Chapter 1. New identities, new commitments: something is lacking between niche and regime

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Abstract

This paper analyses the difficulties in achieving the alignment of actors playing different roles in innovative processes. In so doing it seeks to further our understanding of transitions towards sustainable agriculture. We use an analytical framework that combines the Multi-level Perspective with the Actor Oriented Approach in order to examine the emerging ‘novelties’ generated by family farmers producing medicinal plants in ecological systems in the South of Brazil. We identify the characteristics that fit a definition of ‘innovation niche’. We describe the main weaknesses preventing the complete emergence of a niche, and analyse the misalignment of the various actors’ expectations. This is partly due to the incumbent regime’s strong relationship with the dominant technical-scientific fields, which contrasts with ecological agriculture that is known for its remarkable connection to social, technical, organisational, and behavioural changes. The novelty production of medicinal plants clearly illustrates some of the broader transitions at work in rural development. The case study also highlights the importance of finding ways to effectively manage these ‘niches of innovation’, in order to strengthen the internal coherence of their socio-technical dynamics and to reinforce the social networks. As part of this process, there is a clear need to institutionalise new professional identities that are willing and able to question and even disrupt existing commitments.

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1. INTRODUCTION

Sustainability in farming activities is not only a goal to be achieved; above all, it must be seen as a learning process. Amongst other things, this process requires giving back to the technique its original social component, which has often been lost along the way through the trajectory of agricultural modernisation. Yet despite general consensus about the negative impacts of agricultural modernisation, society and science are still a long way from finding the answers needed, and transitions toward more sustainable development could still head in unexpected directions.

The loss of the social dimension of agriculture has two main consequences. The first is the separation of farming from the particular and heterogeneous socio-material environment in which it is situated, and the subsequent weakening of the co-production processes that exist when the two are closely intertwined (Ploeg, 2003). The second consequence is the very strong institutionalisation of agricultural modernisation, which is seen as the only and self-evident development trajectory (Roep and Wiskerke, 2004). The unquestioned superiority of agricultural modernisation has also had the effect of de-legitimising alternative options, routes and policy objectives, seen as unacceptable because they are at odds with the self-evident (ibid.).

The inequalities that have resulted from the modernisation process, especially in less developed countries, have created a myriad of situations and contingencies which have led farmers to innovate. They do so for a range of reasons, often economic but also frequently rooted in ecological consciousness and/or political engagement. Farmers support and network with other actors, to varying degrees, in order to creatively find new ways of producing, creating alternative markets and empowering themselves. Yet while farmers are experimenting with new ways, it is important not to forget that the modernisation regime is institutionally incapable of doing or seeing things differently.

If one wishes to move beyond simple and limited responses to the agrarian crises (i.e. to move beyond seeking to adapt technologies that meet the imperatives of a narrow sustainability – the ecological modernisation approach – or attempting to simply include marginalised farmers in conventional markets) it is very important to recognise the multitude of local initiatives as a source of potential change. This is particularly true in countries like Brazil where farmer-led innovation is driven not so much by the need to reduce pollution or use less inputs and energy, but by the imperatives of achieving food security and reducing poverty. This means that local initiatives may well follow different technological pathways. At the same time, local initiatives are crucial for social learning to take place and for sustainability to be legitimised as a societal goal.

Ecological farming often embodies many of these sources of potential for change. The development of ecological production systems involves practices that are considered deviant in conventional agriculture, which favours practices and
knowledge that call for an extensive use of inputs (agrochemicals, energy etc). Ecological farming shares a different goal, achieving sustainability in farming, even though it is expressed in a number of ways that differ slightly from one another (in Organic, Biological, Natural or Biodynamic Agriculture, and even Permaculture - as well as the practices associated with local and traditional knowledge). The common features that characterise sustainable agriculture include: nutrient recycling, promoting atmospheric nitrogen fixation and improving soil biotic regulation; managing the agro-ecosystem, with an emphasis on soil, water and energy conservation and increasing agrobiodiversity; reducing the use of external inputs, especially non-renewable ones; integrating local and technical-scientific knowledge and practices together; promoting trust and interdependency between farmers and urban and rural populations [adapted from Pretty (1996) and Gliessman (2000)].

The emergence of this agriculture is not only based on the creation of new products or alternative food chains, but also involves the construction of different social configurations, and requires new patterns of learning and the enrolment of many different social actors. In this sense, the evolving practices surrounding the production, processing and distribution of medicinal plants represent an intriguing manifestation of ‘Novelty Production’. Novelty Production is a key term for describing the emergence of something new: a new practice, a new insight, new artefacts, innovative social or institutional arrangements and so forth (Ploeg et al, 2004). However, while many novelties have the potential to contribute to the global transition towards sustainable development, they remain relatively isolated or hidden. Our first objective in this paper is to highlight the novelties that have emerged from this ‘dissident’ form of agriculture.

The second general objective is to propose a complementary combination of two approaches, by providing a multi-level, multi-actor and multi-aspect analytical framework that integrates structuralist elements from the Multi-level Perspective (Geels et al., 2004) and constructionist patterns from the Actor Oriented Approach (Long, 2001). Using this framework we explore the emerging novelties generated by family farmers producing medicinal plants within ecological systems in Southern Brazil. The empirical research is based on an in-depth qualitative study, which includes five cases of family farmers from different locations in the states of Santa Catarina and Rio Grande do Sul (in the South of Brazil). Complementary interviews were held with eleven scientists who work with medicinal plants. We also analysed reports and speeches from seven different technical-scientific events about medicinal plants at national and international level.

While investigating the novelties and associated learning processes and social relations, we recognised some characteristics reminiscent of an ‘Innovation Niche’ (Kemp et al, 1998; Wiskerke, 2003). We also observed the difficulties involved in establishing a complete innovation niche for medicinal plants – despite the presence of dynamic local innovation. The main purpose of this paper
is to analyze the constitution of this niche, and identify the barriers to fully developing a protected space for it.

We begin by setting the scene at the location where the work took place. We then outline the theoretical approach which guided the empirical research and which orientates the discussion. The analysis is threefold. The first part describes the elements characterising the construction of the promising innovation niche, particularly the novelties involved in producing medicinal plants within ecological systems. The second part reflects on the processes required to change actors’ identities and their established commitments towards the agricultural regime. The third part looks at the gaps that exist between the niche and regime levels, which might influence processes of structural disruption associated with socio-technical transitions. Finally, we draw some conclusions on the broader significance these findings may have.

2. SETTING THE DEBATE

Agrarian studies are underpinned by the notion that ‘technical progress’ is the way to overcome natural obstacles in order to enable the capitalisation process in the agricultural sector (Graziano da Silva, 1981). In Latin America (and Brazil in particular) this notion, together with diffusionist ideals (Rogers, 1958; Schultz, 1965) and the “Induced Innovation Theory” (Hayami and Ruttan, 1978), has unquestionably influenced the research, teaching and rural extension systems.

During the 1970s the Brazilian government pursued agricultural policies that provided credit, guaranteed prices and investment in research, supporting what is now known as ‘conservative modernisation’, a trajectory that deepened existing social and regional inequalities (Gonçalves Neto, 1997). As in other parts of the world, this model of agricultural modernisation had significant negative impacts on the quality of soils, water and biodiversity as well as the health of rural and urban populations.

Brazil is a vast country with huge ethnic, cultural and ecosystem diversity. As such, responses to modernisation vary and may have the potential for providing important new blueprints for sustainable development. Yet agricultural innovation still remains geared towards becoming more competitive by promoting modernisation, for instance through the introduction of genetically modified organisms or even ‘greening’ agricultural export commodities. In such a context one can raise questions about the extent to which the institutions involved in research, teaching and rural extension will be able to comprehend the country’s social and natural diversity and develop appropriate strategies to support a transition towards sustainable development.

Critics of innovation in the Brazilian agricultural system adhere to two main streams of thought. The first comes from neo-Schumpeterian inspiration: it recognises weaknesses in the ‘demand-pull’ and ‘technology-push’ models, but
limits its proposals for institutional change to making adjustments that will better meet changing production and market needs. The second has non-specific theoretical underpinnings but generally highlights the need for paradigmatic changes, which recognise that sustainability requires more than market-led development, and rejects the positivist episteme of science as the single guide for innovative activity.

The controversial issue of the adequacy of technological innovation to meet the sustainability challenge stems not only from the inherent limitations of a top-down approach, but also from the absence of interaction with society at large. There are many social aspects to innovation (production and consumption, technology, policy, government). Rotmans and Kemp (2003) claims that changes in the direction of innovation are fundamentally contingent on technological breakthroughs with unidirectional science-to-practice models. Poel (2000) takes this further, advocating the need for innovation to involve new actors, previously considered insignificant, as they are external to the institutions that specialise in research and development.

It is also important to remember that the production of novelties by farmers (and other related actors) is linked to the development of practices that combine the material, social, symbolic and institutional realities embedded in existing patterns of socio-technical interactions at various levels (Ploeg et al, 2004). Kemp et al. (1998) argue that, innovating, creating conditions for the emergence of novelties, changing behaviour and consolidating these changes at different levels involves a dynamic that must first and foremost be understood as a 'learning process' in which numerous actors are engaged. But it is not always clear how to bring together these different actors, who belong to different ‘worlds’ and speak different 'languages'. Establishing and managing such encounters is one of the biggest challenges for developing new technological practices or establishing a distinctive system of innovation within agriculture.

3. INTEGRATING DIFFERENT THEORETICAL APPROACHES

As there are several promising pathways to (re)-grounding technology in society, it is important to identify and analyse the structural aspects (e.g. from landscape level) in order to establish general inferences about the evolution of technological phenomena. However it is also important not to lose sight of specificities, localities, actors’ protagonisms and knowledge contextualisation. However, the analysis of inter-relations at different social levels usually only focuses on administrative rules and procedures, showing, for instance, the ways in which they shape the work of organisations (Long 2001). Moors et al. (2004) suggest that the interactions between technology and society can be better analyzed by adopting a multi-level, multi-actor and multi-aspect approach.

This approach takes the view that innovative processes are mobilised through co-evolutionary dynamics that emerge from the interaction of nature, techniques
and institutions. These dynamics work at different levels and influence the feasibility and socio-technical stability of innovations. Agency plays a key role here. This approach is a combination of two different approaches, which share a number of common assumptions: the Multi-level Perspective (MLP) and the Actor Oriented Approach (AOA). Both perspectives consider agency to be multi-dimensional, with actors having their own interests and acting strategically, but also being constrained by embedded social structures.

The Multi-level Perspective adopts an interdisciplinary approach to describe socio-technical changes, and is strongly influenced by evolutionary economics, neo-institutionalist notions, and Giddens’ theory of structuration (1984). According to Geels (2004:33), this approach “sprouts from a combination of sociology of technology and evolutionary economics” which seeks to explain technological transitions through the use of three different analytical concepts: the innovation niche, the technological regime and the socio-technical landscape. A niche can be defined as a specific domain within which actors take risks. Innovation (or technological) niches are deliberately created by the actors involved and are supported by specific institutions and rules that limit or guide actions, and that may be regulative, cognitive and normative (Geels, 2004).

Kemp et al. (1998:182) have defined a technological regime as a “whole complex of scientific knowledge, engineering practices, production process technologies, characteristics of the products, skills and procedures, institutions and infrastructures that make up the totality of a technology.” Since it involves many social groups with common rules and a shared grammar that guides and provides stability to the whole socio-technical system, Geels (2005) argues that it is possible to think about a socio-technical regime as a semi-coherent set of rules held by actors linked to different meta-coordinated regimes (technology, science, market, socio-cultural and policy).

The broadest level is the ‘landscape’, representing the whole background of variables, factors and processes that influence the technological transition and consequently the regimes and the niches. The degree of social and institutional structure increases from the micro level (niche) to the macro level (landscape) (Geels and Schot, 2007).

The Actor Oriented Approach (AOA) stems from a long tradition of empirically based studies in the anthropology of development and rural sociology, and it is centred on the notion of human agency, which posits that actors (individual or collective) have a certain capacity for processing social experiences and responding to problematic situations. AOA has often focused on ‘knowledge encounters’, seeking to overcome dichotomised representations of different forms of knowledge (i.e. modern science versus popular science; exogenous versus local knowledge) (Long, 2001). This approach highlights the relevance of discourses that incorporate metaphors, representations, images, narratives and affirmations, which guide the truth on objects, people, events and their inter-relations. These discourses produce texts which may be written, verbal or non-
verbal, and which bestow meanings upon infrastructure, technologies and styles of agriculture (Long, 2001; 2007).

The study of ‘novelties’ in agriculture could therefore be furthered by including theoretical-methodological approaches that recognise the importance of articulating and enlarging learning processes, particularly in light of what Long and Ploeg (1994) called the multiple aspects of the social life of rural development and the corresponding cognitive processes involved.

In practical terms there is potential for locally developed innovation processes and technology choices to be a driver of technological development at a broader societal level. To a certain extent, this assumption puts agency back at the core of dynamics of socio-technical change. This can be better understood by examining how actors support the niches they are involved in. There are many aspects to this process, including the relations between actors and their networking capacity, the cognitive processes involved in practices and in novelty production and the establishment of new rules and institutions. However the exercise is not purely academic – the key objective is not to search for patterns in the construction of niches. It has a more practical focus: to understand how to create more sustainable and innovative spaces.

Insights from socio-technical transition studies suggest that the micro level of action in innovative processes is the main _locus_ of regime change, mainly because there is less structuration at this level (Hoogma et al, 2002; Berkhout et al, 2004; Geels and Schot, 2007). But it is important to stress that the extent to which even successful niches can be effectively adopted at a broader level is limited. Geels and Schot (2007) mention that one more frequently finds a multiplicity of reactions between niche elements and regime components. Moreover, Smith and Stirling (2008) point out that regimes can co-opt elements of a radical niche into an incremental process of change.

Geels and Schot (2007) argue that niche-regime relations can perhaps best be analyzed through the prism of social theories with a stronger focus on the specific causal mechanisms involved. Smith et al (2010) reiterate this point, stating that in empirical settings the distinctive boundaries between niche and regime are not as clear as MLP implies. These authors stress that more research targeting the micro level is needed, as well as better awareness of the fact that the incumbent regime may not be as homogenous as is generally assumed and that a self-evidently sustainable niche is encompassed by broader complex reality.

Hence analytical MLP constructs contribute to developing a deeper understanding of the structural change processes involved in technological development by addressing the interrelations between different levels. AOA provides a complementary approach, which emphasises the need to understand the cognitive processes that emerge from actors’ actions, struggles and networking. An integrated approach to analysing innovative processes in agriculture thus appears to be fruitful.
4. A NICHE UNDER CONSTRUCTION

The global demand for medicinal plants is steadily increasing as natural products become more popular. In the case of Brazil, there are also long-standing traditions of utilising such plants, and public policy is now supporting the introduction of phytotherapy within the public healthcare system. Since 2006 Brazil has had a National Policy on Integrative and Complementary Practices, which embraces the implementation of a National Programme for Medicinal Plants and Phytotherapeutics (Brasil, 2006b). There are many reasons to expand the cultivation of medicinal plants (including obtaining quality assurance and measures to control excessive wild harvesting). However, these 'new crops' are unusual farm products and their domestication and/or cultivation presents several particularities that require significant innovation.

Usually, improving agricultural processes is a matter of increasing biomass production (especially when driven by the principles of modernisation). But with medicinal plants the aim of cultivation is to obtain the active ingredients, which are usually produced by the secondary metabolism of the plants. This means the issue of how to manage (or how to research) these crops needs to be thought of differently. Another difference is that there are thousands of medicinal plant species; most of them not domesticated. Taking an interesting plant from nature and turning it into a standard crop is not a simple matter. Moreover, this huge range of biodiversity is associated with traditional and/or local knowledge held by many different social groups, further complicating the search for innovation. Despite advances in pharmaceutical research and a lot of effort from specialised but isolated groups in agrarian research institutes and universities, there is as yet no nationally coordinated approach to develop the potential of this sector.

Without any off-the-shelf technical package for cultivating medicinal plants ecologically, farmers have sought solutions and produced novelties based on contextual knowledge, building on their own practices and a dynamic learning process that flows through networks created using their social links. These networks have emerged from farmers’ involvement in social and ecological movements, alternative markets, healthcare programmes, communitarian services and (formal and informal) education activities. From this point of view the ecological production of medicinal plants can be considered a 'novelty', generating a number of other interrelated novelties.

The novelties developed by farmers include an assortment of soil management and cultivation systems, the development of special drying and packaging methods, the establishment of local partnerships for processing the products, the continuous introduction of new species and varieties, and the creation of alternative channels of trade and non-farming activities, such as the integration of these activities into rural tourism routes. Each of these novelties has an impact and generates a response, combining elements such as biodiversity, technology, symbolic values, work, organisation, knowledge and economic value. The
coordination of several novelties which emerge from each other is represented by a 'Web of Novelties” (Figure 1).

**Figure 1. Web of Novelties in the production of medicinal plants within ecological systems**

It is important to highlight that this new kind of crop is not seen as a novelty simply because it is an unusual product or creates new market niches, but because the new configurations that are required for this farming activity to emerge involve encounters between different bodies of knowledge. Many aspects of this novelty are deeply grounded in local contexts and (implicitly or explicitly) challenge the established codes of conventional agriculture's socio-technical regime.

The farmers’ narratives show that they deliberately resist the technical and economic homogenisation imposed by conventional agriculture, and mobilise all sorts of socio-technical elements to tap into the potential of the natural diversity surrounding them. The continuous expansion and re-creation of a diverse novelty production evolves through knowledge construction processes, including improvising and experimenting with old and new elements. People react circumstantially, imaginatively and consciously to constraints and opportunities, drawing upon their cultural repertoires, texts or acquired behaviours (Long, 2001).

The dynamics of the genesis of novelties, which takes place at the niche level, emerge from everyday practices developed by farmers. It also involves the mobilisation of a set of social relations, which in and of itself represents a knowledge generation process. In other words, even though the end result may
only be a small change in some agricultural technique, the relationships themselves are novel, because they do not correspond to the conventional path of technology generation and diffusion.

The families who collaborated with the study are pioneers in cultivating medicinal plants within an ecological system in the south of the country. The analysis of their trajectories shows that they have been inspired by distinct motivations. They commonly reject conventional agriculture, create numerous innovation strategies, and broaden their spaces of autonomy, so as to be able to maintain their 'rural lifestyle' and preferred way of carrying out agricultural activities. Such strategies go beyond optimising and recombining production factors: the farmers seek to establish a new nexus and new alignments between distinct blocks of knowledge, expectations and institutions in their quest to produce medicinal plants.

Some farmers working with medicinal plants are involved in different social movements, for instance, the Movimento das Mulheres Camponesas (MMC), a Brazilian group with a strong feminist and socialist perspective; and the Movimento dos Trabalhadores Sem Terra (MST), a group struggling since the 1980s, for comprehensive land reform. More recently these movements have adopted the sustainability discourse and are now explicitly oriented towards agro-ecology. Both movements are part of Via Campesina and, as such, are aligned with other like-minded movements around the world: they seek political alternatives to neoliberal globalisation and, in practical terms, build creative spaces to develop agriculture’s endogenous potential (Sevilla Guzmán and Martínez-Alier, 2006). The contact with, and participation in, these broader movements has enabled the farmers to create local spaces for action and collective learning, as well as affording many opportunities to develop new social ties with different actors.

An interview with one family illustrates the interrelation between political and productive activities and the family’s multiple engagements with such movements: “we are fighters, we took over the land through our engagement in MST that goes back eight years, but we were ecologists before that”. They are based in the extreme south of Brazil, in a region historically dominated by extensive beef cattle production on very large ranches. By contrast they have a plot of 24 ha, where they manage more than 120 different plant species, producing dried plants to sell as tea or as raw material for the small-scale production of hygiene products (shampoo, soap, moisturiser, etc.). One of their marketing channels is the MST network of shops, established in three big Brazilian cities, where they can sell their tea bags under the MST label.

Another example is the trajectory of a farmer from Santa Catarina, who began to work with medicinal plants in communitarian services linked to the Catholic

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3 Peasant Women Movement.
4 Landless Workers Movement.
5 An international movement of peasants, small and medium-sized producers, landless, rural women, indigenous people, rural youth and agricultural workers.
church. After her engagement with the rural women’s movement she, together with other neighbours and with support from the movement, founded an association and set up regular meetings to exchange information and “to learn together”. Later, they integrated extensionists from the state service and teachers from the local university “to help out”. Justifying the invitation she said: “it was necessary to carry out the botanical identification; it’s important to know and it’s a requirement to sell the teas”.

This led them to get a stall to sell the medicinal plants (and other farm products) in a local market-place, inside the university campus, thereby generating income for their families. The purpose of this group is not just to develop a profitable activity, but also to provide plants, remedies and information about basic healthcare to other groups, networking with different actors. This farmer’s personal knowledge and practical experience led her to work in an official healthcare programme together with physicians and pharmacists. This amplified existing social links and created new ones, as well as possibilities to exchange knowledge. This small fragment of one farmer’s trajectory highlights how new social configurations, which involve the actors networking and encountering different forms of knowledge, are at the source of novelty production.

We followed the farmers’ daily activities, which allowed us to observe their other engagement, for example with urban consumer movements. Three of the five families began their commercial activities with medicinal plants through their involvement with the Cooperativa Coolméia, a cooperative that brings together consumers and farmers to create alternative chains for ecological products in Rio Grande do Sul. Since 1989, the farmers have been commercialising medicinal plants through face-to-face markets – one of the current market places receives over 5,000 visitors every Saturday. Their customers and visitors include teachers, researchers, students, public agents, politicians, etc. The farmers recognise the value of these encounters, which create social links that are valuable for exchanging knowledge, mobilising resources, accessing public policies and, in some cases, collaborating in research activities.

The empirical evidence shows a rich set of social relations between multiple actors, which sometimes generate networks. These actors sometimes create linkages between fields of action such as emancipatory movements, the technical-scientific domain, health care programmes and organisations of farmers, consumers and environmentalists. These overlaps seem to provide the conditions needed for the emergence of an innovative space that supports the ecological production of medicinal plants. However, considering that space as an innovation niche does not mean it is a project that has explicitly defined and common goals, shared by all the actors involved. Here, following Geels (2001:5), the niche is understood as an analytical concept to describe socio-technical dynamics, not as an ontological description of reality or a functional and well-defined part of a system.

Projects conducted through ‘Strategic Niche Management’, with a wide empirical base, will generally refer to experiments conducted under shared agreements by
distinct actors. Such experiments need not be limited to strictly delineated and scientifically structured approaches for assessing statistical significance or establishing the value of a pilot project. The most significant feature of this experimentation is that it takes into consideration users’ needs, social benefits, negative effects and regulations (Hoogma et al., 2002). Testing, in this case, should be seen as a learning process in which the potentialities of a novelty are articulated and accepted (Wiskerke, 2003).

Such experiments emphasise dialogue between scientists and farmers (sometimes even state public agents) and, most of the time, relate to a specific location or region (Wiskerke, 2003; Stuiver, 2008). Technological innovation niches are usually protected spaces that have been deliberately created, where innovations can be “nourished” until they become sufficiently “ripe” (Hoogma et al, 2002). For Wiskerke (2003:432), “developing a niche means exposing the novelty step-by-step to real-world conditions”.

The case studies on which this paper is based do not exhibit any deliberate efforts to protect a space for innovation. Yet it is possible to observe some alignment between strategic expectations and engagements that allows us to catch a glimpse of the emergence of the innovation niche. The farmers’ capacity for innovation and the intrinsically deviant nature of the novelties seem to open up certain spaces in the ‘real world’ that suggest dynamic and innovative activity within the emergent niche.

Kemp et al. (1998) suggest that a niche can be distinguished by the presence of three internal processes: a) the articulation of learning processes; b) the establishment of social networks; c) the development and alignment of strategies and expectations. Wiskerke (2003) states that these processes not only guide the innovation niche, but can also be used as indicators for evaluating its success.

The families’ trajectories show that they rejected the ‘expert systems’, associated with the industrial production of poultry or tobacco, and chose to make medicinal plants their main farm product. This involved introducing complex productive processes that embraced changes in technical patterns, family organisation and social and market relations. It required the families to acquire and develop new abilities and practices, which they achieved through persistent observation and experimentation. Despite their pre-existing base of techniques, information, and patterns and practices acquired through their previous agricultural experience, an articulated learning process occurred. This process involved optimising and re-orienting the use of their resources, developing and fine tuning their processes in line with the available factors of production and creating (and re-creating) their abilities and knowledge. These activities were necessary to overcome the limitations imposed by the regime. Such processes are a key characteristic of the emergence of novelties (Oostindie and Broekhuizen, 2008), in addition to their potential to promote the innovation niche.

The second distinguishing feature of the niche was observed in the establishment of networks that developed between individual and collective actors. These provided the conditions for the emergence of social networks through which,
knowledge could flow and allow the articulation of learning processes to overcoming the limitations imposed by the economic order, the legal system, objective technical obstacles and political barriers to the claims and aspirations of the farmers. The creative and well-timed agency of the farmers and other actors led to the creation of networks that improved the farmers’ organisational and strategic capacities to overcome obstacles, and influence ideas or events that eventually lead to ‘novelties’.

The dynamic nature of relations within these networks and even with less complex individual engagements on a smaller scale seems to constitute one of innovating niches’ strengths. Callon (2004) states that it is difficult to predict the results of a network because they depend on malleable and mouldable configurations built by actors. This unpredictability might stimulate novelties, which usually arise as irregularities. Networks often lack a well-defined objective but emerge out of the articulation of knowledge and experiences stemming from such relations.

Nevertheless, social order is never completely consistent; actors always find alternative ways of formulating their objectives, establishing specific ways of intentionally and consciously taking action and providing reasons for their behaviour, which is also driven by feelings, emotions, perceptions and identities (Long, 2001). In other words, the existence of a social network will not necessarily guarantee the success of the niche; it is necessary to ‘learn’ about the networks themselves, especially if we consider that the more diffuse the interests, the more difficult it is to obtain the specific engagement of actors promoting the niche.

“Novelties are related to expectations. It is, however, far from evident whether the eventual outcomes will match the initial expectations” (Ploeg et al, 2004:2). When actors are involved in a niche, they base their strategies and expectations on their own vision of a new socio-technical configuration. It is sometimes difficult to align the expectations of different actors if such visions are not clearly set out. In the case of ecologically produced medicinal plants, this study suggests that since there is no full agreement about ‘expectations’ we can consider it a ‘quasi-niche’.

The field interviews illustrated these difficulties. At the local level, the farmers felt that the technicians and extensionists initially lacked faith in the emerging activity: they were completely sceptical about the viability of ecological production and even more so about medicinal plants. Many of the farmers’ narratives stressed this point and the absence of support or specific knowledge. In the words of one farmer:

“It’s very easy to achieve the conventional; it’s much easier, if you produce with a conventional package based on pesticides and so on. [...] if you have a poultry production for example you will get a lot of technical support. Whereas for ecological farmers and even more so for those who produce medicinal plants, we are few, we are alone”.

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The networks in which the medicinal plant producers are embedded are mainly characterised by arrangements between farmers’ organisations or unions, social movements and consumers’ cooperatives. While some researchers and extensionists may be involved in the network, it is quite clear that their engagement is not always effective. Most of the cases show that the relationship between technical-scientific actors and the farmers still depends strongly on bilateral relations or even just on sporadic individual dispositions. One of the farmers described his relationship with a local university:

“They don’t understand what I’m doing; they think that my system is anti-economic, they think that I need standards and a bigger scale to earn more, but this is not my objective”.

The third distinguishing feature of the niche, the construction of alignments between actors, is possibly the main hurdle towards developing the niche for ecologically produced medicinal plants. However, due to some entrepreneurial success, the enlarging of networks and the intensification of public policies to encourage production systems based on agro-ecological principles and territorial sustainability, the situation is improving. Some technical/state actors are now more inclined to work with farmers searching for new socio-technical configurations. A farmer who has been producing medicinal plants for the last ten years illustrates this point:

“When I began, at that time, if you asked the extensionist something about organic or ecological production or something about fennel or another herb... they’d look down their nose at you. They had no knowledge about it, because they were trained within the framework of the green revolution. Today this has changed, [...] over the last two or three years they have started changing their ideas”.

New policies in Brazil are recognising family farmers as important actors for promoting rural development, and the value of biodiversity as a resource for the healthcare system is gaining recognition and legitimacy. However it is probably too early to draw any definite conclusions about regime change. And we lack sufficient empirical evidence to assert this. Still, it is possible that windows of opportunities are being opened by changes at the landscape level, possibly in response to societal pressure in favour of sustainability. On the other hand, without overcoming the difficulties faced in the shared construction of strategies by actors at the micro level, it will be difficult to achieve complete innovation niches.

5. CHANGING IDENTITIES, ESTABLISHED COMMITMENTS

We should not neglect or forget the fact that “the technological niche is formed against the background of the existing regime and landscape” (Geels, 2001:8).
Thus, gaining allies to support a niche is not a simple process, especially because the values, practices and behaviours of some actors may reflect the prevalent socio-technical regime and impose barriers on new ways of thinking or acting. The actors involved in medicinal plant production are linked to different fields (including emancipatory movements, the technical-scientific domain, healthcare programmes and farmer, consumer and environmentalist organisations). This notwithstanding, they are all pervaded by the grammar of the dominant regime, which is largely impermeable to ‘deviant’ actions and maintains (some) rigid institutional conformity. Creating niches and/or transforming the regime is contingent on actors being willing to leave the mainstream and take on the possible risks or disadvantages of one or several new technologies (Elzen et al, 2004). In the case of ecologically produced medicinal plants this willingness must arise from both the actors who will generate the innovations and those who will use them.

The farmers producing medicinal plants generate novelties (some of them represented in Figure 1) by articulating learning processes and mobilising social networks, which include actors from different domains. However, it is important to emphasise that such networks do not, in and of themselves, distinguish or strengthen the innovation niche, mainly because the actors are not mobilised around common goals. In order to spur a complete niche formation it is necessary to construct shared governance that can guide the flows within and between the networks towards a specific aim. If this does not occur, a large part of the learning and opportunities will be lost or insufficiently developed.

The understanding of scientists and technicians, rooted in the technical-scientific domain, differs widely from the farmers’ attempts to re-orientate their production systems and the technological developments required for producing medicinal plants. The farmers are willing to learn new things and even to abandon their old practices; they seem to always be ready to open communication channels with other actors and to adapt their own identities by becoming involved in different fields. They remain involved in agricultural work, the main symbol of a farmer, but at the same time they are re-inventing or transforming their identities by acting, for instance, as researchers. The following comments by two farmers from Rio Grande do Sul illustrate this point.

*I’ve done a lot of research, about each plant, beginning with the plant’s name. I learnt that there are lots of them. [...] I read one book then another and just kept reading and reading. Once I went to the library of the Pharmacy Faculty. [...] There is plenty of material about medicinal plants, herbal medication and I spent many days there. Just researching; like a bookworm.*

*And really, I learn a lot, so many interesting things. [...] I’ve attended courses and lectures, [...] if one wants to deal with medicinal plants one also has to become a little smarter, more educated.*

The development of an unusual farm activity that is distinct from most common agricultural production (grains, fibres, tobacco and food in general) changes the
demand for knowledge. As the farmers in our study are strategically positioned at the interface between agriculture and health, they articulate at least two broad fields of knowledge: they naturally manage codes, terminologies, and detailed information about phytochemistry, botanics, marketing and so on. These farmers' narratives commonly show how their 'mobility' across different fields has led them to acquire knowledge, which in turn has fostered the emergence of new identities. As one of them said: “we are researchers too, we cannot stand still”.

By contrast, the majority of the actors in the technical-scientific domain seemed less able to formulate new goals or change the rationales that guided their actions: their commitment to the prevalent socio-technical regime seems to be stronger. An analysis of interviews, lectures and published papers reveals that techno-scientific actors still retain a focus on the homogenising protocols of production, narrowing the plant genetic base, developing conventional technological packs, increasing scale and meeting strict quality patterns determined by industry. This approach is at odds with the position adopted by the farmers, whose work and search for solutions are guided by the goals of enhancing agro-biodiversity and autonomy, reducing external inputs and constructing alternative markets.

This point is clarified by fragments of the talks, which scientists involved in research on medicinal plants delivered at the III Simposio Latinoamericano en Producción de Plantas Aromáticas, Medicinales y Condimentarias (Latin American Symposium on the Production of Medicinal, Aromatic and Condimentary Plants) at San Fernando del Valle de Catamarca (Argentina), between 19th and 22nd September 2006.

"It's our goal to achieve better genetic material, finding the best plant design, finding the optimum growing conditions, climate, soil, light, finding ways to protect plants from pests and diseases, finding ways to eliminate weeds. [...] There is also the possibility of mechanisation and determining the best harvest system. [...] We want to identify and isolate the active principles, [...] We select the best genetic material to determine the optimal agronomic conditions for optimum yields and high quality standards; we genetically improve the species to develop high yielding varieties with a determined chemical composition (H. V., Universidad de Talca-Chile).

'Good Practices' are the way to provide a quality guarantee to the final consumer. And this is the responsibility of the producer. [...] It's necessary to set out a standardised operational procedure so that anyone can repeat the process. [...] The use of organic fertilisers is problematic, because the risk of contamination is high. The most important thing is to establish safety standards for the use of agrochemicals. [...] The ideal situation is to establish curves of absorption of nutrients for each species, so you can adjust the quantity of fertiliser for each crop (A.C., Universidad de Luján-Argentina).
During the same symposium, another Argentinean researcher, O. A. from Universidad de Luján, defended the global market’s requirements for certain quality standards and a minimum scale of production: "Small scale production presents problems in achieving the correct quality and acceptable standards for the international market". The researcher also stressed that the lack of homogeneous genetic material and authorisation of specific herbicides for use in cultivating medicinal plants are significant technical barriers to progress.

One can see how such proposals or views are remarkably strongly related to the socio-technical regime of conventional agriculture. The talks make it clear that technological development should be driven by the classical modernisation principles already applied to food production. The statements make the goals explicit: to homogenise the production process and develop technological packages in conjunction with conventional top-down strategies that push for specialisation and scale enlargement.

Similar findings emerged from the analysis of papers presented during the III WOCMAP⁶ - Congress on Medicinal and Aromatic Plants, at Chiang Mai, Thailand, in 2003 and the final recommendations from IV WOCMAP⁷ held in Cape Town, South Africa, in 2008. Scientific research seems to be led by concerns about standardisation and technical efficiency, to be established through expert systems. This was evident in the calls to accumulate specialised knowledge about a few plant species, to develop protocols for biotechnological products and to expand knowledge about plant genomics. In the same line of thought, Bajaj and Ishimaru (1999) argue that it is necessary to engender transgenic medicinal plants to avoid biodiversity loss and to control natural variability.

Researchers often justify the push for complete control over biological diversity as a means of pursuing sustainability goals, set out in various international agreements (e.g. the International Convention on Biodiversity). This type of argument, aligned with economic interests, sometimes justifies the bio-prospecting of species and bioactive ingredients –which can potentially be patented, reserving private rights over benefits (Killbride, 1998). This situation is exacerbated by the well-known lack of recognition of local knowledge and any notion of fair payment for it (Santilli, 2005).

Another issue to underline is that the technological practices related to medicinal plants have a strong focus on establishing technical models that can guarantee consumer safety. However, these quality criteria are normally restricted to a hygiene standard (expressed in terms of the absence of microbiological agents), as documented and suggested, for example, in the GACP (Guideline on Good Agricultural and Collection Practice for Starting Materials of Herbal Origin) (EMEA, 2006). The guidelines are vague about controlling residues from pesticides, herbicides or growth promoters, with no explicit restrictions or

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prohibition of their use. In Brazil, the discussions related to quality parameters have emphasised the need to produce medicinal plants without using pesticides, although there is no system of analysis or established protocols for compulsory control. In the guidelines of “Good Agricultural Practices (GAP) of Medicinal, Aromatic and Condimentary Plants”, there is limited encouragement for organic production and vague advice cautioning against the use of agrochemicals (Brasil, 2006a).

These specific examples illustrate the strong influence that landscape and the prevalent socio-technical regime exert over the rules, practices and actions related to medicinal plant production. But, of course, there are significant internal disparities within the technical-scientific domain and these generate conflict and tension in scientific discourses. There are divergences of position, ambiguities in proposals, and intrinsic contradictions within the main institutions. Often these tensions reflect individual actors’ degree of commitment to the dominant regime. These internal misalignments in the regime or landscape create opportunities and some momentum for the innovations emerging from niches (Geels and Schot, 2007). The full emergence of an innovation niche for the ecological production of medicinal plants seems contingent on the creation and/or identification of such opportunities, but this, in turn, depends on new social commitments between all actors involved in order to achieve some internal cohesion.

6. SOME CONSIDERATIONS ABOUT THE GAPS BETWEEN NICHE AND REGIME

The generation of a wide range of novelties associated with the niche emergence of ecologically produced medicinal plants diverges from the conventional agriculture regime, not only in terms of the innovative characteristics of techniques, products or markets, but, above all, because of the coalitions that form between the actors involved (including some linked to the technical-scientific domain). These coalitions, although sometimes partial and vague, create possibilities for networking and for learning and materials to circulate, which opens up some passages through the ‘hardness’ of the socio-technical landscape. However, the dominant socio-technical regime still seems to be driven by the generation of incremental knowledge.

Geels and Schot (2007) emphasised that actors who have strong ties with a specific regime normally implement only incremental changes. A technological regime contains both cognitive and normative structures that are integrated within a set of functional relationships that exist between the technological components and the actors along the production chain (Moors et al, 2004). Thus, it is important to find effective ways to overcome the idea that the regime in itself guides the recognition and the resolution of any problem created by within it.
The rules established through the regime, represented by a set of commands or requirements (Kemp et al, 1998), limit the actors’ role to maintaining the practices unchanged, reproducing the rules by themselves. Smith and Stirling (2005) argue that these ‘small decisions’ are frequently invisible, but that they are responsible for reproducing the regime. However, changing the patterns of investing in infrastructure, of creating different markets, of transforming the health standards system, of providing innovation for experimental procedures and of democratising knowledge, will all depend on a myriad of small routine decisions that are not consistent with the prevailing rules of the regime. We are considering that, theoretically, these ideas are supported by the notion that actors and structures are jointly and mutually created and sustained (Bijker and Law, 1992:293). They also mobilise the view that the structuring element is contained in the practices themselves (Ploeg, 2003:15); and that agency is a ‘root-metaphor’, condensing fundamental processes of engagement between people and life experiences (Long, 2007:79).

The evolution of socio-technical transitions into structural disruptions presupposes material, symbolic, institutional and cognitive flows between different levels (e.g. niche, regime and landscape). It also requires being able to successfully manage these flows. Structure does not fix actors into immutable positions; yet the control of flows between levels is proportional to the degree of articulation that the actors can achieve through their projects. The whole process seems to demand an adjustment in actors’ social commitments, an enlargement of negotiation spaces and the inclusion of multiple actors.

Changes in social, technical, organisational and institutional behaviour introduced into agriculture by novelty production are part of an ongoing transition in rural development, which challenges the ‘developmental’ path, characterised by a unidirectional concept of progress. Producing medicinal plants ecologically may not be a revolutionary invention but the novelty lies in the fact that it requires a reconfiguring of values and identities, as well as reconsideration of commitments between those who are involved.

The construction of new identities involves multiple learning processes that can disrupt pre-existing commitments, roles and rules. In this sense the farmers seem to be more able and willing to change than actors in the scientific-technical domain. Their new identities emerge from the growing internal coherence and strengthened social networks that have been established in order to find institutional protection for innovative spaces. The emergence of these new configurations is linked to the local context as much as to contextual knowledge and is dependent upon dialogue between different bodies of knowledge. Encounters between actors from the technical-scientific field and farmers can help promote socio-technical transitions towards more sustainable agriculture. As Smith and Stirling (2008) remind us, the promotion of a promising niche involves processes of cooperation, collaboration and consensus. However, the governance of this process is still unclear and the different actors still have quite different expectations regarding the outcome of such encounters. Furthermore,
the incumbent regime is highly structured and there are forms of power in place that favour certain actors at the expense of others.

As Roep and Wiskerke (2004) state, we are still in an early phase of transition in agriculture. Although there are signs of the emergence of a new regime and we can begin to delineate the contours of system innovation in different niches (as in this case study), a major regime change is still a long way off. Nevertheless, it is important not to disregard the fact that regimes often provide the materiality to field of practices, and that their institutions structure the repertoire of possible practices (Smith et al, 2010).

Apart from issues strictly related to the replacement of existing practices and inputs, sustainable rural development requires a socio-technical transition in agriculture. This involves ways of constructing knowledge that are capable of promoting structural changes and transforming the ‘landscape’. This transition, which is fundamentally an evolutionary learning process, is related to the practices that actors construct at the niche level. The main challenges (even the analytical ones) lie at the interface between these two levels. The difficulties in establishing connections between an innovation niche and the socio-technical regime represent not only a barrier to transition, but also an obscure and uncharted theoretical area.

7. CONCLUSIONS

Our analysis of the emergence of the innovation niche associated with the ecological production of medicinal plants leads us to conclude that the integration of methodological and analytical elements from MLP and AOA provides a promising construct for multi-level, multi-aspect and multi-actor approaches. This ‘dialogue’ may perhaps create a new agenda for debate and research on transition management in agricultural technology.

The novelties associated with the ecological production of medicinal plants have been produced essentially in opposition to the conventional agricultural regime. They can be seen as evidence of the never-ending learning processes surrounding the networking between different actors. This suggests that, by introducing social, technical, organisational, institutional and behavioural changes, novelty production in agriculture has sound potential as a vehicle for promoting the transition towards sustainable rural development.

This is however not an unqualified success story. The emergence of an innovative niche for medicinal plant production is far from complete. Our analysis suggests that it is difficult to align actors’ expectations and goals, especially in the presence of strong commitment to the prevailing regime. One reason for this could be the lack of a legitimating interface with the technical-scientific field.

Our field-work shows that the farmers producing medicinal plants ecologically seem to be willing to break their commitment to the incumbent regime, largely...
by constructing new identities through multiple processes of learning and experimenting. The increase in material, symbolic, institutional and cognitive flows between niche and regime is necessary to achieve transitions, but the process seems to demand a greater adjustment of social commitments, an enlargement of negotiation spaces, and a governance system that includes a wide range of actors.

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