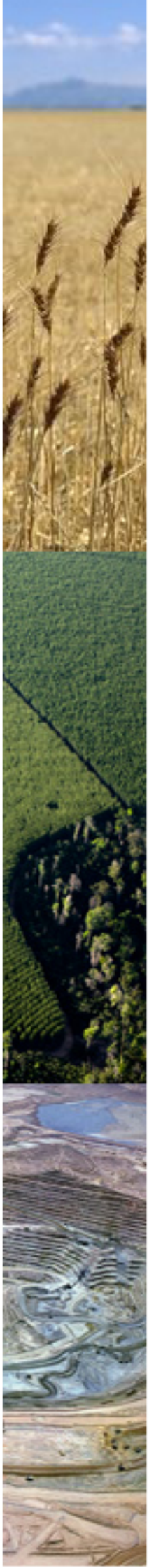

Opening up Natural Resource-Based Industries for Innovation: Exploring New Pathways for Development in Latin America

METHODOLOGICAL PAPER | Evaluating Alternative Productions in Natural Resource-Based Industries in LAC: Can They Help to Transform Problematic NR Activities?

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EVALUATING ALTERNATIVE PRODUCTIONS IN NR BASED INDUSTRIES IN LAC: CAN THEY HELP TO TRANSFORM PROBLEMATIC NR ACTIVITIES?

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The dominant view in development studies in LAC is that **NRs** are problematic (or have low potential to contribute to development), and that we should induce structural change away from these industries towards more knowledge intensive sectors. This view is based on ideas coming from the sectoral innovation literature, which assumes that industries posse intrinsic characteristics which make them more or less dynamic (in terms of innovation), and therefore with more or less potential to contribute to development .In this study we test this view. In line with the socio-technical transition literature, we believe that industries or activities, which are problematic, can get transformed (or transitions can be encouraged, so that economic, social and environmental challenges are addressed). Our interest is thus not so much how to move away from NRs but how to transform NR activities, so they can best serve economic (resilience), social (justice) and environmental (sustainability) priorities in the region.

Industries get transformed and re-structured; the literature on innovation tells us, through the creation of alternatives, **or new projects which propose technologies and organisational practices that depart from the conventional ones in a given industry**. Within each industry there are dominant ways of solving problems, and alternative ways of addressing them. The dominant ways are the ones more widely spread that privilege the mainstream, and are highly institutionalised, benefiting typically from a historic accumulation of technological, institutional, infrastructural and social supports.

The alternatives are practices that departure from these highly institutionalised ways of solving problems, and typically promise different economic, social and/or environmental results than the dominant ways. Alternatives can be more or less radical. The more radical ones, will be truly *path-breaking*, in the sense of transforming the industry and eventually taking it in a different direction of change - or pathway. The less radical ones, instead, will be of two types: *path-repairing*, when they offer partial solutions to some of the problems of the dominant regime, but do not challenge its main logic of development, and *path creating* when they create new pathways for innovation in sectors or industries closed but different to the dominant one, augmenting the density of links among different industrial sectors. The overall aim of this paper is to propose a methodology that helps us to (a) identify different types of alternatives (more or less radical, we are interested in both) within selected NR based industries, and (b) study the evolution of different types of alternatives in relation to their capacity to survive, expand, and eventually transform problematic NR industries, either through path repairing, creating or breaking processes. The paper draws on contributions from three Background Papers developed in the first stage of the project.

The paper is organized as follow. First, we discuss briefly the main concepts of the transition literature that are useful for our study, and how we propose to adapt them to our problem of research. Second, we present the methodology proposed to identify alternatives based on secondary information and interviews to key agents. Third, we propose the main aspects that will be studied in depth in the next stages of the project regarding these alternatives to respond the main questions of the project. Fourth, we discuss some aspects of the methodology to be used in the case study and quantitative analysis (using innovation funds data) to characterize alternatives. Fifth, we conclude with some remarks about next steps in the project.

1. TRANSITIONS STUDIES, a multilevel perspective: adapting the main concepts of the literature to our research problem:

1.1 The transition literature in brief:

The central problem for researching transitions to alternative pathways is to understand whether, and how, we move from a relatively stable and incrementally innovating dominant 'regime' of socio-technical configurations, very often problematic, and towards much more economically integrated, environmentally sustainable and socially just regimes.

The main idea is that alternatives (conceptualised as niches), play a key role in moving away from dominant regimes. Dominant regimes face problems, typically deriving from pressures in the landscape or broad context, and in this way open opportunities for alternative configuration that offer solutions to these problems. Niches are sources of alternative ideas, and capabilities and that can protect from problematic lock in situations. They are spaces that have protection and insulation from the normal selection conditions that exist in the regime and are important because they foster learning processes and the space to build the social networks that support innovations[1]. These niches sometimes manage to challenge the dominant regime, providing feed backs into the dominant system helping to improve it. Whereas in other cases, the niches may entirely replace the ST regime (Geels, 2002).

Changes within the regime, and from one regime to another are explained by the interaction between the characteristics of the landscape, the ST regimes and niches. The relations and interactions between them is known as a multi-level perspective. The main characteristics of this perspective are summarized in Figure 1, which exemplifies how these three dimensions are interrelated. One way of interaction is for instance, that changes in the landscape can put

[1] This allows radical innovations to be generated inside them, since they give the needed protection to new technologies which usually have low technical performance in their initial phases and are also more expensive.

pressures on the socio-technical regime, which in turn, might allow for the emergence of new niches that modify the development path.

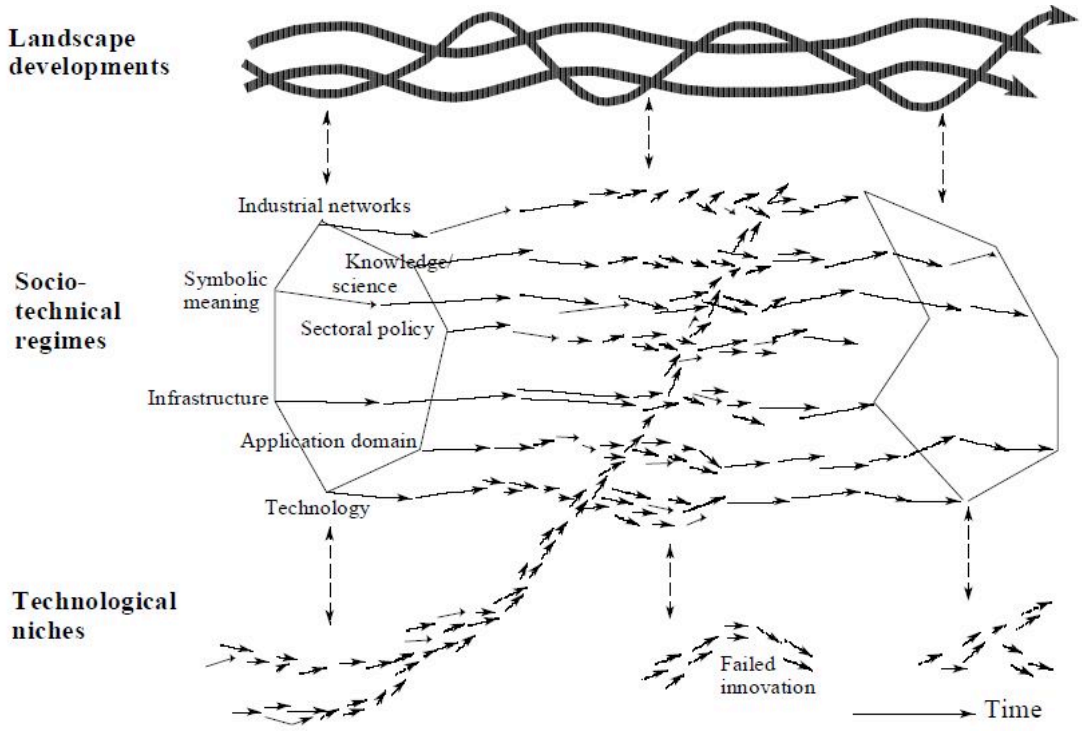

Figure 1: A dynamic multi-level perspective on Technological Transitions (Geels, 2002).

1.2 Adapting some of the main concepts of the transition literature to the project

We explain next how we interpret some of the main concepts of this literature on the light of the objectives and questions of the project.

Industries or social problems: Transition studies focus on alternative ways of solving social problems. We talk in our project of NR based industries, so it seems that we are talking about a different object of study. We could however, conceptualize our problem in a way that is more compatible with the literature by setting our main interest on alternative ways of taking advantages of Natural Resources. This is a key social problem for countries which are rich in NRs and have historically been unable to take full advantage of these resources to improve the quality of life of their populations, or have only taken partial advantage of these resources.

Transitions or diversity: Existing transition studies have mainly focused on radical changes in the way in which societal problems are solved, so that environmental and social problems are challenged. Arguably, these kinds of transitions might not be so self-evidently urgent or possible in NR industries in Latin America. We are interested therefore more than in transitions *per se*, in understanding how to avoid problematic processes of lock-in through a diversity of niche options.

This can be relevant for normative concerns, such as more socially just or economically resilient patterns of development. It is in this sense that we use this framework and adapt it in our project. Consider, for example, concerns about over-reliance and lock-in to highly concentrated forms of agricultural system (e.g. soya). Historically, these have been shown to be less resilient to international and national shifts in circumstance. Nor have they been responsive to these changes. The MLP analytical tool for understanding regime path-dependencies (and lock-in), and analysis of niches as sources of innovative ideas, capabilities, and alternatives that can protect against lock-in, creating for instance diversity, could be useful for our research problem in order to understand the conditions under which alternatives are feasible. It is in this sense that we are interested in the MLP, rather than transitions *per se*.

Transitions within and between sectors: The main focus on 'transitions' has very much been up to now influenced by a European concern to transform their economic sectors into more sustainable forms, such as the move from fossil fuel energy sectors to low carbon energy sectors. We are interested not only in transitions or transformation within sectors, but also in transitions between activities. Two economic challenges of NRs activities are that they operated typically as enclaves, and with low knowledge intensity. One transition in a direction that address these challenges would be therefore a transition towards activities that are related to NR activities, but that are more likely to generate linkages with other activities, and are more knowledge intense. These types of transitions are important in the context of our project because they eventually will reduce dependency with respect to NRs.

Alternatives. In the existing literature alternatives or niches are often thought of as a network of ventures, which can be more or less developed, but that eventually at the end aim to replace or to transform the dominant way of solving problems in an industry[2]. In the project we emphasize the importance of focusing in less radical alternatives, which even though they might not challenge the whole logic of the dominant regime, might provide diversity, new knowledge, etc. In this sense, as we will discuss next, we define alternatives in a more flexible way compared with the existing literature, as we will discuss in the next section, so that a larger diversity of situations is considered that might help to move from lock in situations in our context. Of course, we also take into account that many of the niches will be in a kind of vanguard under different guiding principles and rules that might make them not profitable viewed from the logic of investors in the dominant ST regime. Notwithstanding, in many cases these niches might influence, in certain aspects, ways of working that could be appropriable by the dominant socio-technical configuration.

In the next section we go deeper into the analysis of how we define alternatives and we propose to identify them in practice.

[2] But also many other types of interactions may take place, such as hybridizations between niches and regimes (Smith, 2007)

2. HOW TO IDENTIFY ALTERNATIVES

In order to do this we propose to bring together two aspects of analysis. The first aspect analyses incumbent dominant structures of NR, and their associated technological trajectories, and why these are problematic in terms of social, economic and environmental development. The second aspect analyses the development of alternative structures for exploitation (which advocates claim to lead to more progress development pathways), and assesses the momentum behind these alternatives. The two aspects come together when we consider the extent to which problems in the incumbent NR industrial structures provide windows of opportunity for the development of the alternatives, or, conversely, the momentum and commitments to incumbent NR trajectories effectively lock-out the robust development of alternative pathways

Based on the above consideration we suggest the following analytical steps to be followed in order to identify alternatives to take advantage of NR in LAC:

I. Identify and analyse existing dominant trajectories in the selected NR activities using socio-technical regime concepts.

II. Identify the economic, social and environmental problems associated with these trajectories.

III. Identify and characterise alternative pathways for the NR sectors which address some of the problems identified in the dominant trajectories.

IV. Choose some alternatives for analysis in case studies using niche concepts to assess the momentum and support for these alternatives.

We will develop each one of these steps below and illustrate how it could be applied using the example of the agricultural sector in Argentina.

I. <u>Identify and analyse existing dominant NR trajectories using socio-technical regime concepts.</u>

As a first step we need to identify in each one of the selected NR exploitation per country the dominant trajectory, which are the ones used more often to exploit the selected NR in the context of the study. These will be those trajectories that privilege the mainstream, and highly institutionalized, ways of solving problems that benefit from a historic accumulation of technological, institutional, infrastructural and social supports. Information about the dominant trajectory per industry and country can be collected using secondary data (e.g. previous studies about the sector in the country) and interviews with key informants. Of course, these trajectories are not completely static, but rather following existing paths.

In the case of the agricultural sector in Argentina, for instance, we can say with little hesitation that the dominant trajectory is the one followed to produce (99% of) soya, the crop that dominates the agricultural scene in the country since the mid 1990's, which is also extending to the production of other crops such as cotton, and maize. This is an intensive and extensive

technological trajectory which has developed on the bases of the co-evolutions of several elements: a) Genetically modified seeds, b) Widespread use of herbicides, c) Zero tillage, which involves planting crop seeds in previously unprepared soil, d) The separation between the ownership of the land, and its exploitation, e) Little state intervention in directing the trajectory, and f) Little involvement of local consumers (since almost all production is exported), among other things.

II. Identify the economic, social and environmental problems associated with these trajectories, (note each will also be providing benefits too).

Some of the problems will be related to traditional concerns associated with the exploitation of NR discussed before, some others will be specific to the sector and country of study, and finally, there will be some problems more in general related to the landscape. The following are some examples of each type.

General problems of NR activities include:

- Low technological intensity,
- Trend to operate as a enclave, with little linkages with other sectors of the economy,
- Low technological dynamism ,
- Low innovation,
- Environmental damage,
- Low employment creation, and inclusion,
- Low possibilities to differentiate products (inelastic demand),
- Exclusively oriented to external markets, etc.

In the case of the agricultural sector in Argentina, some of the problems identified by different analysts include:

- Concentration of land,
- Concentration of products,
- Safety and health concerns,
- Soil damage,
- Dependency, lost of control over key aspects of technology,
- Loss of food sovereignty.

Problems related to the landscape could be:

- Climate change,
- Model of growth.

III. Identify alternative pathways for the NR sectors being proposed by different advocates.

Problems or tensions within the dominant regime often open windows of opportunity for changes and alternatives to emerge and prosper. The alternatives are practices that departure

from the highly institutionalised ways of solving problems, and typically promise better ***social environmental,*** and/or ***economic*** results than the dominant trajectories.

Taking into account ***social outputs*** alternatives would improve regarding the dominant trajectory when they promote for instance inclusion, if as it is commonly the case the NR activity it is scoring low with respect to this aspect. Two types of inclusion seem important: 1) inclusion in the process of strategic decision making and in the share of outcomes, and 2) social and economic inclusion, via creation of productive employment, skills, etc.

Taking into account ***environmental outputs*** alternatives would improve regarding the dominant trajectory when they promote sustainable use of NR by taking care of issues such as: [a] the danger of exhaustion of the non-renewable resources, [b] the destruction of ecosystems and [c] the threat of serious pollution of air, soil and water[3], all typical problems of NR activities.

Taking into account ***economic outputs***, the improvements would be typically associated with the creation of linkages, and the promotion of other more knowledge intensive activities that would help to reduce the dependency of the country on this NR, if as it is usually the case within the dominant trajectory the activity tends to operate more as an enclave, with scarce linkages and possibilities of diversification.

In each country however, key economic, social and environmental problems/challenges should be identified in association with the activity selected. Thus, the best alternatives to be studied would be those that address the specific challenges of this activity in this country.

The following are some of the dimensions that can be explored to distinguish alternatives from dominant projects. The greater the number of distinguishing dimensions, the more the chances that the alternatives are more radical.

Product: when the product is different, differentiated, regarding the one (or the predominant type) produced within the dominant regime. For instance, where the economic incentives induce to the production of commodities, when land is utilized to produce a differentiated product (e.g. quinoa), we can talk of an alternative regarding product.

[3] It is important to bear in mind that some of the times the selected pathways will have contradictory outcomes regarding these three dimensions. In these situations we will be interested in exploring the governance of the pathways, particular with respect to their ability to balance the three objectives. It is also important to mention, that some outcomes will not yet be manifest materially. Indeed, expectations are a key theme in the study of niches, since so much research into sustainable solutions is forward-looking. In many situations, therefore we will not only focus on benefits that have already taken place but also on expected outcomes amongst key actors in the NR sectors.

Process and organization, when the organization of labour, management, ownership etc. is different from the one predominantly utilized in the dominant regime. Here, we include for instance all the organizational dimensions that distinguish intensive methods from organic ones in agricultural production, whether or not and to what extent the activity generates inter-sectoral linkages, etc.

Technology: when the machinery, and other inputs, differ. For instance, in the case of agriculture we can have techniques with or without transgenic seeds, or with or without pesticides. An important distinction also relates to how environmentally friendly is the technology is.

Type of Agent: Here the differences might derive from the nationality of the companies, size, vertical integration, if they are private or co-operatives, large companies or micro ventures, etc.

Geographical zone: here we can consider the projects or activities which are located in a region which is marginalized from the dominant regime.

Type of knowledge utilized: Here we include projects that use different kinds of knowledge than the one prevalent in the dominant regime, typically coming from formalized, institutionalized sources. For example knowledge which belongs to a community, not thought in universities. We could also include here issues related to knowledge intensity.

Market orientation: Here we distinguish alternatives with respect to how far are they from the dominant regime regarding the market they serve. Natural resource activities in developing countries are typically oriented to satisfy external markets. Projects that orient production to meet local needs can therefore be considered alternatives regarding the dominant regime. Moreover, we will also consider niches alternatives that anticipate new markets structures and that are preparing to compete in them, or, on the other hand, alternatives which are trying to fit in a new way to existing markets.

Organizational and structural characteristics of the main innovation networks: Here we consider issues of openness, complexity, inclusion, distribution of knowledge, collaboration, centralization, interaction, and transparency, among others. These features are potentially key in the distinction between dominant and alternative pathways, and cut across all the other dimensions. For instance, it is likely that more distributed and collaborative networks are more likely to generate inter-sectoral linkages and therefore diversification. It is also reasonable to expect that more inclusive and horizontal networks are more likely to have better social and environmental effects, since they would include different types of actors, with different views and concerns in the decision making process.

We could use a graph as follows (Figure 2) to show differences among projects, where the center represents the dominant regime, and the axes differences with respect to the

dominant in relationship to each one of the dimensions considered. The scale measure relative differences, and is arbitrary.

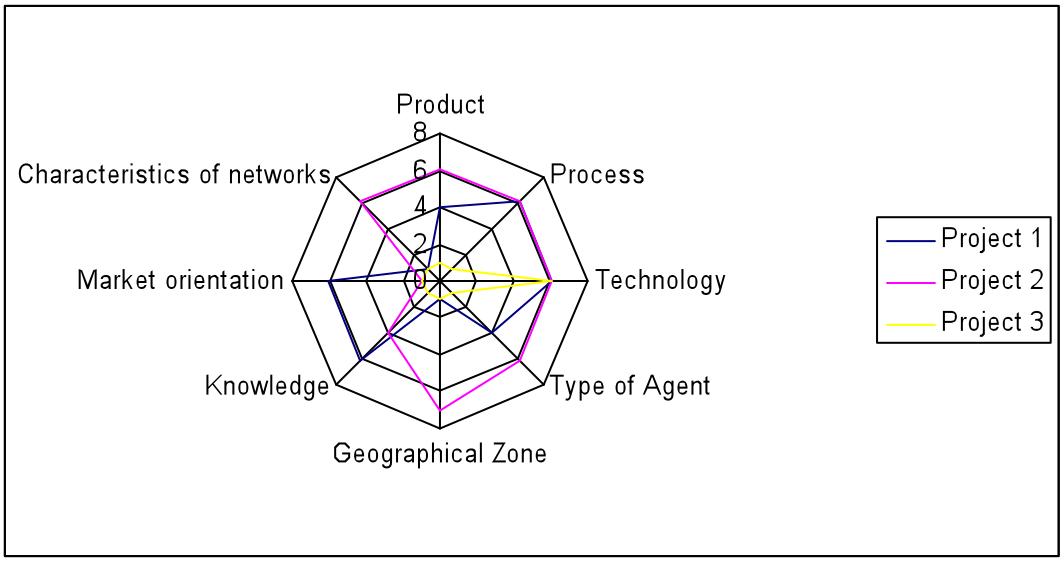

Figure 2: A schematic way to show the differences among projects.

In this example, not real, Project 2 seems to be the more distant to the dominant, since in this project differences regarding the dominant, as represented by distances with respect to the center, are higher, with respect to a larger number of dimensions, relative to the others.

IV. Using agreed criteria, choose some alternatives for analysis in case studies using niche concepts to assess the momentum and support for these alternatives.

Once a number of alternatives have been identified in each sector, at least three of them will be selected to be explored in detailed case of studies. Alternatives will be selected according to their importance, and radicalism. We propose to explore the following three types of cases:

- One that represents diversification in related or not sectors, based on the advantages of the regime. Here, problems would be "addressed" via developing other sectors and becoming less dependent on the problematic NRs.
- One that follows the dominant trajectory, but is path repairing. Here the project/venture should be oriented to address some of the challenges generated by the dominant, but it does not aim to question the whole socio-technical regime.
- One radical, path breaking, that proposes a completely different way of using the natural resource under question. This type of project should differ in almost all the dimensions discussed above, product, technology, process, organization, etc.

Then, in-depth case study will be used to interrogate initiatives. In each of them we will have to interview entrepreneurs, actors in their support networks, and policy makers, among others.

The main questions to be explored in the case studies are discussed in the next section. Then, we finish by explaining how we plan to use evidence coming from innovation funds databases to complement the evaluation of niches done in case studies.

3 WHAT DO WE AIM TO UNDERSTAND ABOUT THE SELECTED ALTERNATIVES

Our core analytical concern in this project is about the potential of alternatives to transform problematic NR activities in LAC, and about the momentum building behind these alternative sustainability ventures.

To understand this important issue, we propose to explore three types of questions:

1) Do we have in the region alternatives potentially capable to transform NR activities in better directions? How developed are they? In which directions do they aim to go? Do they aim mainly to feed up or transform? How do they compare with the dominant regime?
2) How do "successful" niches become widespread, by creating institutions, networks, diffusion from one to another alternative, etc.? and,
3) Which are the main factors that contribute to lock in situations, or obstacles to growth and propagation of these alternatives? How can they be removed?

1) Do we have in the region alternatives potentially capable to transform NR activities in better directions? How developed are they?

This is a descriptive question, that give us a first overview of the possibilities of the sector to be transformed via alternatives, and should be answered using a mix of secondary evidence: from innovation funds data, existing reports, and interviews with key informants, experts.

A key distinction regarding the level of development of alternatives is the following:

- Isolated projects - are single projects that address some of the issues concerning the dominant trajectory but that have not expanded to involve other actors, institutions or users.
- Niches are network of ventures/projects addressing similar issues, which involve different actors, including users. It is important for a niche to develop to have users involved in

some way. Otherwise we stay in the stage of pure laboratory experimentation rather than 'experimentation' in the real world. In a niche alternative projects are networking, lessons are being shared, and there are social, economic or policy actors that are promoting the future development of this alternative (e.g. lobbying for policy support, seeking investor capital, positioning the alternative as a solution to debates about the future of the NR). It is also the case that in a niche there is already: (i) A clear 'socio-technical' vision for the alternative pathway: guiding principles, favoured technologies, industrial organisational models, markets and user relations, policy and institutional support, among other dimensions mentioned previously, (ii) an established constituency of support for the alternative, e.g. some business interests, government departments, public research institutes, social or environmental NGOs which give an idea of the political structure that the niche has, and (iii) a minimum number of practical projects exist that are experimenting with a prototypical version of the alternative 'socio-technical' exploitation of the NR. So, when we have these elements we can talk about more advanced alternatives.

Another key distinction regarding the type of alternative is related to the direction of the alternatives. Alternatives can address the problems of the dominant in three ways, as

a) *Path-breaking*, when the project/venture, aims to take the industry/activity in a completely different direction, involving differences regarding most of the dimensions characterising the socio-technical regime, e.g. organisation, technology, product, process, market, property, network organisation, etc..

b) *Path-repairing*, when the project/venture proposes only partial solutions, to some of the problems emerging in association with the dominant regime, by typically changing some aspects of the technology used, or organisation, but not questioning issues such as the property, market orientation, etc. These projects are very important as well because they provide feed backs into the dominant regime, and create awareness about the problems of the regime.

c) *Path-diversifying,* when the activities in the dominant Socio-Technical regime stimulate new projects/venture in nearby economic sectors that help to, diversify economic activities and to increase interlinkages among industrial sectors.

2) Which are the possibilities of survival and growth of the alternatives selected? Through diffusion from one to another alternative, i.e. through the development of networks.

Here we are interested in the extent to which the niche has grown or might grow through replication of initiatives in different locations; strategic learning across replicated initiatives has facilitated or can facilitate scaled-up adaptations; and that elements of these translate into new business models and markets. Self-replicating diffusion is challenging for local initiatives; support is needed for both niche development and initiative-to-initiative networking. This suggests niches do not provide blueprints, but rather reservoirs of ideas and practices; and that dedicated work is needed to transfer and adapt from across locations, scales and contexts (e.g. into commercial

prospects). Of course, given historic difficulties in scaling-up and diffusing exemplars, it is likely that future, niche-oriented research will also end up studying the difficulties experienced by our hypothetical path-building processes: when is social learning ignored; when do expectations deflate; and why do networks fragment? What wider structural changes are needed for niches to flourish? In sum, why are some niche pathways utopian?

Existing transition studies suggest that niches grow and contribute to pathway momentum through three inter-linked processes:

a) **Expectations** contribute to successful niche building when they are robust (shared by many actors), specific, and of high quality (substantiated by ongoing initiatives);

b) **Social networks** contribute when their membership is broad (plural perspectives) and deep (substantial resource commitments by members); and

c) **Learning** processes not only accumulate facts, data and first-order lessons, but also generate second-order learning about alternative ways of valuing and supporting the niche. Here it seems important to understand the extent to which new knowledge generated in the niche can be codified and transmitted so that good experiences can be replicated. This aspect becomes crucial if one takes into account that the dominant regime has normally penetrated universities and other institutions in charge of diffusing good practices.

Niche practices become influential to the extent that processes 'a' to 'c' above become robust enough not only to facilitate diffusion, but also exert influence over wider institutional changes, such as policy support.

We propose to explore these mechanisms in detail, to try to understand the possibilities of growth of the alternative projects selected, considering as well the influence of the interactions between the three levels analyzed under the framework of the multi level perspective.

3) <u>How niche dynamics compare to regime dynamics?</u>

The regime and alternatives will be compared and contrasted regarding the dimensions explained previously. We can use them to characterise the socio-technical regime associated with any given NR industry, but also to characterise the *envisaged* (and often poorly formed) socio-technical characteristics of alternative niches and their development pathways.

The regime and alternatives can then be compared and contrasted in order to get some sense of the multiple dimensions of radical change that each alternative demands. Some will 'fit' quite easily into a reformed regime; others imply a complete transition to a new regime, were they to become the new regime. So, for example, a move from export-led, soya-dominated agriculture to intensive mixed farming is relatively easier than a move to organic farming in terms of capabilities,

technologies, markets, and institutions. Transitions analysis is interested in interactions between regimes and niches across these multiple dimensions, the intermingling and contentions between pathways, and how the development of alternatives in 'niches' may over time transform the dominant regime and lead to new pathways of development.

4) Why do niches not become more widespread?

To explore this question, in addition to the dimensions discussed above, we propose to explore the following set of processes that promote stability, informs governance strategies, and perpetuates the regime trajectory (Walker, 2000, Unruh, 2000). These processes include (Marin & Smith, 2011):

Capabilities. The innovation activities of incumbents are constrained by existing capabilities and knowledge (Dosi 1982; Nelson and Winter 1982), which channel technical developments into restricted subsets of all possible directions (Kemp et al., 1998, Elzen et al., 2004). Innovative activities and investments are also constrained by existing beliefs and perceptions, routines and habits. The accumulation of capabilities around the use of Zero Tillage technologies in the agricultural sector in Argentina is a good example of how this mechanism operates. This is limiting explorations in other possible directions within the agricultural sector (such as ones involving for instance rotation between agriculture and cattle) but also in related sectors, such as the agricultural machinery sectors.

Economics. Existing technologies tend to be cheaper and more efficient in the short run because they have benefited from long periods of dynamic increasing returns (e.g. learning-by-doing and using, scale economies and positive network externalities). This puts them in advantageous positions compared with novel practices (Arthur, 1989; Dosi 1982), and explains why developing countries adopt them massively in most industries, particularly in the export-led industries. Thus, it is not surprising that developing countries face important economic barriers to move to uncertain alternatives, since this means departing from important economic benefits gained from investment in existing technologies. The adoption of GM in the agricultural sector in Argentina once again provides a good example of this economic barrier to change. GM soya bean explains 25% of the country exports, and 8% of all tax revenues. Moving to alternative technologies in this sector would mean therefore that the government has to offset one of the most important sources of income at the moment, which is also being used to maintain the current exchange rate, and therefore the only industrial policy of the government.

Vested interests. Incumbents have sunk investments (in capital, competencies and social networks, for example) that they will try to protect. They therefore resist any radical change that threatens them. Large, established industries may contain divisions and individuals with more radical ideas, but they are less often empowered to implement these if core business interests are thereby challenged.

Politics and power. Incumbent businesses, regulators and others enjoy important positions in the current system. Economic power bestows considerable influence; they have voices that will be listened to by innovation policy processes (Smith et al., 2005). Innovators outside this nexus rely on future expectations to make their case. 'Outsiders' need not be small players, for example large information technology companies can be outsider innovators, but have a potentially transformative role to play in a move to 'smarter' technologies that threatens some incumbents. However, 'outsider' innovators are often relatively weakly organised compared to incumbents. Whilst today's shareholders, workers and customers can invest, vote and exert influence in numerous ways, tomorrow's stakeholders in more sustainable systems are a constituency less immediately powerful politically or economically. The Argentinean agricultural system assures that the voices of big business are heard by providing companies, such as Monsanto, Singenta, Dow and Bayer a place in the discussions of Conabia (the main body responsible for GM approvals).

Infrastructure. Existing technological devices may be embedded in dedicated infrastructures that make their substitution with alternatives difficult (Jacobsson and Johnson, 2000). A very good example in this sense are the existing programmes in degrees in Agronomic Sciences in Argentina which increasingly only teach subjects and contents that support the use of Zero Tillage, transgenic, etc..., with not mention almost to any other competing technology.

Institutions. Government regulations and subsidies, professional associations, and market rules have co-evolved as part of existing systems and tend to reinforce existing trajectories of development (Hughes, 1983; Walker 2000). In the case of Argentina, the way these different institutions have evolved together to provide support for the use of biotechnology in the agricultural sector has prompted some analysts to identify a Bio-hegemony in this country (Newell, 2007): "bio-hegemony has been produced and sustained by an alliance of interests which included powerful agribusiness producers and traders (such as Cargill), export-oriented elements of Argentine capital (such as Biosidus, Relmo, and Don Mario), multinational biotechnology firms (such as Syngenta, Dow and Monsanto), large commercial banks, and supportive elements within the Argentine state itself" Newell, 2009, p. 35).

These processes interact and mutually reinforce one another, thereby structuring the way industries commit to certain socio-technical trajectories rather than others (Geels 2002). Systems that have become 'locked-in' to these trajectories are difficult to unsettle and re-direct.

Innovation research in both evolutionary economics and STS traditions argues transformative processes be conceived as challenges of socio-technical re-configuration (Rip and Kemp, 1998). Considerable technical, economic, sociological and political work has to be done to align discourses, actors, artefacts and institutions into a working ensemble. Consider all the material, discursive and institutional elements and changes needed to make an organic food system succeed: specialized knowledge, reliable techniques, skilled workers, investment capital, supply and distribution infrastructures, maintenance services, willing customers, profitable markets,

acceptable environmental impacts, and so on, and so on. Considerable social agency is required (Marin & Smith, 2011).

Developing such highly novel, 'path-breaking' socio-technical configurations takes place in the context of the deeply embedded, substantially institutionalized and widely reproduced 'socio-technical regimes' characterised above (Unruh, 2000; Geels, 2002). At times, it can appear as though societies are 'locked-in' to certain regimes, such as the intensive GM soya bean complex in Argentina. However, inflexible path-dependent alignments can, under certain circumstances, become a source of fragility as circumstances change. For instance, in Argentina the highly concentrated benefits and dependencies under the soya boom, and the inability of the soya 'socio-technical regime' to address this problem through incremental reforms, is leaving this mode susceptible to criticism and growing dissent. In addition, internal misalignments, brought about by technical changes or shifts in ownership for instance, can combine with external processes, such as concentration of wealth, growing impoverishment, rising environmental awareness, demographic change, and resource shifts. Such processes can unsettle regimes and open windows of opportunity for alternatives to develop, and perhaps seed transitions towards radically different configurations.

4. SOME ASPECTS OF THE METHODOLOGY TO BE USED IN THE CASE STUDIES AND QUANTITATIVE ANALYSIS

4.1 How to use case study evidence to respond these questions

We propose to select three ventures to be studied in case studies. The design of the study should include the main network surrounding each venture. So, interviews should be conducted not only with the entrepreneurs in charge of each venture, but also with the main actors at the center of the networks built surrounding the venture, i.e. sector experts, suppliers, technicians, institutions involved, etc. We have estimated that around seven interviews should be conducted related to each venture.

The three ventures should include at least, one more radical and less radical, or aiming to path repairing, rather to path breaking. As discussed above the more radical ones would be the ones that departure in more dimensions such as technology, knowledge, organization, etc., with respect to the dominant.

We propose to use open questionnaires to conduct the interviews. The questionnaires should be adapted to the characteristics and role of the interviewed, and of course, the survey will be designed so as to use language familiar to the practitioners rather than jargon from socio-technical pathways framework. An outline with the main issues that should be covered will be circulated among the team members before the start of the fieldwork.

The questionnaires will have different sets of questions that will guide the gathering of information, among them we are considering the following ones:

- Questions oriented to explore the nature of the alternatives, which could be isolated or more developed into a network of projects, or more or less radical. Regarding the second issue, it is key to understand the aims of the main advocates of the alternative.

- Questions oriented to understand the possibilities of survival and growth of the ventures projects. Here it is important to explore whether the good experiences have been replicated in other contexts, whether knowledge has been codified, whether or not other actors in the system know about the experience, besides the radicals, if a market exist for the products, etc.

- Questions oriented to characterize the alternative according to their main actors view based on the different dimensions mentioned above.

- Questions to compare and to shed light on the different interactions between the alternatives and the dominant socio technical regime dynamics.

- Questions aimed to identify the main barriers that block a widespread expansion of the alternatives.

With the purpose of gaining a better understanding regarding all these issues it will be necessary to complement case studies with a review of secondary information, interviews with experts, etc.

4.2 How to use Innovation Funds dataset to respond these questions

Innovation funds data may be used in two ways: to help identify alternatives and key informants for interviews, and as a complement to interviews, to characterize alternative pathways in different ways.

Regarding identification of alternatives, in theory, it could be possible to create a predictive function that classifies all funded projects into either the dominant trajectory or a particular alternative pathway. In practice, because of the complex relationship between niches and regimes, this doesn't make much sense. Moreover, data in most countries is not as rich as to allow something like this to be done. What can be done even with the most basic data, is to manually find projects associated to alternative pathways, with help from keywords that are only associated to the alternatives and not to the regime (such as 'organic' or 'natural herbicide' in the case of soya). Project names and descriptions should help confirm if the projects are effectively associated to pathways. Then, individuals and institutions associated to these projects can be considered for the case studies interviews.

The other potential use for innovation funds data is to help characterize alternative pathways, complementing the case studies. One particularly interesting way of characterizing them with this

data is to try to build the networks associated to each alternative. This would allow us to complement the MLP analysis with a social network theory analysis (Caniëls and Romijn, 2007).

Innovation funds data may help in answering all of our main questions related to the alternatives. With respect to their characterization, funds data may help understand how radical they are, characterize their actors, and their networks, as described above. Regarding possibilities of survival and growth, funds data may give us an objective measure of the alternative's progress, in terms of the amount of projects funded, and how the new projects are making or not progress along the alternative's roadmap. Project descriptions may even complement interviews in understanding the desired future development of the alternative, as well as the way in which the alternatives plans to break into or interact with the regime (this could be seen in the objectives declared by the projects, for example). Depending on the available data, it may also give information in several dimensions of interest, such as types of knowledge, infrastructures and technologies preferred, if they promote linkages or not, if they make use of particular local resources or not, or their relationships with users and markets, to name some.

If it was possible to have access not only to funded projects but to funding applications, this would also allow us to study if the institutionalized regime is inducing a bias in project funding.

5. CONCLUSIONS

In this paper we have made some propositions about how to apply the theoretical framework that has been reviewed in Background Paper 1 (Marin & Smith, 2011) to explore the research questions of our project. In particular, we have started to consider adaptations to the socio technical transitions framework that will allow us to apply a better framework for NR based problems in developing countries. We have also advanced on the methodological front, by proposing some specific steps to identify alternatives and investigate them. More specifically, we have proposed to explore the following three questions:

Do we have in the region alternatives potentially capable to transform NR activities in better directions? How developed are they? In which directions do they aim to go? Do they aim mainly to feed up or transform? How do they compare with the dominant regime?

How do "successful" niches become widespread, by creating institutions, networks, diffusion from one to another alternative, etc.? and,

Which are the main factors that contribute to lock in situations, or obstacles to growth and propagation of these alternatives? How can they be removed?

Finally, we have provided some guidance regarding how to conduct the cases studies, and about how use data on innovation funds to complete the information gathered in the case studies.

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