its own R&D facilities. Part of that knowledge, which is based on scientific and experimental work, can be codified but importantly not all of it. Innovation efforts are directed at identifying existing unknown variability within species that can be useful to develop new seed characteristics. The results of these efforts are not patentable (under Argentina's existing institutional rules) and so the company's seeds, which embody new knowledge, can be used by others as a basis for developing further novel seed varieties without restriction. Don Mario obtains genetically engineered events under license from MNCs, and incorporates these into some of its varieties, and these are protected by the MNC's patents. Other key areas of knowledge are partly embodied in equipment and tools, such as molecular markers, information technologies and robotics, or are delivered through knowledge service contracts or under joint technological agreements.

Box 3: Don Mario: obtaining profits with an alternative more sustainable model of innovation

Don Mario has multiple positive economic outputs. It contributes to diversification within and outside of the agricultural sector. It develops a product that uses new knowledge intensively developed by the company, in partnership with other actors in the innovation system and it demonstrates how it is possible to innovate and grow with an open source model of innovation which is beneficial to the wider economy because it preserves free circulation and access to existing knowledge and therefore favours innovation and biodiversity. Specifically, since the new seed varieties developed by Don Mario are not and cannot be patented, other firms and public sector institutions can improve on the new varieties and develop and register these as new seeds. The company therefore does not capture rents by blocking others from using its innovations, and instead its business model relies on a strategy of continuous innovation, and first mover advantages. This business model differs significantly from that used by large chemical MNCs in the seed business that introduce very few innovations and aim to capture rent from these for the maximum possible period of time, using patents. Don Mario is also able to contribute to a diversification of agricultural practice because it can and does develop seeds for diverse forms of agriculture, including practices that use external inputs less intensively, such as organic practices.

Its social contribution is related to the high use of skilled workers in both urban and rural areas and the multiple research partnerships it has with more than 50 research institutions in Argentina and abroad. Through some of these agreements Don Mario supports postgraduate research which advances knowledge useful for the company but which remains free to be used by others.

Don Mario is indirectly supported by and benefits from mainstream policy institutions and existing regulations insofar as the company is closely connected to the mainstream agricultural sector. However, where, as is sometimes the case, the interests of Don Mario clash with those of other powerful actors in the sector, existing institutions and regulations typically do not favour it. The primary example is the intellectual property rights system for seeds, which currently favours both the agro-chemical MNCs that dominate the market for transgenes, and large landowners. This is because Argentinean seed law enables large MNCs to use patents to protect their transgene innovations, which is a much more powerful institutional tool for capturing rent than the plant variety rights available to Don Mario for its conventional seed breeding-based innovations. One consequence is that this provides a marked advantage to MNCs in negotiations between the patent holders of transgenes and Don Mario about how to share income from seed sales. At the same time, existing seed law on plant variety rights benefits large landowners because the law does not require that farmers pay Don Mario for re-using its seeds. Instead, the company uses private contracts with large farmers to organise

payment beyond first use of the seeds, but farmers are not obliged to use those contracts and have the choice to avoid payment. Another example is the lack of support from R&D institutions which have historically directed most funding to projects aligned with the conventional biotechnology industry led by large MNCs from the chemical industry, fostering domestic firms like Bioceres dedicated to identified genetic constructs.

Box 4: Don Mario actions required to expand

Although Don Mario's business model is indirectly supported by domestic agricultural institutions and regulations, that support prioritises the interests of large-scale commodity crop producers. Where Don Mario's interests diverge from the typical agricultural venture, a strategic response has been required by the company. In particular, given that the company develops new seeds based on an open source innovation model, significant efforts are devoted by the company to try and capture rent from its innovations. For instance, Don Mario signs private contracts with its clients that require that they pay a fee for re-using new seeds for three years, but about 80% of all seed is obtained by farmers on the black market. Proposals to reform Argentinean seed law, so that, amongst other things, large farmers are required to pay for re-using seed, have stalled for over two decades given landowners and large farmers political power. Another problem for the company is to obtain a 'fair' share of the income distribution from the contributions that Don Mario makes to improving seed varieties, viz a viz the contribution, in the form of patented transgenes, made by large MNCs. Don Mario typically obtains 30% of the total price, while the MNCs providing transgenic events obtain 60%. With intellectual property regulations favouring landowners, large farmers and MNCs in negotiations over the distribution of rents, Don Mario would need to try and influence the regulatory system to provide more supportive rules for its open source business model

Table 1: Socio economic and technical practices of mainstream and alternative ventures

		Mainstream	Coopsol	Don Mario
Main product/services developed/provided		Homogeneous, commodity	Differentiated - through certifications	Differentiated, knowledge intensive.
Main productive processes utilised or being developed		Large scale, input intensive, capital intensive	Organic, fair trade, labor intensive in the countryside, professional and non-professional	Knowledge intensive. Labour intensive in cities and countryside. Mostly professionals.
Favoured technologies and innovative efforts		Oriented to improve productivity: OGM seeds, pesticides, zero tillage	Locally produced, adapted to organic or alternatives to input intensive	Cross breeding, biotechnological tools, bioinformatic. Open source
Organizational model		Traditional hierarchical, contractors	Cooperative	Traditional hierarchical within, highly interconnected outside
Ambitions and guiding principles		Short term maxim profit seeking - Market driven	Long term local development- Social and environmental sustainability. Collective decisions. Creating markets	Medium term, profit seeking. Create new knowledge, create diversity. Creating markets and market driving.
Demand and users		Global	Mostly global	Local and regional.
Market Structure		Concentrated, medium to high entry barriers	Atomised, low to medium barriers to entry	Very high barriers to entry, it depends on regulations
Geographical área of operation		Rich-advanced in the center moving to north,	Marginal, disconnected	multiple regions and international
Knowledge related factors	Key Innovative actors	Private: Input providers (chemicals, seeds, machinery) - Contractors, Technology institutions (INTA)	The cooperative, farmers, International ONGs, local universities	In house R&D, research institutes and input providers (e.g. molecular markers)
	Main sources of knowledge	Mostly embodied in inputs and suppliers. Tacit in professionals.	Mostly local and experimental. Traditional and scientific. Embodied in local farmers and international institutions.	Scientific, new knowledge from field experiments, and existing embodied in inputs (e.g. genetic events).
	Knowledge - codification	Highly codified, easy to transfer.	Low codification - difficult to transfer.	Low codification - difficult to transfer.
	Knowledge - appropriability	Public and proprietary. Concentrated	Public. Disperse.	Public and proprietary. Disperse.
Institutional support and regulations		Supported massively by domestic institutions and policies	Limited support from local institutions and regulations	Support dependent on alignment with mainstream actors

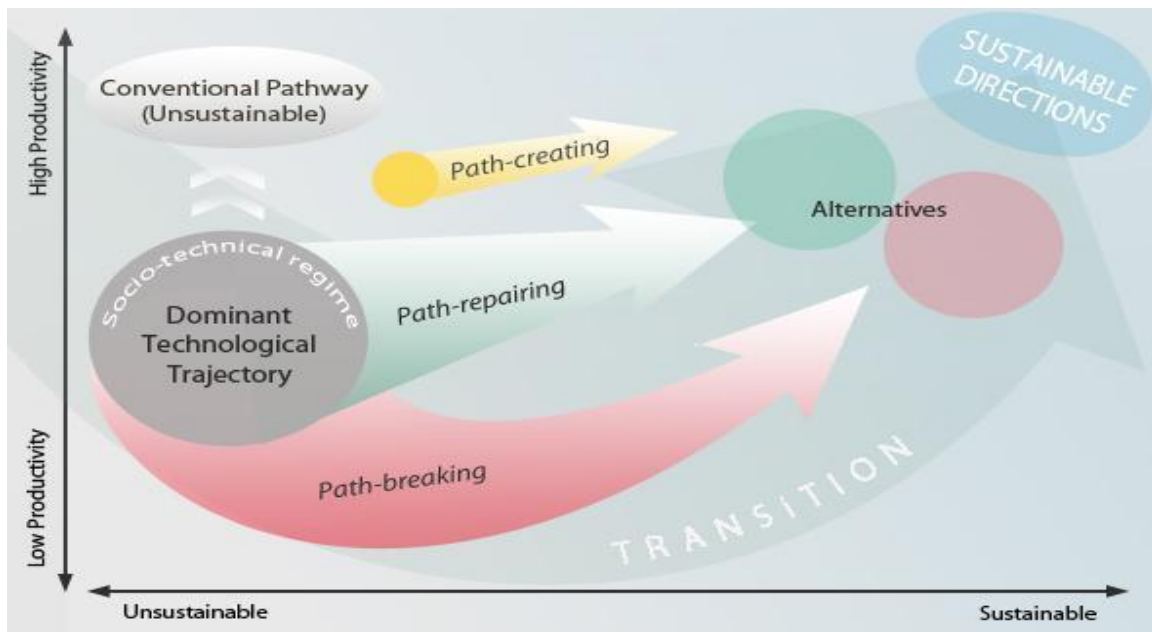
The contribution of alternative agricultural ventures to trajectories of change

Within the transition's literature, analysts have identified a number of distinctive 'transitions pathways' These fall into two general types. One involves the *gradual reorientation of trajectories of socio-technical change* within incumbent regimes, for instance as a result of the cumulative adoption of incremental innovations that are developed by mainstream regime actors themselves in response to external pressure, or through the (partial) adoption of niche innovations into mainstream practice that help address problems, especially niche innovations that are not radically different to mainstream practices and so easily 'fit' within a reforming regime. A second type involves *a more radical reorientation of trajectories of socio-technical change* caused by the destabilization of existing regimes as a result of critical failures to respond to external pressure and problems, and their eventual replacement by highly novel socio-technical configurations associated with one or more emerging, often highly alternative niche innovations. (Smith et al 2005; Geels and Schot 2007; Berkhout et al 2009)

We can usefully differentiate two different kinds of alternative ventures or niches that are associated with these two broad types of transition pathways (Marin and Smith, 2011). One can be termed a *path breaking* venture/niche in that it suggests a completely different way of providing a good or service, relative to the incumbent regime and thus implies transforming that activity radically, taking it in a different direction – or trajectory. This type of venture is likely to differ with respect to the dominant regime in almost all the dimensions discussed earlier, but especially in terms of guiding principles and cultural meanings. A second, less radical *path repairing* venture does not challenge the foundations on which the incumbent socio-technical regime rests, and differs in terms of its socio-technical-economic practices to a more limited extent with respect to the dominant technological regime. But it nevertheless can make a contribution to reform of that regime by generating new knowledge and practices that can be incorporated into the mainstream system.

We also propose the identification of a third kind of alternative, a *path-creating* venture/niche. The practices associated with this type of venture are also more closely aligned with those of the dominant regime, but with a greater potential to transform it by creating new, complementary activities. Those complementary activities do not imply a direct replacement of the incumbent regime, but they nonetheless help to indirectly address its negative impact by diminishing its relative importance. We suggest that path creating ventures are very important for addressing the sustainability challenges associated with natural resource based industries, such as agriculture in developing countries, to the extent that they contribute to diminishing the importance of these activities in the creation of the country's wealth, and therefore render them more susceptible to be challenged, modified and even replaced. The mainstream agricultural sector in Argentina explains at least half of the total exports of the country, and therefore possess very significant economic influence and as a consequence political power. Ventures that initially develop within, or in association with, that sector, but reduce dependency on it by creating entirely new industries are very important in thinking about processes of transformation. Path creating types of ventures have been extensively studied within economic and innovation studies of development, when addressing the challenge of diversification, but not using concepts and ideas from transition studies which can help to understand non-economic barriers to their expansion. They have not been contemplated either within transition studies, as possible contributors to transformation.

Graph 1: Transforming NRs: different kinds of transformative alternatives



Coopsol can be understood as a path-breaking venture. The company proposes a completely different way to practice agricultural production. It differs from mainstream agricultural ventures in every single socio-technical-economic dimension that we analysed (see Table 1). At the same time it pursues better social outcomes, by including economically marginalised actors in benefit sharing and decision making processes economic outcomes via differentiation of a commodity and making it profitable at small scale levels of exploitation, all of which help to reduce economic and productive concentration. And it pursues better; environmental outcomes by incentivizing beekeeping and organic practices in an area where there are high levels of deforestation and use of pesticides. The company is profitable, supported (protected) in part by sophisticated global market niches, and in part by financial loans and aid from international NGOs. Yet, due to the lack of 'fit' with the dominant agricultural production regime in Argentina it has to take multiple and varied actions and initiatives to survive and expand that go well beyond those typically discussed in business books or contemplated within policy-decisions oriented to supporting conventional innovations and/or businesses. It is not only creating its own market, as conventional entrepreneurs do, it also has to create the infrastructure and local capabilities required to succeed; from the communications infrastructure necessary for farmers in remote localisations to the capabilities to certify farmers as organic producers.

Don Mario, unlike Coopsol, shares some of its economic and socio-technical practices with mainstream agricultural ventures but it differs in key areas, mainly in terms of greater knowledge intensity, higher added value, less technology dependency on external actors, and less direct dependency on natural resources, particularly land. Unlike Coopsol, Don Mario does not compete with mainstream ventures in the sense of providing an alternative approach to performing agriculture and exploiting land resources. On the contrary Don Mario, initially at least, depended strongly on those mainstream ventures, complementing them, and developing in close association with them, but rather than aiming to repair incumbent pathways of change in the mainstream agricultural systems (i.e. commodity crop production practices), or to challenge and attempt to replace those pathways, they have *created a new pathway* in a complementary but different activity. That new activity contributes to domestic capabilities and resources that are a precursor to any possibility of taking the entire agricultural sector in a different, more sustainable direction. It does this by providing diversity to the system as well as technological autonomy through reducing dependency on 'external' input providers. It also acts so as to diminish the weight of commodity crop production per se in Argentina's agricultural system, thus potentially reducing the relative economic and political power of farmers and landowners in the economy. In this way the venture helps to address some of the key challenges created by the incumbent regime. As a 'path-creating' venture, Don Mario has to cope with problems that differ from those that confront mainstream agricultural ventures. Some of these are typical of innovative companies, such as those concerned with obtaining risk capital for investments, developing in house R&D capabilities and absorptive capabilities to take advantage of external knowledge. Others, however, are different and not well captured by the economic and innovation studies of development literature. For instance, in a context of high technological and regulatory uncertainty it is crucial for a business like Don Mario to obtain support from policy and regulations that allow it to capture rents. This is complex because the company disputes this rent with other mainstream actors that hold significant power in the country such as large farmers or large MNCs from the chemical sector.

5. DISCUSSION AND CONCLUSIONS

Economic and innovation studies of development and transition studies are both concerned with structural transformation. The first of these areas of study has been inspired primarily by the urgent need to increase wealth and reduce inequality in poor countries where the basic needs of large proportions of citizens are unmet. The second area has been inspired by the equally urgent need to radically re-direct patterns of production and consumption in order to avoid irrevocably undermining the ecological conditions that sustain human life. The two fields of inquiry have developed different concepts and approaches and models to explain and foster structural change and have focused on different types of mechanism and processes. Economic and innovation studies of development began with approaches that emphasised how labour and capital accumulation were the main drivers of growth, but in recent decades have paid more attention to how the capacity to access and develop new knowledge and technology affect growth prospects and income distribution. Within this field, the focus is now on how new knowledge and technology are developed, albeit imperfectly, in markets in which the interaction of firms and consumers shape outcomes in a quasi-deterministic manner. The younger field of transition studies has, from the outset, put new knowledge and technology at the center of its understanding of processes of structural transformation, but with a more sociological perspective on socio-technical change in which human agency and culture have as an important a role

in explaining processes of change as markets, and in which markets, and the institutions and regulations that shape markets, ultimately reflect the exercise of political and social power.

The two fields of study have always overlapped analytically, but their focal areas of concern are also beginning to, at least partially, converge. Growth and inequality were the main concern of economic development studies for many decades, but it is increasingly recognised that these objectives cannot be pursued without considering their environmental impact. This is particularly the case with natural resource- driven processes of growth. At the same time transition studies need to consider the contexts of developing countries they are to engage with global processes of structural change; contexts in which the challenges of economic growth, economic resilience, and inequality are paramount.

In this paper we have provided some indications of how these two bodies of literature could be brought into greater dialogue. In very general terms, bringing transitions perspectives to bear on economic and innovation studies of development helps to shift the focus of the latter from exclusively market processes and productive and technological effort and learning, to incorporate issues of power in shaping the contexts in which firms and other ventures operate, for example in terms of asymmetrical patterns of negotiation between actors, as well as attention to how policy and wider social and public support for particular kinds of technological practice is important. Innovation studies of development have produced important ideas in terms of our understanding of transformation possibilities in developing countries, in which the role of new knowledge, technological capabilities and learning is emphasised, and about how different industries and interactions between state and private actors can contribute to these processes. Yet this literature neglects challenges associated with competing businesses or competing technological approaches, or how conflicts of interest and objectives, asymmetrical power relations, and shifting culture are all important when thinking about processes of structural transformation.

At the same time, bringing economic and innovation studies of development to bear on transitions studies can encourage the incorporation of economic development ambitions within a framework that has been traditionally concerned with how environmentally damaging (and to a lesser extent socially inequitable) production and consumption systems might be reconfigured in more environmentally sustainable (and just) ways. The absence of the economic development pillar of sustainable development, as emphasized by Brutland, is perhaps a reflection of the European/North American focus of much of this body of research, where problems of economic development are substantially 'solved', in the sense that the global North is characterised by highly diverse and competitive industrial and service sectors. Even where development issues are raised, in work on transitions, the focus tends to be on norms of (local) poverty reduction rather than a broader concept of economic development. (Ramos-Mejía et al 2018) Nevertheless, this may be a key reason why the field of transitions research has had little impact so far on economic ideas about development, and why it is largely absent from the policy agendas of most countries in the global South.

Our empirical exploration of a more unified framework in the agricultural sector in Argentina highlights some of these traditional blind spots in the two bodies of literature, especially in terms of how policy-makers might interpret and understand our two cases of alternative ventures. For example, to the extent that the organic honey co-operative, Coopsol, might be recognised as a desirable business by policy-makers working within an economic and innovation studies of

development framework, support would likely be provided in terms of increasing its R&D capabilities or obtaining certification. It is unlikely that Cooposol would be recognised as a path breaking venture, deploying ideas, practices and business models that could contribute to structural change to a more sustainable agricultural sector. Transitions studies analysts would recognise that potential, and might emphasise the need for more wide ranging policy support, for example, in terms of non technological capabilities, or political support to cope with conflicts with the incumbent agricultural practices that undermine its viability and ability to expand.

In the case of Don Mario, policy-makers working within an economic and innovation studies of development framework might recognise that the firm is valuable in terms of the knowledge intensity of its activities, but it would be likely to be seen as a relatively backward firm, competitive in the seed market in Argentina, but not compared to the large agro-chemical MNCs that dominate the global seed market. As described earlier Argentinean innovation funds have supported domestic seed firms like Bioceres, that seek to follow the trajectory of Large MNCs and specialize in transgenesis , but have not provided any funding to Don Mario. Advice for a firm like Don Mario might be to interact with the national science and technology system in order to reach the technological frontier in plant breeding, understood as plant genetic engineering. At the same time even though transition studies might have very useful insights to explore Don Mario, analysts working within this perspective would be unlikely to even recognize the seed firm as a potentially transformative alternative venture, because that potential lies primarily in economic aspects of development, such as knowledge intensity, diversity and path creation, rather than environmental performance. Yet from a modified transition framework that incorporated economic development as an transformative ambition, the importance of the alternative technological choices and innovation models championed by Don Mario might be emphasised, and again the conflicts of interest between this company and the dominant agricultural regime might come into clearer focus. Again, non-technological barriers and so political and policy support for the practices and business model of Don Mario might be emphasised in addition to R&D support.

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