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Pathways Towards Regional Sustainability of Agriculture in Europe

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1 Introduction to FarmPath

The research project “Farming transitions: Pathways towards regional sustainability of agriculture in Europe” had two major conceptual building blocks: (1) that to achieve sustainability, the focus should be on the collective impact of farms at the regional level, thus taking into account interactions and synergies between various actor groups, and (2) that to achieve sustainability, a transition at the regime level is needed, as the impact of isolated initiatives (i.e. niches) is often not sufficient to achieve fundamental change.

Focusing on **regional sustainability** implies a territorial approach, where not each and every farm can be expected to contribute towards all activities and functions linked to sustainability. Of course each farm has to comply with minimum criteria (e.g. legal environmental regulations), but farms should be encouraged to build on their specific strength and collaborate with other actors. This shift would encourage diversity in farm types and in farm activities, and would promote collaboration between farms. By emphasising potential synergies between farms – and between farmers and other actors – new forms of social organisations can be promoted. These social innovations are expected to enhance the sustainability of practices, while at the same time increasing the attractiveness of farming to young farmers and new entrants.

FarmPath took into account the **diversity between regions**, by acknowledging that different regions may face very different sustainability challenges (e.g. areas of intensive agricultural practices, regions facing ageing and land abandonment, regions with high potentials for diversification). Regions also differ in their past history and their culture, so that even when faced with similar sustainability challenges, different solutions might be preferred by actors. By using a transdisciplinary approach and thus working closely with regional stakeholders, these differences can be taken into account.

At the conceptual level, the focus in FarmPath was not on niche-internal processes (i.e. the active construction novelties), but on the **interactions between niches and regimes** (i.e. the activities implemented to enrol actors from other niches or from the regime). Indeed, for a niche to have the potential to contribute to a transition, it will have to engage with actors from outside agriculture and/or actors at the regional (national) level. The aim was thus to identify case studies that were well established (i.e. practices are developed, networks between different types of farms, with retailers or consumers are established). A number of the studied niches were thus in the ‘take-off’ phase, i.e. are engaging with regime actors, to initiate institutional and structural changes (e.g. supportive policies, representation in decision-making bodies, etc.).

In a number of dimensions FarmPath built on earlier research (e.g. on endogenous rural development, system innovation, learning networks), and attempted to take the next step by assessing under which conditions these niches can initiate a transition at regime level. A **transition** is a whole complex of interrelated changes that lead to new policies, new institutional arrangements, new beliefs and values, and new technologies. Transitions often involve a reconfiguration of actor groups, i.e. collaboration between actors from societal domains that previously were seen as separate (e.g. reconfiguring agriculture as energy provider, as provider of care or of recreational services). There are few studies analysing what processes are involved in such an emerging transition, or how governance structures and institutional arrangements need to adapt to enable such a transition. In particular the power issues involved in renegotiating societal structures have so far received little attention within the transition literature.

FarmPath used the multi-level/multi-actor perspective in transition studies and applied it onto agro-food systems. The aim was to analyse how the dynamic of niche-regime interactions can be used to induce and stimulate transitions. The overall goal was to understand which conditions enhance the likelihood for a niche to successfully initiate a transition towards regionally sustainable farming systems, esp. which policy measures and governance approaches can support this process.

2 Transitions to sustainability – Theoretical foundations

2.1 Underlying theoretical concepts

Transition studies build on a wide range of **theoretical backgrounds** (Geels and Schot, 2010:29ff). These include evolutionary economics, which focuses on long-term processes and developed the concept of technological regime to understand coordination within a population of firms. They also include sociology, esp. structuration theory, which assumes knowledgeable, interpretive actors that enact rules and structures, and where structures guide but do not determine action. Furthermore, they draw heavily on innovation studies and on science and technology studies (STS) which have shown the complexity, fluidity and contingency of technological change (Elzen et al., 2004b).

Transition studies are based on conceptualizing societal systems as **complex adaptive systems** (Rotmans and Loorbach, 2010; de Haan and Rotmans, 2011). These are open systems (i.e. they interact with their environment) and the rules governing interactions between components change over time, as a result of co-evolutionary processes. Such systems are thus essentially evolutionary, i.e., adapting to a changing environment, involving both variation and selection, and learning from experience. A complex adaptive system thus constantly changes and unfolds over time rather than stabilizing around an equilibrium. Given co-evolutionary processes, feedback loops and non-linear interactions, future developments cannot be predicted.

The concept of **co-evolution** denotes the interaction between societal subsystems which influence the dynamics of the individual societal system under study. Indeed, as economic, cultural, technological, ecological and institutional subsystems interact, they respond to changes in each other and adapt. Understanding transitions thus means that structures, cultures and practices of a societal system are analysed in an integrative manner (de Haan and Rotmans, 2011). The structures include e.g. the formal, physical, legal and economic aspects that enable or restrict practices. The cultures include the cognitive, discursive and ideological aspects involved in sense-making. Finally, the practices include the routines, habits, procedures by which actors (individuals, organisations) maintain the functioning of the societal system. A socio-technical transition involves the development of technical innovations (by scientists or entrepreneurs), their organisation (manufacturing, financing), their use (selection, adoption), and the broader societal embedding (regulations, markets, infrastructures, cultural symbols). Since various these societal elements co-evolve, it implies that in a transition, the structures, cultures and practices of a societal system are fundamentally changed so that the way the societal system functions is profoundly altered (de Haan and Rotmans, 2011).

The complex and changing interactions between components also imply that they cannot be steered using a command-and-control approach, thus limiting the suitability of ‘conventional’ policies. Instead, adaptive policies have been suggested, which facilitate autonomous action and allow for uncertainty (Swanson et al., 2010). This allows them to navigate toward successful outcomes in settings that cannot be anticipated in advance.

The fundamental assumption underlying studies of transition to sustainability is that persistent problems (such as environmental degradation) are not caused by clearly identifiable groups of actors or structural factors, but that they indicate systemic failures. To tackle such persistent problems requires structural changes in technical systems, change in beliefs and values as well as governance structures (Kemp et al. 2007). As a result, transition processes fundamentally change both the structure of the system and the relations between societal actors.

2.2 The Multi-Level Perspective

The **Multi-Level Perspective** (Fig. 1) has been developed among others by René Kemp and Arie Rip, and further refined by Frank Geels and Johan Schot. The multi-level perspective views transitions as non-linear processes that result from the interplay of developments at three analytical levels: niches (the locus of radical innovations), socio-technical regimes (the locus of established practices and associated rules that stabilize existing systems) and an exogenous socio-technical landscape (Geels, 2011). Each level refers to a heterogeneous configuration of elements, with the regime more stable than the niches in terms of number of actors and degrees of alignment between the elements. This perspective emphasises that for a transition to be successful, processes at the niche, regime and landscape-level need to be aligned. In other words, the successful development of a novelty into a niche will not lead to transition, unless e.g. pressures from the socio-technical landscape open up a window of opportunity through putting pressure on the regime.

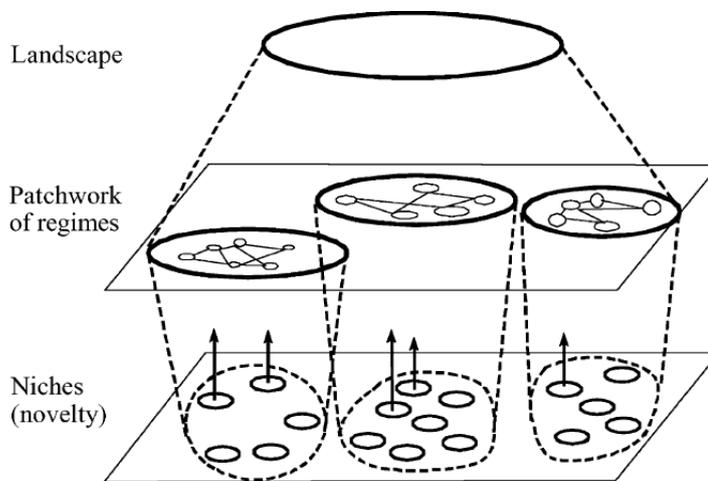


Fig. 1: Multiple levels as a nested hierarchy (Source: Geels, 2002:1261)

Niches are created by actors at the local level (e.g. the invention of a new technology, entrepreneurs developing new markets). They may be protected spaces, such as subsidised demonstration projects or small market niches where users have special demands and are willing to support emerging innovations (e.g. local organic food chains). Niche actors (such as entrepreneurs) work on radical innovations that deviate from existing regimes. Niche innovations are often characterised by a mismatch with existing regime dimensions (e.g. lack of appropriate infrastructure, regulations or consumer practices). Niche activities usually include the articulation and adjustment of expectations or visions, building of social networks and the enrolment of more actors, as well as learning processes on issues such as technical design, user preferences, organisational issues and business models, policy instruments and symbolic meanings (Schot and Geels, 2008). Niches are crucial for transitions, because they provide the seeds for systemic change, even if many of these seedlings will eventually perish (Elzen et al., 2004a).

The **regime** is the meso-level and includes social networks, regulations, techno-scientific knowledge, infrastructure, etc. A regime is characterised by fairly stable rules, e.g. cognitive routines, shared beliefs, capabilities and competencies, lifestyles and user practices, favourable institutional arrangements and regulations, and legally binding contracts. Since these elements, as well as items such as physical infrastructures and organisations, are well aligned, regimes are characterised by lock-in. Innovation occurs incrementally with small adjustments accumulating into stable trajectories. The regime is actually composed of several sub-regimes (e.g. user preferences, market regime, policy regime, science regime, technological regime, etc.) which have their own dynamics, but inter-

penetrate and co-evolve with each other. The concept of socio-technical regime aims to capture the meta-coordination between these different sub-regimes (Geels, 2004). There is thus both alignment and tensions within a regime.

The **socio-technical landscape**¹ designates the long-term exogenous trends at the macro-level (e.g. demographical trends, political ideologies, societal values, macro-economic patterns, climate change). In the short-run, these processes at the level of the socio-technical landscape cannot be influenced by niche or regime actors (Geels and Schot 2010:24).

Within the multi-level perspective, niche innovations are the seeds of transition, but configuration at the regime level will determine whether they can unfold or not. Thus, a transition can only take place when the dynamics at various levels reinforce each other. Since existing socio-technical regimes are stabilized in many ways (e.g. technical standards, sunk cost by key players who have no incentive to change, production structures and industry networks, user practices), **transitions** do not come about easily. However, over time a regime will display weaknesses, often as a result of unintended side-effects that cumulate and become problematic over time. As the persistent problems become increasingly obvious, they can lead to pressures from the socio-technical landscape to alter practices. This creates a window of opportunity for a niche-innovation to break through, especially if the regime is not able to adequately address the persistent problem.

The influences from the socio-technical landscape and from various regimes, as well as the suitability of niches are not mechanical. They are always mediated by actor's perceptions, negotiations and agendas. Thus there is **no linear causality** within the multi-level perspective of transitions (Geels, 2011). Instead, there is a co-evolution within and between levels.

When analysing emerging transitions it is especially important to keep in mind that (sub-)regimes are not homogeneous and monolithic. Indeed, whereas regimes may appear as coherent blocs from the outside (and tend to represent themselves that way), there are often **internal tensions**, disagreement and conflicts of interest (Geels, 2011). An example may be the organisations that represent agriculture (ministry of agriculture, chamber of agriculture) who tend to project a unified image, while underlying it, there are tensions with a broad variety of farming styles, with a number of farmers that are not adhering to the modernisation paradigm. Thus regimes have coherence, shared values, and similarity, but on the other hand contain variety, disagreement on specific issues, debate and internal conflict. These tensions can be an opportunity for niche actors to identify sympathetic regime actors and gain support.

Furthermore, when analysing emerging transitions it is important to pay attention to the **interactions between regimes** (Geels, 2011). Indeed, the growth of niches often requires interaction between two (or more) regimes, e.g. between waste incineration and electricity generation (Raven, 2007), or between agriculture and energy regimes in the case of biofuels. Thus, the positive or negative interaction between regimes can enable an emerging transition. But the niche actors behind the emerging transition might just as well actively construct new relationships between previously separate regimes as part of their proposal to radically alter the dominant regime.

The focus in **FarmPath** was on niches that have gained momentum because the various learning processes have resulted in a (more or less) stable configuration, and their project and values have become more broadly accepted. Most of the case studies in FarmPath were thus niches whose networks have become larger and now include the participation of powerful actors which convey legitimacy and secure resources for the niche. The analytical focus was on the learning processes, network dynamics and struggles between the niche and the dominant regime on multiple dimensions. FarmPath analysed how far niche actors from emerging transitions took advantage of

¹ The 'landscape' as used in transition studies designates a sphere of activity (as in 'political landscape') and has little to do with the natural landscape (i.e. an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors, as defined in the European Landscape Convention). Given the importance of (the physical) landscape in rural areas, and to avoid confusions within FarmPath to designate macro-level processes in a transition to sustainability we will always use the term 'socio-technical landscape'.

Other authors have proposed different frameworks for **transition patterns** (e.g. de Haan and Rotmans, 2011) indicating that so far there may not be sufficient empirical studies to clearly identify a typology that best captures the range of patterns. Geels and Schot (2010:78) also indicate that there may be several regimes rather than a single regime that is clearly dominant (e.g. specialized farming might be dominant, but there are still a lot of mixed farms involved in crop production and animal rearing). Such a multi-regime situation might then have several regimes in competition and if a transition is to be achieved it is likely to follow a different pattern than if there is one clearly dominating regime.

2.4 Strategic niche management and transition management

A range of researchers have worked on conceptualising transitions, however the group around the Dutch DRIFT and the KSI-network² may be seen as the centre of the efforts to theorise and empirically study transitions. Next to the multi-level perspectives, two other approaches play a role in conceptualising specific aspects of societal transitions: strategic niche management and transition management.

Strategic niche management builds on the core assumption that transitions towards sustainability can be facilitated by the creation of niches, i.e. protected spaces that allow nurturing and experimentation with the co-evolution of technology, user practices and regulatory structures (Kemp et al., 1998). Niche creation and development may be supported by government policies, but they may also spring from endogenous processes. Studies of strategic niche management focus on niche-internal processes (esp. articulation of expectations and visions, building of social networks, and learning processes), but also include analyses of the interaction between niches and regimes. Failed niche developments were related to either minimal involvement of outsiders in the experiments and a lack of second-order learning, or to minimal involvement of regime actors, which resulted in a lack of resources and institutional embedding (Geels and Schot, 2010:83).

Similar to strategic niche management, **transition management** highlights the importance of experiments. In transition management, the goal is also to create a space (often called a 'transition arena') where niche players and change-inclined regime players can form new coalitions (Rotmans and Loorbach, 2009). These coalitions help drive the activities in a shared and desired direction, develop the network into a movement and put societal pressure on policy. In the transition management framework, activities related to the content (integrated systems analysis, envisioning, agenda building, experiments) are linked to activities related to the process (network and coalition building, execution of experiments, process structuring). While strategic niche management builds on evolutionary processes based on market competition, transition management suggests a more ambitious approach of goal-oriented modulation.

Studies in strategic niche management as well as transition management can be seen as inquiries into understanding the successes or failures of establishing a niche (e.g. developing rules, stabilising networks, promoting learning based on experiments) and of a niche inducing a regime shift. This implies a shift from putting attention to a single innovative project towards analysing a series of projects which accumulate into learning trajectories. Research thus focuses on mechanisms and factors that make sequences of projects gel into niche development, and on the interaction between niches and/or between a niche and the regime towards regime shifts (Geels and Schot, 2010:87). The goal is less to push for a certain technology (an approach which is linked to the modernist way of managing the introduction of technology in society), but to take into account the co-evolutionary dynamics, i.e. the alignment and mutual adaptation between niches, regimes and landscapes (i.e.

² DRIFT: Dutch Research Institute on Transition – <http://www.drift.eur.nl/>

KSI: Knowledge network for System Innovations and Transitions – <http://www.ksinetwork.com>

See also the STRN: Sustainability Transitions Research Network – <http://www.transitionsnetwork.org/>

taking into account the broader institutional and cultural changes), calling for an approach based on reflexive governance (Rotmans and Loorbach, 2010).

2.5 Characteristics of a transition to sustainability

Historical studies of socio-technical transitions have focused on transitions that were not planned or managed by policy to become a transition. Their objectives were not determined beforehand, but the transitions and their directions emerged as result of coevolutionary processes involving a variety of societal influences (Slingerland and Rabbinge, 2009). Many of these historical transitions were driven by commercial motivation of pioneers and entrepreneurs that developed the technology (e.g. cars, steamships). While normative changes are often involved, they were not the main drivers.

FarmPath – as well as other studies on current societal transitions – substantially differ from these previous studies, as (1) they explicitly focus on transitions to sustainability, which is a **normative goal** and thus there is an (implicit) intention to steer them in the ‘right’ direction; (2) most of the case studies in FarmPath are emerging or ‘transitions in the making’ (Elzen et al., 2011), rather than completed transitions. Given complex societal co-evolution processes, it is unpredictable whether they will effectively lead to a transition.

Despite the uncertainty surrounding future developments, it is important to distinguish emergent transitions from (incremental) general change processes. Case studies of transitions should thus display following characteristics (Geels and Schot, 2010:11):

- Transitions require multiple changes in societal systems (co-evolution)
- Transitions are multi-actor processes, which entail interactions between societal groups such as businesses, users, scientific communities, policymakers, social movements, etc.
- Transitions are radical shifts, which refers to the scope of change, not the speed of change
- Transitions are long-term processes (40-50 years), but break-throughs may be relatively fast (e.g. 10 years)
- Transitions are ‘macroscopic’, i.e. affect a whole ‘organisational field’ (aggregation of suppliers, consumers, regulatory agencies, etc.)

3 Previous studies related to transitions in agriculture

The term ‘transition’ has been used in the agricultural context by a range of authors to label different processes. For example some authors use the term at farm-level (e.g. Wilson, 2007; Lamine and Bellon, 2009; Milone, 2009). In this context it indicates a reconfiguration of activities engaged in by the farm family. These farm-level transitions may or may not stabilise over time, not least depending on the farm family life cycle. These farm-level processes are the core building block of niche-level processes that were extensively studied in the framework of (endogenous) rural development (e.g. van der Ploeg and Marsden, 2008), which focused on novelty development.

3.1 Research on ‘food regimes’

Work on ‘food regimes’ does not use the multi-level, multi-stakeholder perspective of transition studies. However, it analyses long-term trends in global agro-food systems and thus might yield insights that are relevant for the work in FarmPath, especially regarding how specific pressures have transformed whole supply chains in the past.

Studies of ‘food regimes’ have analysed the particular **configurations of geopolitical power** which have conditioned agricultural production and consumption relations (McMichael, 2009). The perspective prioritises the way in which forms of capital accumulation in agriculture shape global

power arrangements which are expressed in global patterns of food circulation. Two past food regimes are identified: the first food regime (1870-1930s) which is characterised by imports to Europe from tropical colonies as well as settler colonies. The second food regime (1950s-70s) is characterised by re-routed flows of surplus food from the USA and EU towards developing countries (in the form of food aid), as well as by transnational linkages by agribusinesses (e.g. the animal feed protein complex). The emergence of a third food regime is discussed (starting in the late 1980s), which is linked to social movements around such issues as fair trade, animal welfare, consumer health and ecologically-appropriate food systems (Campbell, 2009).

The historical studies of past 'food regimes' conceptualised some key **contradictions** in particular food regimes, contradictions that produced crisis and put pressure on the regime. Thus 'food regimes' can be reframed as the result of niche-level processes (i.e. social movements) which align with the agendas of regime actors such as corporations and government strategies. Since the emphasis within food regime studies is on the structuring forces in the global food system, the 'regime' level in this body of literature can be seen as equivalent to the level of the socio-technical landscape in the transition literature. This literature might thus help understand how various trends within the socio-technical landscape interact and put pressure on the regime. Since in FarmPath the focus is on niche-regime interaction, this literature might mainly serve to understand how regimes come under pressure to change.

3.2 Research on rural development initiatives

There is a vast literature on rural development in Europe, closely linked to multifunctionality and thus to social and economic sustainability of farming. Most of this literature focuses on processes at the niche level, esp. on changes at farm-level from which the niches emerge. Indeed, rural development is linked to a wide variety of new activities engaged by farmers, e.g. production of high quality, region-specific foods and short supply chains, as well as agri-tourism or nature conservation and landscape management (Knickel and Renting, 2000; van der Ploeg et al., 2000; Schmid et al., 2004a; Wilson, 2007; Renting et al., 2009). At the **farm-level**, strong multifunctionality is thus characterised by regional embeddedness, environmental sustainability, low farming intensity, high food quality, recognition for the value of local knowledge and a diversification of farm activities. Different farm types may have different potential from engaging in change processes towards such a strong multifunctionality, as it depends on the resources of the farm, as well as production logic, i.e. the mindset of the farmer (Wilson, 2008).

Engaging in multifunctionality and thus activities not previously seen as the realm of agriculture, leads to a reconfiguration of the way resources are used within the farm, and between farming and other rural activities. Whereas most studies start at the farm level (including the activities of all members of the farm household), some **structural changes** result from a reconfiguration of resources that can only be observed at the regional level, e.g. the interrelations between farms and other rural enterprises, the resulting networks and the natural landscape. The interrelations can be highly dynamic, creating synergies between network members (see e.g. van der Ploeg and Marsden, 2008; Milone and Ventura, 2010; Hermans et al., 2013). They can also increase the differentiation process going on in rural areas (Pinto-Correia and Breman, 2009; Berkel and Verburg 2011), strengthening the spatial, temporal and structural co-existence of several processes going on in rural areas in Europe (Wilson, 2007).

This vast work on (endogenous) rural development generally does not build on the conceptual framework of transition studies. However, it has provided a deep insight into the start and development of **niches** and the drivers of successful collective action. Indeed, many rural development initiatives can be conceptualised as a niche in the framework of transition studies, i.e. the site where novelties are developed, which may subsequently be transformed into innovations (Roep and Wiskerke, 2004; Oostindie and van Broekhuizen, 2008).

Similarly, a number of earlier research projects have focused on understanding the factors influencing the launch and growth of initiatives such as short supply chains and direct marketing (e.g. SUS-CHAIN³, FAAN, OMIaRD), care farming (e.g. SoFar) or labelled quality foods (e.g. COFAMI). Most of these initiatives are based on collective action but so far remained a niche. Frequently they are understood as a resistance or contestation of the dominant regime but without significantly changing it, much less inducing a transition in the regime. While such niches play a crucial role in developing alternatives and demonstrating that they are a viable system, it is not clear under which conditions they remain a niche, or they 'break through' and start to transform the dominant regime. This however is the core issue in research on transitions towards sustainability: the dynamics that fundamentally alter dominant practices, replacing the incumbent regime by realigning technical processes, social actors and mental frameworks.

Within **FarmPath** transition studies in agriculture were thus conceptualised as building upon previous work on rural development. These focused on the issue of how novelties emerge and establish themselves in rural communities, which factors support or hinder the emergence and development of these novelties and what policy measures could support them. The transition study framework shifts the emphasis onto radical change, has a normative goal (transition to sustainability) and focuses on initiatives which transform the dominant regime. There is thus an overlap with previous work (e.g., many of the research on alternative food networks also focused on radically new ways of organising food chains), but more emphasis is laid on the interactions, discourses with the dominant regime that allows niches to grow and may eventually replace the dominant regime, as well as on the institutions and infrastructures, path dependencies, etc., which hinder this development. FarmPath can thus build on the insights generated in the research on rural development, and may select as case studies some rural development initiatives that have had a wider impact in a region, e.g. by aggregating with other niches and/or enrolling regime actors.

3.3 *Research on innovation systems and on system innovations*

Promoting innovation in agriculture is frequently seen as a means to accelerate agricultural modernization. The **innovation system** is usually linked with a top-down 'innovation transfer' approach, based on public research agencies, education and extension bodies. In many countries this innovation system is under the control of the ministry of agriculture. Although this innovation system has had strengths (esp. in promoting yield increases in areas favourable to agriculture), it also has limitations (esp. in marginal or 'less favoured areas'), where recommendations derived from laboratory and station-based research were not adopted to the extent expected by regime actors. Also, the government-driven agricultural knowledge system is perceived by some actors as overregulated and unresponsive to the needs of farmers and to emerging societal concerns (Vanloqueren and Baret, 2008, 2009; Levidow, 2011; Dockès et al., 2011).

Given the limitations of this approach to innovation, a second paradigm has developed, which focuses on bottom-up process and emphasises rural innovation and learning networks. This approach is called 'Agricultural Knowledge and Innovation Systems' (**AKIS**) (Knickel et al., 2009; Dockès et al., 2011). In this approach the goal is to foster collaboration, knowledge exchange and engagement in collaborative life-long learning within a diffuse network of actors. As such it strives to increase the role of 'learning and innovation networks for sustainable agriculture' (LINSAs)⁴. If an AKIS is to be effective, in helping to manage innovation in rural areas, then there is a need for new

³ COFAMI: Encouraging collective farmers marketing initiatives (<http://www.cofami.org/>)

FAAN: Facilitating Alternative Agro-food Networks (<http://www.faanweb.eu/>)

OMIaRD: Organic Marketing Initiatives and Rural Development

SoFar: Social services in multifunctional farms – Social farming (http://sofar.unipi.it/index_file/socialfarfarming.htm)

SUS-CHAIN: Assessing and enhancing sustainable rural development through new modes of food provision (<http://www.sus-chain.org/>)

⁴ See e.g. the SOLINSA project: Support of Learning and Innovation Networks for Sustainable Agriculture (<http://www.solinsa.net/>)

governance approaches and regulations, so that it integrates farmers developing novelties with actors from traditional agricultural research institutions. **FarmPath** can thus learn from this approach which governance structures may help to integrate niche and regime actors. For example the project IN-SIGHT⁵ highlighted the importance of networking between innovators and professional associations (i.e. between niche and regime actors); the importance of social innovation, since these can facilitate the application of technological innovations; and that the success of innovations depends on the embeddedness of novelties in regional settings (Tisenkopfs et al., 2009). Another important issue raised by the IN-SIGHT project was that in some cases, a mediating institution that coordinates innovation networks at regional level was crucial to help the innovative niche to link with and enrol regime actors.

Whereas the term ‘innovation system’ is mostly used to label the institutions and government bodies linked to agricultural research systems, the term ‘**system innovation**’ is used to designate the scope of an innovation. The differentiation is thus made between a technological innovation with limited scope as it might be limited to a technological substitution, and a systemic change (Klerkx et al., 2012). The ‘system’ under consideration might be a production system (e.g. a sustainable husbandry system for pigs that aims at structural changes in both animal and crop production, see Bos and Grin, 2008). Or the system may be the socio-technical regime that fulfils a societal function, e.g. mobility. As such, successful system innovations are similar to transitions, in that they involve new technological artefacts, but also new markets, user practices, regulations, infrastructures and cultural meanings (Geels et al., 2004). Studies of system innovations may thus focus on transitions at the regime level, but they do not necessarily use the multi-level framework.

Transition studies thus offer a new lens on an established area of research. The multi-level approach aims at structuring the analysis thus highlighting issues that were not previously the focus of attention. Indeed, for the various niches to contribute to a transition to sustainability, they need to develop and ultimately replace the incumbent regime. Which of the possible niches eventually becomes dominant cannot be foreseen as it depends on the complex interactions between multiple actors, involving moves and countermoves, strategic games, shifting alliances, political support, economic success, technological learning processes and changing perceptions (Elzen et al. 2011:264).

3.1 Farm trajectories (i.e. farm-level transitions)

The work on farm-level transition addresses the pathways at farm-level, i.e. how farms change and adapt over time. For example the work by Wilson (2007, 2008) focuses on the potential of a range of farm types to transition from weak to strong multifunctionality. In this work, the spectrum of transition pathways are bounded by productivist and non-productivist action and thought (Wilson, 2007:171ff). These transitions are often characterised by non-linearity, heterogeneity, complexity and inconsistencies. A transition is thus seen as neither inevitable, nor as temporally linear (i.e. non-productivism does not necessarily follow sequentially from and replaces productivism). Also, the transition trajectories of individual farms can take a number of forms, e.g. a steady shift from weak to moderate multifunctionality, a slow change for a length of time and then sudden changes of a relatively short period of time, or also highly fluctuating trajectories that shift several times between different multifunctionality levels (Wilson, 2007:284). Thus, change is not always gradual, but interspersed by ruptures (i.e. follow a pattern similar to a ‘punctuated equilibrium’). Such a rupture might be the result of the farm being taken over by a new owner, or by an external crisis (e.g. BSE). The pathways of a farm is influenced by path dependency, i.e. current change options are constrained by past activities, since these have an impact on the knowledge, experience, networks and resources available to the farm and the farmer (i.e. ‘history matters’) (Wilson, 2008:376).

⁵ IN-SIGHT: Strengthening innovation processes for growth and development (<http://www.insightproject.net>)

Thus, the conceptualisation of a transition is somewhat different from the transition studies of the Dutch school, since it is not necessary that the new farm organisation is stable after the transition. In other words over time an individual farm might transition from weak to strong multifunctionality, and then transition back to weak multifunctionality, depending on a range of factors, e.g. farm succession, pluriactivity opportunities, or financial situation. To avoid a confusion through unclear terminology within FarmPath we will thus use the term 'trajectory' at the farm level, whereas the term 'transition' will refer to a fundamental change that stabilises (at least if the transition is successful).

In the context of farm-level changes, one 'transition' that has frequently been studied, is the **conversion to organic farming**⁶. Here too, it is often understood as a 'punctuated equilibrium' type of change, with a long incubation period where the farmer observes other organic farmers and explores potentials and networks. The conversion itself is then a rapid change, not least due to institutional demands as a farmer needs to apply for certification, applies for agri-environmental payments and switches (some of) his retailing network. After the formal conversion, the farmer is usually engaged in further learning processes and in building new networks (Lamine and Bellon 2009).

Other research on **farm trajectories** (e.g. Cialdella et al., 2009; Terrier et al., 2012; Chantre and Cardona, 2014; Coquil, 2014) has also emphasised that considering a period of 50 years, the development of farms depend both on the resources available, technological development (which is linked to the workload and investment choices), the off-farm income generating activities, and the preferences of various members of the farm families. This leads to a co-evolution, whose outcome is not predictable, thus leading to non-linear trajectories, indicating that different strategies may be chosen during different time periods. Farms are thus engaged in a co-evolution with their surroundings, adapting to internal and external changes, to perceived threats and opportunities (Darnhofer et al., 2010a).

Overall the work on farm-level trajectories was used to inform analyses in FarmPath, e.g. regarding the factors that impede or allow for the participation of individual farms in collective action, i.e. niche building. However, the focus of FarmPath was on the conditions that allow (established) niches to transform the (regional-level) regime, so that farm-level processes will not be the main focus.

3.2 Studies using the multi-level perspective

There have been a few studies that have analysed **historical transitions** in agriculture from a multi-level perspective. They are based on available historical literature and study long-term transitions (50 years or more). For example Grin (2010) has analysed the modernization of agriculture in the Netherlands between 1886 and 2006 (see also Geels, 2009). Belz (2004) has retraced the transition in Switzerland from intensive, industrialized practices towards integrated and organic practices. Smith (2006) has analysed the development of organic farming in the UK. Sinclair (2014) retraces the transformative change in the Australian subtropical dairy system, since its deregulation in 2000. As the field of transition studies itself is relatively young, these studies can be seen as applying the proposed theories on historical case studies to ascertain that the multi-level perspective is useful in structuring the analysis of processes in the agricultural domain, and to contribute to refine the theoretical propositions. The studies on past transitions in agriculture and food show that the sector is more dynamic than may appear if the analysis focuses on short-term developments.

⁶ For the sake of simplicity, we focus on farms that convert to organic farming in a system-redesign approach and that remain certified organic. We thus make abstraction from 'conventionalized' organic practices which are in effect an input-substitution strategy rather than a fundamental change (i.e. a system redesign). We also make abstraction from farmers who revert back to conventional practices after a few years (e.g. after the minimum duration stipulated within an agri-environmental measure).

Notwithstanding these studies of historical transitions, the introduction of the multi-level perspective of transition studies to agriculture and agro-food chains is fairly recent. Some of the work done has been published in edited **books**⁷, e.g.: Elzen et al. (2004b), Wiskerke and van der Ploeg (2004), Poppe et al. (2009), Vellema (2011), or Spaargaren et al. (2012). Many of the contributions on agriculture in these books focus on **niche-level processes**, i.e. how novelty emerges and through which processes a niche establishes itself. This focus allows highlighting the innovativeness of farmers, and pointing out that currently the novelties produced by farmers tend to remain hidden, because the prevailing scientific regime does not recognise that such novelties are the key to effective innovations (van der Ploeg et al., 2004). They also explore under which conditions some novelties (i.e. niches) are absorbed, transformed and generalised through the incumbent regime. Thus Roep and Wiskerke (2004) identify seven lessons for successful niche development and management in agriculture:

- (1) create and maintain a learning environment, privileging double-loop learning (i.e. learning about the assumptions, meaning and preferences of relevant actors). Learning should focus on how networks are built and maintained, and on the complex interactions between technical and institutional aspects linked to novelty creation;
- (2) explore and understand diversity, which enables to present a novelty as promising, and to develop it into a convincing and well-functioning programme;
- (3) make new and effective connections, e.g. with rural entrepreneurs, researchers, extension agents, farmers' unions;
- (4) take into account that creating alignment between strategies and expectations is a continuous process, thus the niche and its network requires continuous management and evaluation aimed at maintaining individual responsibility and commitment to the collective goal;
- (5) ensure that all actors improve their own situation, since progress or reciprocity (at the material or the moral economy level) is the reason for their participation;
- (6) change agents are crucial to set the process in motion, e.g. by envisioning windows of opportunity, expressing expectations, enrolling alliances and creating room for manoeuvre at the local level; and
- (7) appreciate the value of the unexpected, i.e. build the capacity to transform the unexpected or unintended into something useful or valuable, instead of assessing outcomes only according to initial expectations and learning processes.

Similar conclusions were reached in the OMIARD project, based on the study of a wide range of organic marketing initiatives (Schmid et al., 2004b), where the internal factors for success were found to include: professional management, key individuals, clear objectives and strategic planning, recognition of strategic turning points, ensuring motivation and coherence, innovation and market research, and networking. The IN-SIGHT project, which focused on **novelty to niche transitions**, i.e. how innovation networks are constructed, also reached similar conclusions. Results from this project demonstrated the relevance of innovation dimensions such as networking, multi-actor participation, efficient work of agricultural knowledge and innovation support institutions, individual and collective learning, interplay between economic, technical, organisational and social innovations, as well as the importance of collaboration and territorial governance (Tisenkopfs et al., 2009).

Other studies (e.g. Bos and Grin, 2008; Elzen et al. 2011) have focused on pressures from the socio-technical landscape and on **niche-regime interactions** which have enabled (or not) the establishment of e.g. pig husbandry systems in accordance with animal welfare and sustainability concerns. These

⁷ Much of the research reported in these books has taken place in The Netherlands. This focus on transition studies was spurred by the 4th National Environmental Policy Plan which was released in 2001 by the Dutch government (Slingerland and Rabbinge, 2009); as well as by the establishment of two research initiatives: the Dutch Research Institute on Transition (DRIFT) and the Knowledge network for System Innovations and Transitions (KSI). The 4th National Environmental Policy Plan identified seven persistent problems that needed to be overcome to reach the objective of a sustainable society. To overcome them, structural societal changes are needed, which are labelled 'transitions'. These transitions differ from previous societal change because they are deliberately steered by policy (rather than emerge from the interaction of societal actors) and have a normative goal: sustainability (rather than being focused on primarily solving technical problems or increasing economic efficiency).

can be seen as first case studies of on-going, i.e. emerging transitions. They demonstrate how processes at each of the three analytical level need to align for an innovation to 'break through' and transform the regime. Since so few empirical studies have yet studied emerging transitions in agriculture and focused on the dynamics of the niche-regime interactions involved, the literature gives few indications as to which patterns might be expected. This is where FarmPath intends to make a contribution to the study of transitions towards sustainability.

4 Conceptual elements emphasized in FarmPath

The work in FarmPath was rooted in the multi-level, multi-actor and multi-factor approach to transitions. This perspective has tended to emphasise the role of structure (e.g. the role of technological novelties) while at times underplaying the role of 'soft factors' such as consumer preferences, beliefs and power structures (Elzen et al., 2004a; Holtz et al., 2008; Geels and Schot 2010:28). However, transitions to sustainability in agriculture may not be primarily technology-driven, but are likely to involve elements such as social innovation, and will require changes in beliefs and values by all societal actors. Thus, in FarmPath transitions were not seen as driven by economic and/or technological determinism. The focus was on capturing social processes, especially in the interaction between the niche and the regime. Indeed, transitions not only involve social struggle, they are also driven by this socio-political struggle (van der Ploeg, 2009).

4.1 Complexity: riding the dynamics

Based on the insights of complexity and of co-evolutionary processes driving societal change, it becomes clear that transitions cannot be technologically driven, expert-led or 'rationally' planned (Woodhill, 2009). Indeed, the development of societal systems is inherently unpredictable. Thus, gathering data about cause-effect relations to design an intervention that will have a predicted outcome contributes mostly to the 'illusion of agency' (Rip, 2006).

Transitions are sometimes represented as a **mechanistic system**, i.e., as a set of factors or conditions that, if they all work together, will cause a desired change. The suggestion is thus made that transition processes can be steered or engineered to a certain extent. Thus, even if guidelines derived from transition studies are not deterministic, recommendations, methods, and techniques are still often presumed to have real effects, which can be used to attain certain objectives and solve certain problems. This, in effect, is a form of social engineering (Duineveld et al., 2009). However, not only will there always be a difference between the context which is analysed, and the contexts for which recommendations are drawn. Also, the socio-political processes, which involve power games, (different problem definitions, different actors and balances of power, different means which are considered necessary) will have a different outcome every time. With every step, the context changes, demanding new actions and new policies adjusted to the new situation. Thus, clear cause-effect relationships are bound to remain elusive.

This understanding of complexity implies that better understanding processes will not necessarily enhance the capacity to manage. Indeed, the outcome of deliberate intervention is inherently unpredictable. Political processes can or might help steer processes in the desired direction, but they do not do that by definition (Duineveld et al., 2009). This implies a modest approach to the **ability to 'manage'** or 'steer' long-term changes in society. In other words, much caution needs to be applied with the implicit assumptions conveyed by terms such as transition management, agents shaping niches or selecting one pathway over another (Shove and Walker, 2007). Many of these seem to imply that deliberate intervention in pursuit of specific goals is possible and potentially effective. However, care must be taken not to slip into an engineering mindset, i.e. a belief that social change can somehow be planned and executed in a linear fashion. A transition is a long-term process

involving a multitude of societal agents, and is thus fraught with scientific uncertainty, social ambiguity and unpredictability.

In complex adaptive systems order **emerges** ‘bottom-up’ through the independent yet coordinated action of many individuals. Through a network of feedback mechanisms, and interpretation by the agents, the system is constantly evolving in response to real, perceived or anticipated changes in both the internal and external conditions. The way in which the societal needs are articulated and met is an emergent features of the interactions of these actors and structural elements, i.e. there is no central actor who has control over a regime. Instead, actors navigate the system through probing and learning, finding their way through searching and reacting, through trial and error (Elzen et al., 2004a). The interactions and struggles of a wide variety of actors adds up to patterns at the aggregated level. Thus the regime, as an alignment of actors with their individual goals, perceptions, knowledge and values, technological possibilities, institutional settings, infrastructure, etc. emerge over time, through a mix of conscious design and processes of self-organization (Holtz et al., 2008). The construction of an emerging transition, the interlinkage of different novelties, is not driven from one single ‘locus of control’. As van der Ploeg (2009:300) points out, a transition is “grass-root driven, spontaneous and, to a degree, guided by an unfolding ‘narrative’ that links the many initiatives and experiments into a self-propelling process. Because it is not planned, it allows for unexpected outcomes and, wherever possible, these outcomes are intelligently woven together into a seamless web – after which the emergent web gives rise to new novelties”.

One way forward can be to enhance the **learning capacities**, thus enabling a greater responsiveness. In essence this means “tackling transition processes by distributing understanding, improving feedback linkages and enhancing capacities for adapting to change in a dispersed and non-hierarchical, yet coordinated, manner” (Woodhill 2009:281). This requires capacities to design, lead, facilitate and support such processes in ways that lead to real learning and change. For such learning networks to be successful some critical factors can be identified, such as creating heterogeneous groups of stakeholders, develop mutual trust and social cohesion, finding a communal perspective for the future and good process management (Vogelezang et al., 2009). The goal can thus not consist of planning change, but rather creating conditions that encourage co-evolutionary processes based on learning and reflexivity.

In this co-evolutionary process, **reflexivity** has a key role to play. Reflexivity allows taking into account learning and unforeseen developments, as well as reflects on whether the on-going processes are adequate or should be improved in some dimension, e.g. when they reinforce existing power relationships rather than ensure broad-based participation. Indeed, learning dynamics cannot be separated from power and political dynamics (Woodhill 2009:284). Empowerment of a particular stakeholder group may often be a precondition for any effective multi-stakeholder engagement. Such empowerment relates to capacities for engagement (i.e. capacity for communication, conceptual analysis, self-reflection, leadership and facilitation) or to the group’s power in a wider political context. However, this empowerment should undergo reflexive monitoring, so as to make transparent e.g., what values are given precedence, which groups are excluded from the process and assess whether this constitutes the most appropriate way forward, or whether adjustments may be conducive for the way forward. Although representativity and legitimacy issues cannot be conclusively solved (Peppe et al., 2009), the choices made should be made transparent and the effect of the choices taking into account in the assessment.

Such reflexive processes enhance **adaptiveness** since they are built on the recognition that taking action will lead to new insights and the willingness to revise assumptions, goals and strategies based on these insights. The process should also include reflections on such issues as whether the current institutional framework allows for participatory and adaptive processes, e.g. whether sufficient trust has been built up and whether there is the political will to invest the funds and see the process through to implementation.

4.2 Power: resisting and steering transitions

A defining property of a regime is the interdependent, highly institutionalised alignments across heterogeneous processes that serve to reproduce the regime, and which tend to engender path-dependent development (Stirling and Smith, 2008). This constitutes a form of **structural power** which privileges certain actors at the expense of others. Indeed, some regime members command key positions in the reproduction of incumbent regimes, by ensuring the maintenance of the rules, infrastructures and values underpinning socio-technical practices. However, per definition, a transition to sustainability implies a radical shift. Indeed, the changes that have been implemented by the regime, within the dominant paradigm, have not been able to successfully address sustainability issues, leading to the persistent problem. A transition leads to new technologies, social practices, institutional forms, policies becoming valued. It is a high-stake process. A transition necessarily involves disrupting established personal, economic and decisional power dynamics, which the regime agents are likely to resist since they tend to perceive it as a loss (Kemp and van Lente, 2011). Indeed, structural change at the regime level is bound to involve a number of winners and a number of losers. Transition processes thus need to be seen as power relationship transformation (Duineveld et al., 2009). Thus attention must be paid to organisational, institutional systems, policy instruments and compliance to rules, which are all part of these power relationships.

Obviously different societal players are involved in contesting and influencing the definition of what issues are seen as problematic and need to be addressed, and how they should be addressed. This gives rise to **competing models** for ordering the future, and depending on the path taken, different groups will win or lose (Fouilleux, 2000; Purseigle 2010). As such transitions involve social struggle, i.e. competition, changing coalitions, and contrasting aspirations which contain contrasting patterns for the spatial, temporal and social distribution of benefits and costs (van der Ploeg, 2009).

Research increasingly indicates that broad participation enhances results of change processes. However, few organisations (e.g. agricultural research, chambers of agriculture, extension and education) are equipped to handle the diversity in perspectives, social ambiguity and scientific uncertainty. Furthermore, organisations who have vested interests in the current regime may well coalesce to block policy reform that change existing institutional and production patterns (Barbier, 2011). Many of these formal organisations in the agricultural sector tend to have **vested interests** in the productivist-modernisation approach to agriculture and may be unwilling or unable to assess the relative merits of alternative paradigms (Vanloqueren and Baret, 2009; Levidow, 2011). They tend to be part of the dominant regime and thus either ignore or actively suppress the emergence of niches that may lead to new regimes, in which they might lose their power or their influence on how issues are framed, which options for dealing with issues are considered as efficient. Even if the process includes multi-stakeholder involvement and participative designs, these are never 'neutral' and never devoid of power and strategic behaviours (Bickerstaff and Walker, 2005).

However, interdependencies between actors shift, **power relations alter**. New discourses generate new expectations about the adequacy of regime performance (such as its sustainability) and contribute to a re-ordering of priorities (Muller, 2000; Fouilleux, 2000). The status of resources and regime position of different actors are cast in a new light. Shifts in relations of power thus need careful attention in transition studies (Duineveld et al., 2009). Indeed, politics is the constant companion of transitions, serving as context, arena, obstacle, enabler, arbiter and manager of repercussions (Meadowcroft, 2011). Yet, transitions are the result of political processes, and are ultimately legitimised and enforced through the institutions of the state.

Example of **strategies** used to influence societal change processes include lobbying, formation of networks, coalitions and alliances, playing the media, use of rhetoric, selective use of the results of scientific research, funding specific types of research, selecting specific stakeholders for inclusion in participatory processes, making and implementing laws, formal rules and procedures or transforming

institutions (Duineveld et al., 2009). Each of these strategies can be used to either instigate change, or ensure stability.

Thus for a niche to break through and initiate an emerging transition requires **niche actors** to develop a political capacity for positioning the niche favourably in the light of ongoing processes (e.g. environmental or economic crises), mobilising support, influencing agendas and re-directing investments and policy commitments away from incremental repair work and towards a more radical transition. Indeed, regime transformations are an emergent outcome of resource-interdependent actors negotiating material responses to future expectations (Stirling and Smith 2008:16).

It is thus important to understand the paradigms underlying political action, as well as the institutional effects of transitions, e.g. by scrutinising the evolution of guiding images and ideals, as well as to the resistances to these ideals. These may play a key role in explaining the success in the negotiations between the niche and the regime, and thus for the continued development of the niche into an emergent transition. Attention must be given to how reflexivity can be embedded in institutions to ensure a continual dynamic in which further adjustments are required as environmental conditions change. The comparison between case-study countries will allow to analyse which institutional constraints limit effective participatory processes as well as the implementation of the outcome of these processes.

Ultimately, the aim of analysing case studies and deriving insights into the dynamics of the processes in the emergent transitions is to assess whether these insights can be used to induce or stimulate transitions. In other terms, the challenge will be to identify **opportunities for intervention** and specify how such interventions can be productive. These suggestions will need to take into account the fact that transitions, as co-evolutionary processes, cannot be steered or managed in a strict sense (Elzen et al., 2004a). No central actor like a government can set a specific objective and realize it by using the 'right' instruments under the 'right' circumstances. Such an approach does not take into account that transitions are the result of unpredictable interactions between different stakeholders, shaped by power games, and need to adapt to new developments as they arise.

It is thus generally agreed that the transition to a sustainable society also necessitates new management and governance approaches, in other words: "management of transitions requires a transition of management" (Teisman and Edelenbos, 2004: 187). Given the co-evolutionary nature of transitions, governance will necessarily be **reflexive** and involve a **cyclical process** of action and evaluation (Elzen et al., 2004a).

4.3 Sustainability: politics and definitions

One of the key issues in transitions to sustainability, are the political processes involved in identifying which problems need to be addressed and selecting suitable solutions. This is a political, constructed and often contested process. Indeed, there is typically ample scope for debate over the sustainability of both incumbent regimes and alternative niches (Stirling and Smith, 2008:14). **Sustainability appraisals** are necessarily undertaken from different positions and perspectives. Overall goals for sustainability, such as preservation of biodiversity or reducing the environmental impact of agricultural practices often achieve broad rhetorical consensus. However, more specific criteria tend to be hotly contested, with profound implications for the favoured pathways. A typical example is the current debate regarding the sustainability of biofuel production, which is rife with ambiguities on the choice of indicators, the projected future environmental and societal impact and the relative weighing of effects in developed and emerging countries.

This contributes to a **paradoxical situation** found in most modern consumer societies with, on the one hand, the wide acceptance that to achieve sustainability there is a need to radically change the established values, lifestyles and societal structures, and on the other, a profound inability and/or unwillingness to implement such change (Ehrlich and Kennedy, 2005; Blühdorn, 2011; Barbier, 2011).

A transition to sustainability implies a systemic change, and thus a change of criteria that actors use to judge the appropriateness of products, services and systems (Kemp and van Lente, 2011). In particular, it might be necessary to shift criteria from aligning with economic benefits toward aligning with sustainability concerns. Indeed, catering to consumer's desire for comfort, convenience and low costs (i.e. 'business as usual') is unlikely to lead to sustainability transitions. Such a transition may require a change in consumer values as well as in the practices and criteria that define 'good food' or a 'good farmer'. Changes in criteria and cognitive frames may occur through cultural change, prices and new and better knowledge, but will always be the outcome of political struggle between contending paradigms and framings.

Regarding agriculture, there are obviously several **contending paradigms** (van der Ploeg, 2009; IAASTD, 2009; Freibauer et al., 2011). There is ample discussion e.g. on whether a transition to sustainability can be achieved by focusing on technological artefacts (e.g. GMOs, precision agriculture) or whether it is more effective to focus on consumer behaviour, social relations, allocation rights, institutional structures and cultural perspectives. Each of these elements are part of a discourse, and there is intense debate as to which standards are suitable, as well as which criteria adequately reflect sustainability and is thus a legitimate criteria. Thus transitions both presuppose and bring about a shift in standards of legitimacy.

These **standards of legitimacy** are reflected in the conceptual frames that define which problems are 'persistent' (while ignoring and downplaying others), and which solutions are appropriate to address the problems. As a result, emergent transitions tend to be rooted in contrasting sets of interests and prospects, different values and cognitive frames. A societal discourse ensues on which of these is legitimate, often by influential members of the established regime (e.g. agribusiness groups, banks, state agencies, expert systems). Regime actors are likely to attempt to block transitions that are advocated as necessary by particular lobbies, and support another emergent transition by arguing it is 'objectively necessary', given the rationality of their cognitive frame (van der Ploeg 2009). However, what counts as 'authoritative knowledge' is often as much a reflection of institutional power as it is of robust or comprehensive understanding (Stirling 2009:7). The issue of the definition of what counts as a transition to sustainability is thus closely related to the question of 'whose system counts', which includes the definition of the boundaries of the system under consideration, as well as what its structure is and how it functions (Shove and Walker, 2007). Thus, both the identification of persistent problems and solutions that lead to sustainability are the result of social interaction, political decision-making and conflict.

In **FarmPath** there was no *a priori* assessment of which niches are or are not sustainable, but the discourse of the stakeholders involved were analysed, their framing of both persistent problems to be addressed and criteria to assess the relative worth of alternative pathways to sustainability. What is considered 'sustainable' and why will be a topic of discussion in the workshops with the National Stakeholder Partnership Groups, as well as with the regional stakeholders. Subsequent analysis may identify the underlying paradigms. Attention was also be given to the extent to which there are reflexive processes which re-open the debate over what is to be sustained, why, for whom and how (Stirling, 2008). This will allow to assess the extent to which the regime as well as the niche is involved in a recursive dynamic between 'opening up' to alternative framings of sustainability and 'closing down' around a sub-set of pathways.

4.4 Institutions: rules, values and lifestyles

Another aspect that has not stood at the centre of previous studies on transitions to sustainability is the role of institutions. **Institutions** are all those 'rules of the game' such as norms, conventions and ways of doing things that structure human interaction and activity (North, 2005). The rules can be formal or informal, overt or implicit. The rules are expressed in artefacts, such as long-lived material infrastructures. Socially agreed rules of interpretation and signification of the external world also

build cognitive frameworks. These cognitive frameworks are embodied in discourse and narratives through which people make sense of their environment. Similarly, lifestyles are the embodiment of societal conventions and values. Artefacts, cognitive frameworks and lifestyles tend to dampen, delay and raise the stakes of attempts at rule reformulation, i.e. transition.

The **lifestyles** in western consumer democracies may be a major barrier to a transition to sustainability. Indeed, in transition studies, the role and importance of consumer expectations is sometimes overlooked. Sustainability is often tacitly defined as a matter of resource management, efficiency and ecological modernisation. Thus transitions to sustainability are seen as requiring the transformation of systems of provision. However, these transitions are bound to imply changes in lifestyles and patterns of demand, which are rarely discussed (Shove, 2004; Shove and Walker, 2007). Indeed, unsustainable patterns of demand are integral part of the systemic failures that give rise to the persistent problems. The steps that most members of the relevant scientific community believe are necessary (e.g. reduction of human-caused greenhouse gas emissions, limiting per capita consumption, lifestyle and dietary changes) are disconnected from those measures society – both policy makers and consumers – is willing to implement (Ehrlich and Kennedy, 2005; Blühdorn, 2011). Indeed, even if powerful regime actors are committed to change, their ability to bring about change is constrained since the regime is also reproduced by the daily routines and decision taken by end users. Thus while institutional agents might want to introduce changes, the (unpredictable) response of everyday users will affect how the change will unfold (Shove and Walker, 2007).

Thus, it is not only governance and corporate actors that are key players, but the consumers as well. In the agro-food chain it has been pointed out that e.g. shopping practices (i.e. frequent trips with a car), the demand for convenience food and for out-of-season fresh products are some of the aspects that may need to be changed to increase the sustainability of food chains. Thus, if transitions to sustainability are to succeed, they need to take account of how they will play out in ordinary arenas of everyday life, and whether consumers are willing to implement the necessary transformation of their **daily routines**. In other words, when analysing transitions, the consumer-citizen should not only be included as a driver of change in her role as e.g. social movement activist, but also as key player influencing the success of a transition by implementing it in everyday routines.

But it is not only consumer-citizens whose values and cognitive frameworks need to change, but also those guiding decisions within **organisations**. For example, many organisations search for ways to reduce the transaction costs of existing production and market relationships, i.e. search and information costs, bargaining and decision costs, and policy and enforcement costs (Barbier, 2011). The outcome of this behaviour is a replication of the same patterns of resource-based development, despite the rising ecological scarcity associated with overreliance on fossil fuels and ecological degradation.

Furthermore, many organisations – including many government bodies – tend to focus on single problems or sectors, ignoring system-wide interactions, which lead to unwanted outcomes. However, current organisations are not necessarily designed – and thus not well equipped – to deal with a rapidly changing environment, nor with the increasingly **intertwined challenges** that tend to span several sectors which are often seen as distinct (e.g. health and agriculture, both connected through food; or energy and agriculture, connected through biofuels). Thus, such organisations may prevent change, be ineffective or inefficient, mostly due to their internal operation logic, rather than because they have specific interests to protect. Such institutions are challenged when it comes to manage boundaries between knowledge and action in ways that enhance the salience, credibility and legitimacy of knowledge (Cash et al., 2003).

Essentially transitions involve **changing the incentives** for how individuals and organisations behave, which in turn means changing institutions (Woodhill, 2009). Indeed, incentives for behaviour come from a complex and highly interconnected web of institutional factors, not least of them belief systems (North, 2005).

Scenarios should thus take into account the effect of the emergent transitions onto the daily life of consumer-citizens and whether they seem acceptable or under which conditions they may be feasible. Also, we will discuss how institutions may facilitate a change in human behaviour, to increase local appreciation of shared global concerns and the preservation of public goods. With regional stakeholders, we will discuss what the roles and responsibilities of private citizens, the private sector and the government could be. Particular attention will be given to the potential role of elements of the civil society, in particular NGOs, young farmer associations as well as special interest groups and other informal groupings. Such organisations tend to be closely in touch with the grassroots, as well as more flexible and responsive to societal change and thus co-evolve with their environment.

5 Specifying ‘emerging regional transitions to sustainability in agriculture’

The aim of FarmPath was to study, at the regional level, emergent transitions to sustainability in agriculture, using the Multi-Level Perspective. This requires defining quite a few concepts in the context of agriculture (e.g.: what is a niche? A regime? How may their interactions lead to an emerging transition?), and specifying them for the purposes of the research project.

5.1 *The socio-technical landscape and its dynamics*

The **socio-technical landscape** designates the long-term exogenous trends at the macro-level, which – in the short-run – cannot be influenced by niche or regime actors (Geels and Schot 2010:24). A number of trends which are likely to influence the future development of agro-food systems can be identified. The overview below focuses on those trends which have received some policy attention, as they are increasingly recognized as ‘persistent problems’. These often result in pressures from the socio-technical landscape onto the regime, thus possibly opening up ‘windows of opportunity’ for a transition. Persistent problems with impact on EU agriculture, and trends which are expected to lead to problematic situations in the future, include:

- **CAP reform at a time of tight government budgets:** The current CAP will end in 2014, and over the last few years there have been intense discussions on how to shape the new CAP. The EC aims to address three broad challenges (food security, environment and climate change, territorial balance), and to ensure that the new CAP contributes to the EU 2020 Strategy which aims at a ‘green growth’, i.e. a smart, sustainable and inclusive growth (EC, 2010). The negotiations are conducted in a general atmosphere of tight government budgets and an economic crisis. Given this background, it is unclear to what extent financial support will be available for niches and innovative approaches in agriculture.
- The Millenium Ecosystem Assessment (MEA, 2005) has concluded that many **ecosystem services** have been degraded as a consequence of actions taken to increase the supply of other services, such as food. Moreover, the degradation of ecosystem services could grow significantly worse during the first half of the 21st century. The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met. However, they involve significant changes in policies, institutions, and practices that are not currently under way (e.g. adaptive management, polycentric governance, investment in education and health, proactive action to address environmental problems before their full consequences are experienced). Furthermore, there is evidence that changes being made in ecosystems are increasing the likelihood of nonlinear changes in ecosystems (including accelerating, abrupt, and potentially irreversible changes), with important consequences for human well-being (see also Stoate et al., 2010; EEA, 2010). The

ecological concerns are likely to increase the attention to environmental protection in the CAP (i.e. through cross-compliance).

- **Demographic trends:** three processes are likely to affect the EU: population decline, shrinking working-age population and an ageing population (EC, 2008; Davoudi et al., 2010). These trends will be aggravated in a number of rural areas due to the young and well educated segments of the population leaving for urban areas. Regions in demographic decline may face difficulties in financing essential public goods and services. Although these trends are likely to affect all sectors of the economy, it is likely that agriculture will be most affected. In particular the average age of farmers is high, indicating that agriculture is not attractive to young farmers and new entrants, or that there are high entry barriers.
- **Health crisis:** Currently, more than half of the total adult population across the European Union are overweight or obese (OECD, 2010). This trend is linked to poor diets and low physical activity, so that the EC has called for strengthening integration of health concerns into all policies (EC, 2007). These concerns may create pressure on retail chains and processors, with subsequent changing demand structure for farmers.
- **Food safety concerns:** following a number of food-scares (e.g. BSE, avian influenza), The EU follows an integrated approach through coherent farm-to-table measures and adequate monitoring. The aim is to assure a high level of food safety, animal health, animal welfare and plant health. Also, there are on-going discussions on a range of issues, such as the long-term health and environmental effects of GMO; as well as the debate regarding appropriate labelling of food (EC, 2006a). The rapidly evolving regulatory environment increases uncertainty for farmers, but may also open windows of opportunity.
- **Consumption patterns:** current consumption patterns in Europe are not sustainable, as shown for example through the 'ecological footprint'. Important factors that drive our consumption include growing incomes, technological breakthroughs (such as the Internet and mobile phones), decreasing household sizes, an ageing population, habits and cultures. Housing, food and drink, and mobility have the greatest environmental impact over their lifecycle in terms of emissions of greenhouse gases, as well as material resource use (EEA, 2005). Despite this awareness, economic performance is still measured primarily as growth in gross domestic product (GDP), spurring further consumption. There are increasing voices questioning the indicators used to assess economic performance and social progress, which would imply radical change (e.g. Stiglitz et al., 2009; Jackson 2009).
- **Coping with the impacts of climate change:** With global warming it is expected that the average temperature will increase, as will the frequency of extreme weather events (droughts, floods, etc.). A change in climate is likely to directly affect agriculture, by increasing crop productivity in northern Europe, and a decrease in crop productivity in southern Europe (Iglesias et al., 2009). Generally it is expected that the variability of harvests will increase, and thus stronger fluctuations on commodity prices. This will have a direct impact on farmer incomes.
- **Reducing GHG emissions from agriculture:** as agriculture is an important producer of greenhouse gasses, the EC has proposed that the agricultural sector can reduce non-CO₂ emissions by between 42 and 49% by 2050, compared to 1990 (EC, 2011:9). It proposes that this can be achieved through e.g., efficient fertiliser use, bio-gasification of organic manure, improved manure management, better fodder, local diversification and commercialisation of production and improved livestock productivity, as well as maximising the benefits of extensive farming. There is thus a strong pressure on agriculture to change production practices.
- **Peak oil:** Given that agri-food chains currently heavily rely on fossil fuel (fertilisers, tractors, transport of feed, transport of food, packaging, consumer mobility, etc.), and given that it is generally agreed that maximum rates of fossil fuel extraction has been reached, prices for fossil fuels are likely to increase. This will affect cost of production and of prices, as well as

spur the search for alternative sources of energy. In agriculture it might also lead to a relocation of some sectors (esp. greenhouses, off-land livestock production) closer to urban centres to reduce transportation costs (Portet and Hérault, 2010).

- **Agriculture as a producer of energy:** Given the search for alternative sources of energy, agriculture is called upon, e.g. for the production of energy through biomass production, or through using buildings and land areas (e.g. photovoltaic arrays, wind turbines, geothermal systems). Furthermore in a number of countries farmers also own forests, so that they may use wood for energy production (e.g. wood chips for heating). The policies to support biofuels have led to a controversy regarding economic viability, reduction in greenhouse gas emissions and the impact of land use changes. Ethical concerns have been raised regarding the non-food use of cereals and vegetable oils. Generally it can be expected that in the future the agricultural and the energy sector will be tighter coupled.
- **Growing global population,** raising the challenge to feed 9 billion people in 2050. It is unclear whether the problem is best addressed by increased agricultural production, better global distribution of current production, shifting diet composition, and/or more efficient use of available food (i.e. avoidance of storage losses and food wastes) (see e.g. Collins and Chandrasekaran, 2012). The growing population, combined with environmental degradation and political instability in some parts of the world is also likely to lead to migration movements, to urban centres as well as towards Europe.

These trends in the socio-technical landscape are surrounded by competing interpretations, regarding their current impact and their future development. Similarly, which measures are appropriate to mitigate their impact depends on the paradigm underlying the analysis. The uncertainty is compounded by the fact that the various trends are interrelated, linked through reinforcing feedback loops (Fig. 3). For example demographic and lifestyle changes affect local rural development (e.g. through demand for processed and/or imported foods) which affects energy consumption for transport (both for international transport as well as the ‘final kilometre’ with personal cars), increasing demand for fossil fuels and/or bio-energy.

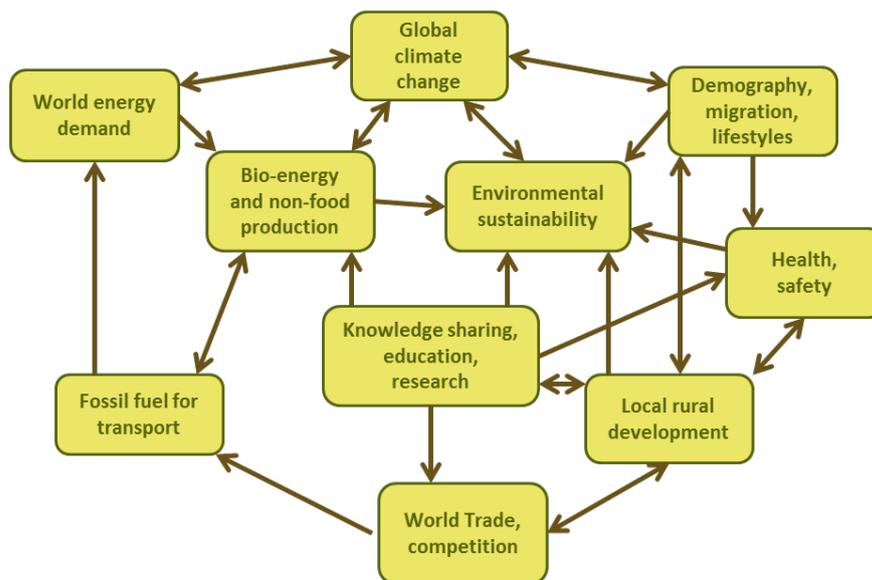


Fig. 3: Cross-impacts of some of the major driving forces (Source: adapted from Harper, 2008)

To clarify potential future impacts on agriculture, a range of scenarios have been developed, such as ‘SCENAR 2020’ (EC, 2006b), the ‘Agriculture 2013 foresight study’ by INRA (2008), the ‘3rd SCAR Foresight Exercise’ (Freibauer et al., 2011), ‘Five scenarios for 2050-Conditions for agriculture and

land use' (Öborn et al., 2011), or studies focusing on specific issues such as 'Agriculture and Energy' (Portet and Héroult, 2010). From these and other studies, a number of recommendations have been derived, leading to reports such as 'Food futures: rethinking UK strategy' (Ambler-Edwards et al., 2009), the 'International Assessment of Agricultural Knowledge, Science and Technology for Development' (IAASTD, 2009), the 'Manifesto for reforming the global food and agriculture system: Towards a questioning agenda for a new manifesto' (Millstone et al. 2009) or 'The future of food and farming: Challenges and choices for global sustainability' (GO-Science, 2011).

Given complex interactions between the various trends in the socio-technical landscape, it is unclear which issues will dominate the public discourse and which pressures will be put on the regime.

5.2 Defining and operationalizing the regime

The **regime** is of central importance for transition research, since it defines the societal systems within which transitions are analysed. The regime refers to a "semi-coherent set of rules that guide, orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems" and thus accounts for the stability of the system (Geels, 2011:27). The regime thus includes both the tangible and measurable elements (e.g. artefacts, market shares, infrastructure, regulations, consumption patterns, public opinion) as well as the intangible elements, i.e. the deep structure made up of beliefs, rules of thumb, routines, and standardized ways of doing things, policy paradigms, social expectations and norms (Geels, 2011).

As the regime has often been studied at the national level (i.e. a country), it might seem like a spatial concept (similarly, the socio-technical landscape is often linked to international trends). However the regime, as well as the socio-technical landscape and the niche, are actually defined by their (relative) **temporal stability**, not by their spatial spread. Nonetheless, in practice the two dimensions are often related, as practices that involve many and a wide variety of societal actors tend to be spread over larger areas and tend to be stable over time. On the other hand smaller networks may be more dependent on individual actors or susceptible to shocks and thus less stable.

The close link between farming and its (natural and social) context, its spatial dependence, and the diverse functions it fulfils and diverse societal expectations it faces, meant that the 'agricultural regime' is neither homogeneous, nor monolithic (see Smith et al., 2005). Rather, the regime, i.e. the policy paradigms, visions, social expectations and norms are "**semi-coherent**" and characterised by "internal tensions, disagreement and conflicts of interests" (Geels, 2011:31). Thus while the agricultural regime is focused on promoting 'modernised agriculture' (or might want to appear that way), at the same time it offers some protection for niches, e.g. through providing funds and regulatory support for rural development activities such as alternative food networks. In farming transitions are thus likely to be characterised by diversity, and to be a result from push-and-pull efforts by niche actors in cooperation with regime actors (of the agricultural or other regimes).

What the 'regime' is, is not given through clear and unambiguous **system boundaries**. It needs to be defined relative to the topic of analysis. Defining a regime thus entails the usual problem of drawing boundaries, which is dependent on framing (Holtz et al., 2008; Ison, 2010; Geels, 2011). What is defined as the regime plays a crucial role in studying transitions. Indeed: "what looks like a regime shift at one level may be viewed merely as an incremental change in inputs for a wider regime at another level" (Geels, 2011:31). For example, defining the regime e.g. as the 'agricultural regime' within a region might lead to the conclusion that the niche studied cannot be reasonably expected to lead to a transition in the agricultural regime, while missing the fact that the niche does have a radical impact at a lower scale (e.g. the horticultural sector of the region).

There are several features that distinguish the 'agricultural sector' from the 'industrial' or the 'service sector', and which need to be taken into account when studying transitions. In particular these are

the diversity in farming, its spatial nature, its multifunctionality, its public good character, all of which contribute to the high level of policy involvement in the sector (Darnhofer et al., 2014).

Within FarmPath **two broad approaches** to defining the regime seem particularly useful. The first approach is to define the regime as including the subsystems along the food chain, i.e. from ‘farm to fork’. This is useful if the focus of the niche is an alternative food system (e.g. a short food chain), and the analytical focus is on how the relationships along the food chain are renegotiated, how norms are redesigned. The second approach is to discern several regimes (e.g. the agro-food regime, the recreation regime or the energy regime). This is useful in case studies where the multifunctionality of farming is central and the analytical focus is on how the relationships between the regimes are renegotiated and shifted.

Focusing on emerging transitions within the agro-food regime

Holtz et al. (2008) propose to define a regime in relation to the **societal function** it fulfils. A societal function encompasses the expression of a human need and the way in which this need is met. Thus a regime consists of all actors and elements that are involved in originating, shaping, fulfilling this need and/or regulating how it happens. A transition is a radical shift in how this societal function is fulfilled. One societal function could be fulfilling the human need for food. This follows a sectoral approach to agriculture. Within the Multi-Level Perspective this sector can be understood as a socio-technical regime, with its constituting sub-regimes (see Geels, 2011:27), e.g. agricultural policy, agricultural research, agro-food industry, food production and processing technology, market and consumer preferences.

Yet, for analytical purposes, it might be useful not only to distinguish between sub-regimes, but also to **distinguish between subsystems** which address specific processes involved in fulfilling the human need (e.g. develop new technologies, produce food, process food, sell food, make policies). Obviously these subsystems may overlap and do interact, for example through the demand of processing technologies and the availability of transport infrastructure (Fig. 4). Thus, within a regime, multiple societal actors interact, each having their individual goals, contributing to the overall societal function (Holtz et al., 2008). As a societal function thus usually spans the spheres of interest and influence of many actors (e.g. producers, government ministries, SMEs, consumers), complex processes of **coordination** are required (hierarchies, markets, networks, public policies) (Holtz et al., 2008). In the coordination of actions, cognitive frameworks play a key role, and these meanings are redefined in a continuous process of renegotiation and being enacted by individual and collective action.

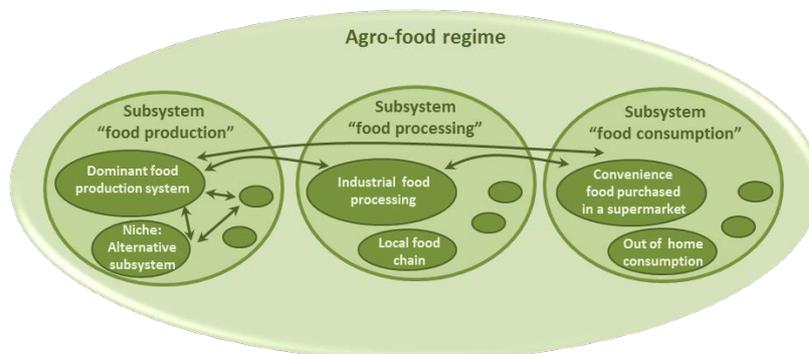


Fig. 4: Schematic representation of regimes fulfilling societal functions. Within a societal function (e.g. provision of food) several subsystems might be distinguished. These subsystems will have a dominant way that processes are organised (e.g. modernised agriculture). However, often there will be niches (i.e. low-input organic farming) which offer an alternative way to organise the subsystem ‘food production’. Niches interact with each other as well as with the dominant mode of organisation. In an emerging transition the dominant mode is in a process of being reconfigured, which is only possible if other subsystems (e.g. ‘food processing’ and ‘food consumption’) are also reconfigured.

Each subsystems might have niches which will be characterised by a **diversity** of technology used, institutions, values and beliefs of actors, economic logics, access to finances, etc. For example in a certain context it may be useful to distinguish between producing food in intensively managed commercial farms (the incumbent regime) and low-input family farms (a niche) as these ways to organise the subsystem 'food production' tend to be linked to different farm management paradigms, and with different impact on e.g. the environment and rural development.

A further important element in describing the regime will be to understand the **interdependencies between the subsystems**. Indeed, subsystems constrain, influence and mutually shape each other, so that the state and development of a subsystem can only be understood in the context of the broader regime (Holtz et al., 2008). The interdependencies between subsystems might also be of major importance to understand the state of a regime. In the assessment of interdependencies, cognitive frameworks will play an important role, since they filter – or even distort – information exchanged between sub-systems. Hence, the dynamics of a social sub-system (unlike natural systems) are not directly influenced by the actual state or change in other sub-systems, but by what is transmitted through the perceptions of actors or through the indicators used to assess relevant system states. For example the perceived environmental impact (and thus sustainability) of various food production sub-systems will depend on the interrelations assumed important and thus the indicators used. If different indicators would be used, it is likely to affect the overall assessment of the sustainability of a sub-system (Smith and Stirling, 2007).

This integrative analysis of the sub-systems within a regime allow to study the systemic changes that are needed for a transition. Indeed, it is unlikely that a niche can break through in the production sub-system unless there are accompanied by shifts in the food consumption sub-system. Indeed, without changes in demand, farming is unlikely to be able to implement radical change towards sustainability. Thus, to ensure that the regime under analysis was autonomous enough to be able to realise radical changes, the whole value chain may need to be included in the analysis and thus the definition of the regime, i.e. research and development, education, input-suppliers, farmers, the structure of trade and consumer lifestyles (see e.g. Darrot et al. 2014).

Focusing on emerging transitions driven by multifunctionality

While transformation dynamics are often driven by tensions and contradictions within a regime, it has been pointed out that transitions often involve novel links between previously separate societal domains (Holtz et al., 2008), i.e. different regimes. When analysing a specific situation, it thus seems useful to explicitly identify the societal domains that are involved, and how they are involved (Holtz et al., 2008). If these societal domains – addressing different societal functions – are coordinated by different sets of rules, they may be labelled as separate regimes. Distinguishing between regimes might be particularly appropriate when studying potential transitions in agriculture (see Fig. 5) given the multifunctional nature of farming. If the topic of analysis reveals the involvement of several regimes, including them will allow identification of tensions both within each regime, and between regimes. It also highlights that a niche may build ties with one regime, and uses these ties to reinforce the pressure on another regime (see Diaz et al., 2013).

This allows to highlight the **territorial approach** to agriculture, and its multifunctionality. Indeed, since the 1990s a **multifunctional** understanding of agriculture plays an important role (Marsden and Sonnino, 2008; Renting et al., 2008). While the specific aspects of multifunctionality are debated, there is broad acceptance of the general principles. These state that while the function of farms is to produce food and other goods (e.g. fibres, energy), they also provide other (non-market) functions such as protection of natural resources (soil, water, biodiversity), maintenance of forests, biotopes and other valued elements of landscapes, as well as contribute to the cultural heritage of rural areas (including traditional, speciality foods).

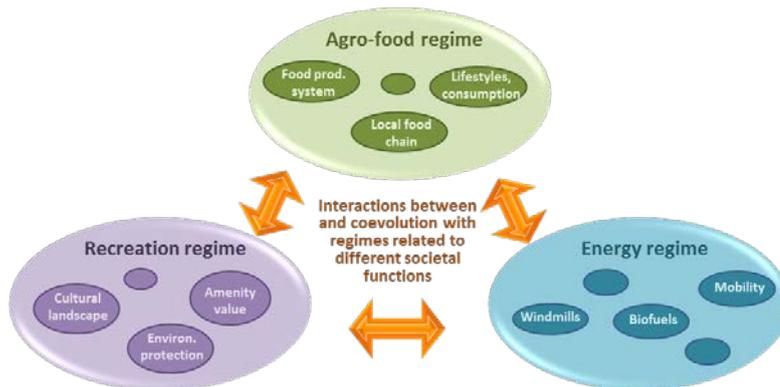


Fig. 5: Schematic representation of interactions between regimes. The understanding of farming as multifunctional shifts the perspective from a sectoral to a territorial approach, emphasizing the manifold interdependencies of rural areas and farming. This multifunctionality may enable niches that are based on novel interactions between the agro-food regime and another regime, e.g. recreation, energy or environmental protection. As Holtz et al. (2008) have pointed out, niches may emerge through a new interaction between formerly distinct regimes, or through novel interactions between regimes.

Multifunctionality of agriculture also implies that farming is faced with simultaneous – and contradictory – demands to maximise productivity (food, feed, energy), while taking into account rural development, environmental sustainability, social justice, contributing to climate change mitigation and reducing dependence on fossil fuel (Pretty et al., 2010). These **contradictory pressures** are bound to lead to regime-level tensions and ambiguities, both regarding which trends need attention the most, and which course of action is suitable. It is thus likely that there are several sub-groups at regime-level which champion different transitional trajectories. For example, van der Ploeg (2009) identifies three transitional trajectories that are simultaneously present and are mutually competitive, resulting in a variety of contradictions and complex dynamics formed by the interaction of these diverging processes. He distinguishes: (1) industrialisation characterised by farm enterprise expansion and scale increase as well as a standardisation of the agricultural labour process. (2) Repeasantisation which is characterised by the active construction of new degrees of autonomy (e.g. through on-farm processing, direct marketing). Finally (3) deactivation is characterised by a reduction of agricultural activities and a shift towards leisure, nature reserves, rural dwellings, and bioenergy production.

Distinguishing between several regimes is particularly useful in those case studies, where niche activity focuses on building novel links between several regimes, thus highlighting the role of **multi-regime interaction** in an emerging transition. For example the agricultural regime might interact with the environmental protection regime: the Nitrate Directive, the need to increase biodiversity, or to protect sensitive ecosystems creates pressures on the agricultural regime (Diaz et al., 2013). The tension between the two regimes creates opportunities for many niches within which alternative – environmentally friendly – practices are promoted, both at farm level and along the food chain.

The central role of **multi-regime interactions** in the niches studied within the FarmPath project are linked to the multifunctionality of agriculture and so may be expected to become a distinguishing feature of transitions in farming. This is especially the case if a territorial approach is selected, i.e. one that looks at the different activities and roles of a farm in its natural and social context, rather than taking a sectoral approach, where the farm is seen primarily as an element along the food chain. As a result a farmer may be engaged in food production, energy production, amenity production and environmental protection. Farmers could thus be considered as actors engaged in multiple regimes, making the farm a locus of tension of different demands linked to different regimes. Simultaneously, these links with different regimes offers various options to the farmer, on how much and how s/he engages with each regime, again reinforcing the diversity in farming and of niches linked to farming.

Operationalizing the regime: a reflexive and contextual practice

While the operationalization and specification of regimes has been understood as challenging (Geels, 2011:31), this is linked to the problem of defining the topic of analysis. The ‘regime’ is thus an **interpretive analytical concept** that invites the analyst to investigate what lies underneath the activities of the actors, e.g. shared beliefs, policy paradigms, visions, social expectations and norms, lifestyles of users, institutional arrangements and regulations (Geels, 2011:31). For each case study, it was thus first necessary to define the scope of the empirical topic, so as to define what the ‘regime’ is, in the context of that particular topic. This choice should be made transparent given that the way in which the regime is defined will determine the processes and change the dynamics that can be analysed, while obscuring others.

Distinguishing between regimes or between subsystems is challenging, as the actors and structural elements of a regime may not reveal a ‘natural’ way to subdivide the regime. Regime descriptions, i.e. identification of functional subsystems and the interdependencies between them, thus demands pragmatic deliberation based on the specific issues involved in each case study. The choices made should be made **reflexively**: in most cases there will be several feasible options – rather than ‘better’ and ‘worse’ options. But the choices will inevitably have implications on actors included in the analysis, power games captured, framing of problems and potential solutions, impacts of transitions captured, etc. These choices thus need to be documented and discussed with the stakeholders, e.g. before the scenario development.

5.3 The case studies: niches ‘taking off’

Within the MLP, the **niche** is the place where entrepreneurs work on radical innovations that deviate from established norms, processes or practices, usually based on different beliefs. As a result of the adjustment of expectations, enrolment of new actors, expansion of the resource base and learning processes, networks become larger, especially through the participation of powerful actors, which convey legitimacy and supply additional resources (Geels, 2011:27).

A case study in FarmPath is an **established niche**, i.e. the pre-development phase is completed, there is a stable pattern building on defined rules and standards and energies are increasingly used to network with niche-external actors and institutions. For example, the farms in a region, as a group and in collaboration with other stakeholders, are have developed a new approach to food production, may be by creating new links with the recreation regime or the energy regime. This new approach substantially enhances the ecological, social and/or economic sustainability of food production as compared to the currently dominant practices. Individual farms or actors might enter or leave the niche, but this does not destabilize the niche dynamic. This means that the niche as acquired substantial skills, knowledge and experience (Schmid et al. 2004a: 160ff; Schmid et al., 2004b: 57ff). Furthermore, to qualify as a case-study, the niche not only needs to have stabilized, it also needs to have engaged with actors and organisational structures at the regime level in a significant way, i.e. show concrete evidence of being an emerging transition.

Thus the case studies in FarmPath were selected because they show a potential to contribute to a transition to sustainability in agriculture. They are engaged in **new developments** that question the dominant paradigm, i.e. the basic assumptions of the existing regime in a fundamental way. The niche might ‘anchor’ in through proposing new rules, technical systems or networks (Fig. 6). It is likely that a niche that manages to anchor in all three dimensions will be more likely to initiate a transition (Elzen et al., 2012).

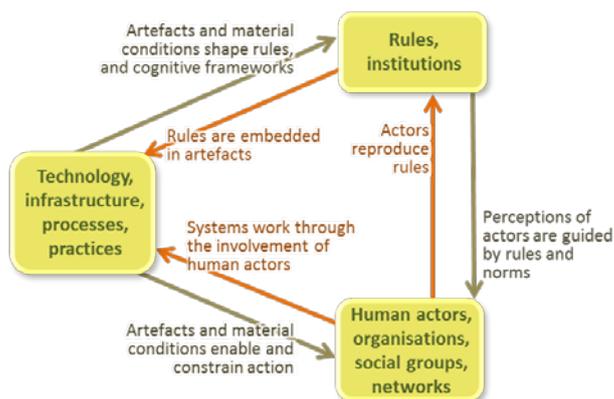


Fig. 6: Three analytic dimensions to understand niche-regime interactions and identify potential levers for transitions (adapted from Geels, 2004:903). Whereas the three dimensions are always interrelated in practice, it may be useful to distinguish them to investigate the interactions and dynamics in niche-regime interactions

The aim was thus to select **case studies** which drive change that:

- (1) affects a whole sector, a whole value chain, or a territory (i.e. include several sub-functions). The change should be characterised by new user practices and may involve new technical systems or drive social innovations;
- (2) leads to a new alignment of actors or networks. This may include e.g. new production or processing practices, new behaviours of consumers, farmers and local stakeholders, new links between previously separate regimes, new institutional arrangements, and/or new governance partnerships.
- (3) is based on rules and values that are clearly distinct from those of the dominant regime, yet are to some level compatible to allow engagement. These rules and values should address a sustainability issue that is clearly defined by the stakeholders involved in the emerging transition
- (4) if possible, young farmers and/or new entrants should be involved in the case study, thus allowing to identify the characteristics of transitions that are attractive to young farmers and/or new entrants.

Despite careful selection of the case studies⁸, whether or not a niche studied in FarmPath will 'break through' is outside of the scope of the project, since it would require a longitudinal study. Indeed, whether a niche will successfully navigate the take-off stage and thus initiate a transition, and whether that transition will be realised (or falter), can only be ascertained in hindsight. Emergent transitions are surrounded by great **uncertainty** and complexity, so that the degree of predictability is relatively small. The breakthrough will depend – among other – to depend on political opportunity structures ('windows of opportunity'), and alignment of normative pressures with market and technology development (Elzen et al., 2011).

The aim of FarmPath was thus to understand why and how some niches **set in motion** transitions at the regional level, while others fail (i.e. remain a niche or disappear). To understand the conditions that favour or impair a breakthrough, much attention will be put on the processes by which niches and regimes interact and are interdependent (Smith, 2007). In FarmPath have put particular emphasis on exploring the role of various types of actors (especially young farmers and new entrants), on regional specificities, and on policies that support the breakthrough of a niche into the dominant regime (e.g. Swanson et al., 2010).

⁸ It has proven challenging to identify case studies involved in an 'emerging' transition. Indeed, case studies had to be selected at an early stage of the research project, often based on limited information. While the niche might a priori have seemed promising, upon closer analysis different aspects might be revealed that indicate limitations in niche dynamics, leading to the conclusion that a 'take-off' is unlikely. Also, while niche actors are usually understood as driven by the hope that their novelty might eventually be used in the regime or even replace it (Geels, 2011:27), some niches were found not to have such an ambition (see Darnhofer et al, 2014).

5.4 Challenges to identifying an emerging transition

The **ideal-typical representation** of a transition is a process that results from niche-innovations that build up internal momentum, changes at the landscape level that create pressure on the regime, thereby creating windows of opportunity for niche-innovations (Geels, 2011:29). However, Geels (2011:29) clearly pointed out that there are no simple causalities in transitions, rather there are “processes in multiple dimensions and at different levels which link up with, and reinforce each other (‘circular causality’)”.

In FarmPath the aim was not to study completed transitions, but rather, current on-going processes that – a priori – seemed promising for initiating a transition at a later time. **Two challenges** had to be tackled to clarify what would constitute an ‘emerging transition’: Firstly the distinction between marginal and radical change, and secondly the spread of a change which can be difficult to ascertain given the diversity in farming.

The first challenge is linked to selecting the criteria that differentiate a transition from marginal change. Indeed, a transition is characterised by **radical change** at regime level. To talk about a transition it is essential to clearly differentiate between radical changes (a fundamental shift in system logic) and incremental changes (e.g. when the regime adapts in response to landscape pressure, or when it co-opts a niche). The challenge is that incremental vs. radical change is not a binary either/or as one might lead to the other. Especially in the context of emerging transitions, it is unclear whether observed incremental changes might coalesce into a radical change. There is a distinct possibility that incremental changes may accumulate, but add up to nothing radical. The challenge is then to distinguish between radical changes and those marginal changes which are part of the on-going adaptations of the regime, i.e. changes that do not question fundamental values, paradigms, social expectations and norms, lifestyles of users, or institutional arrangements and regulations.

The second challenge is linked to pin-pointing a transition given the **diversity of practices** within a region. Indeed, identifying a radical change in values and practices is easier if the ‘dominant’ practices are fairly homogeneous (e.g. transportation by automobiles), or at least there is one clearly dominant practice with a few minor practices (e.g. in energy production), esp. if these practices rely on large investments in infrastructure (e.g. roads, power plants). However, in farming the ‘mainstream’ might be more an artefact of the rhetorical power of regime actors (e.g. the Chamber of Agriculture) than a faithful description of farmer’s practices.

Diversity in farming is not limited to production methods and farm structure, or the influence of terrain and climate, but also influenced by the types of markets that farmers serve, be it long or short food chains, energy markets or the services they offer (e.g. tourism and recreation). Given this diversity, a transition will not take the form of a transition from a clearly defined set of practices ‘A’ to a new – and radically different – homogeneous set of practices ‘B’. It is more likely that a transition will translate into a **shift in relative importance** of practices, a different mix, different emphasizes, and differences in the linkages between elements of a farming system. This makes it challenging to clearly pinpoint the transition ‘of what to what’.

Indeed, research based on an actor-orientation, such as the research on e.g. farming styles (van der Ploeg, 2000) or on rural development (van der Ploeg et al., 2000) has shown that farmers are not deterministically guided by structural constraints such as subsidies, markets or natural environment, but actively mediate their impact, resulting in a wide variety and diversity of on-farm practices. Thus, given farmer’s agency and the dependence of farming on the natural and cultural environment, a **uniform ‘transition’ is unlikely**. Yet, it is debatable whether a shift in the proportion of farms using a particular practice (e.g. direct marketing, energy production) or a shift towards a higher level of diversity is sufficient to be labelled a ‘transition’.

5.5 Regional-level transitions

On the one hand FarmPath will build on the insights derived from previous transition studies, and apply them to on-going transitions at a smaller scale. **Regional-level transitions** are situated at a smaller spatial scale (regional instead of national) and smaller temporal scale (5-10 years instead of 30-50 years) than most studies of socio-technical transitions. On the other hand, the regional-level transitions we will focus on in FarmPath will be situated at a higher spatial scale than most of the studies focusing on niche development within agriculture.

The focus is put on the regional level as the region is **emerging as a key level of governance** and action. It is the level at which various public policies are being translated into concrete action, where the demands that various societal groups make of agriculture and the rural landscape are becoming manifest (indeed, at the national level they tend to be 'siloe'd', e.g. in various ministries and sectoral policies). The interests of these societal groups may well diverge and lead to conflict. But there are also actors who cooperate and strive to move towards concerted action.

In FarmPath the region is thus – to some extent – seen as a **micro-cosmos** of the larger spatial level, especially regarding the diversity of societal actors and agendas as well as institutions and structures. Of course the regional level has some specificities that are distinct from the national level (thus some limitations will apply when trying to transfer insights from the national to the regional level), but it will allow to study the societal dynamics that a niche needs to tackle to initiate a transition at the broader societal level.

Initially, the region was seen as roughly the size of a NUTS 3 level, to ensure **fairly homogenous** biophysical and socio-cultural characteristics. However, an administrative delimitation may not always be practical for the initiatives studied in FarmPath, nor for the regional scenarios. Indeed, what constitutes a region is necessarily socially constructed and negotiated.

The region is thus not understood in a positivist way (i.e. space as a neutral container, place as objective, bounded, self-contained and measurable), but follows the interpretive tradition that considers **space as relational** (Davoudi 2012:431). The emphasis is thus on fluidity, reflexivity, contingency, connectivity, and multiplicity. In other words: the region is understood as socially and culturally produced, as constructed around values, norms, beliefs, aspirations and memories. In other words, "regions are historically contingent processes, wherein the reproduction and transformation of society is inseparable from the transformation of nature within prevailing relations of power" (Neumann 2010:372). When defining the region for the scenarios, attention will be paid both to the objective and physical matters *of* space, as well as the subjective and social concerns *about* space and place (Davoudi 2012:432).

As a result, the delimitation of the 'region' did not (necessarily) follow administrative or political boundaries. Rather, it was defined with the **participants** based on their assessment of what spatial scale is needed to effectively address the key challenges to sustainability of agriculture within the selected region and what spatial scale is meaningful to them. This delimitation ensured that actors and processes that need to be included to understand the transition are included, without the region being larger than necessary.

5.6 Transition to sustainability

There is a general consensus that sustainability implies **four dimensions**: economic, ecological, social and institutional⁹. Sustainability is thus not only understood as maintenance (or enhancement) of

⁹ While the first three dimensions (economic, ecological and social) are firmly established, there are several proposals for a 'fourth dimension' of sustainability, including communication, culture, institutional. Within FarmPath it seems that the institutional dimension may be the most useful. Following Douglass North, 'institutions' are the "rules of the game", consisting of both the formal legal rules and the informal social norms that govern individual behaviour and structure social interactions.

ecosystem services (i.e. ecological sustainability), but also in the ability of the region to build on inclusive governance processes to successfully face on-going changes while maintaining economic viability and social well-being. Indeed, regions face important challenges as we are entering a period of scarcity (Freibauer et al., 2011). The scarcities include lack of public finances, peak oil, and planetary boundaries. Adding to adjusting to scarcity, regions need to cope with the uncertainty that characterises the changes (e.g. as a result of competition in land-use between food and energy production, climate change, urbanisation, etc.).

In agriculture in the European Union, sustainability has been addressed at the environmental level through agri-environmental schemes and cross-compliance requirements, at the economic level with the direct payments as well as market-based measures through the first pillar, and at the social level through securing farm incomes with the above mentioned payments as well as second pillar measures such as payments for farms in less favoured areas and other rural development measures. These policy measures are complemented by other programmes (e.g., LEADER) which support collaboration between a range of stakeholders, and may contribute to both economic viability and social cohesion. This approach to sustainability tends to be based on **privileging scientific knowledge** over local knowledge (e.g. for identifying suitable farming practices); on a **top-down approach** (as measures are defined and specified in policy documents); and on an **atomistic approach** (i.e. each farm is seen as a separate entity).

This approach has undeniable strengths, and has contributed to environmental protection as well as secured the income of farm households, even in less favoured areas. However, it also has weaknesses which are similar to those frequently associated with ‘**normal science**’ and top-down policy approaches, e.g. some problems have proved to be persistent (Stoate et al., 2009). Indeed the concerns regarding environmental effects are not resolved, and there have been side-effects in other domains such as weakening social cohesion as well as local capacity to act, or increased dependence on external inputs such as farm inputs, information, finances.

There are number of **sustainability assessment methods** (e.g. ecological footprint, wellbeing assessment, ecosystem health assessment, quality of life and natural resource availability). However, they have been found not to effectively measure progress toward sustainability at the regional scale (Graymore, et al. 2008). Other assessments build on criteria, and a wide variety of criteria have been established (e.g. the Sustainable Development Indicators from the EC, or the SAFA sustainability dimensions of the FAO). Generally, it has been pointed out that available indicators of sustainability mostly succeed at measuring unsustainable trends that can be targeted by management action, but fall short of ensuring sustainability (Dahl, 2012).

Such assessment methods are poorly suited to the work in FarmPath. On the one hand these approaches are mostly aimed at comparing the changes in indicators over time (i.e. are most useful for longitudinal studies) or comparing one value chain against another (or against a benchmark). On the other hand – based on the understanding of sustainability as resulting from co-evolutionary dynamics – FarmPath shuns a superficial consideration of sustainability as something that can be objectified. Thus, while accepting that objective data is important, we focus on the task of creating meaning to the numbers, of **identifying interconnections** between issues and criteria, of addressing underlying (power) dynamics. Indeed, sustainability assessments that focus only on facts and figures tend to reinforce techno-economic values to the detriment of issues such as procedural justice, or fairness in the distribution of costs and benefits. In FarmPath, participants were encouraged to be explicit about “what is being sustained, for whom it is being sustained, how it will be sustained, and why it should be sustained” (Berkhout et al., 2004:59). Indeed, achieving sustainability is fundamentally an ethical challenge requiring a new set of values-based indicators, addressing e.g. justice, moderation, solidarity (Dahl, 2012:18); and it should be understood more as a process to engage in, rather than a fixed set of indicators to achieve.

Regional sustainability is thus based on two main premises: (1) that a range of local stakeholders needs to be actively involved to ensure that the local specificities are taken into account; and (2) that

collective action plays a key role, not least to ensure social sustainability (e.g. ability to discuss, reach a consensus and act). Regional sustainability of agriculture is thus understood as an ongoing adaptive process of increasing the ability of farming households and stakeholders along the agricultural production and consumption chains to respond to the changing needs and preferences of consumers and citizens. Doing so involves a flexible combination of farming models and the provision of a suite of public goods and agricultural functions at regional level. By emphasising potential synergies between farms – and between farmers and other actors – new forms of social organisations can be promoted. These social innovations are expected to enhance the sustainability of practices, while at the same time increasing the attractiveness of farming to young farmers and new entrants.

However, special emphasis will be put on the extent to which the transition proposed by the niche is making farming more attractive to young farmers and new entrants. This is understood as a crucial dimension of **social sustainability**, i.e. a ‘persistent problem’ of the current agro-food regime. The issue of young farmers and new entrants is seen as a symptom that the current regime does not ensure that structures are open and paradigms attractive to the current generation of young farmers and new entrants. However, **young farmers and new entrants** are likely to play a key role in a transition towards sustainability. It is likely that they have innovative ideas on how to transform the current regime, and they will be the ones to implement the new practices, build the new networks. For example there are ample reports that in some countries the first organic farms were ‘new entrants’ (i.e. people not coming from a farm background). Also, both new entrants and young farmers are likely to have innovative ideas on how to do things differently, thus helping to address various sustainability problems in the dominant regime.

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7 Appendix 1: A transdisciplinary approach

A definition

Term transdisciplinary is an emergent approach for which a range of definitions can be found (Pohl and Hirsch Hadorn, 2007:70ff). However, **definitions** of transdisciplinarity are characterised by three recurring elements: the integration of disciplinary paradigms, the use of participatory methods, and the application to real-life problems (i.e. not curiosity-driven research). Trans-disciplinary research thus aims at transcending disciplinary limitations as well as transcending the science-society divide. It is seen as holding much promise when tackling messy or wicked social and environmental problems which are intertwined with the socio-political context and require the participation of stakeholders to generate socially acceptable outcomes (Carew and Wickson, 2010). The goal of transdisciplinary research is to integrate potentially disparate knowledges with a view to creating useable knowledge, i.e. knowledge that can be applied in a given problem context and that has some prospect of producing desired change in that context.

As such the term ‘transdisciplinary’ is built on the one hand on the conceptual development from the need for **multi-disciplinary** approaches (several scientific disciplines working separately on a topic, with disciplinary results joined at the end of the project), towards **inter-disciplinary** approaches (overcome the limitation of multi-disciplinary design, need to integrate the disciplines throughout the project, implies intensive discussions between researchers to understand the focus and methods of the other disciplines). And on the other hand a **transdisciplinary** approach recognizes that scientific knowledge is not sufficient to effectively tackle real-world problems and calls for the integration of scientific knowledge with practical knowledge of stakeholders. This is necessary to adequately take into account systemic processes and social perspectives, as well as the diversity of problem perceptions.

Transdisciplinary approaches should be used when knowledge about a problem field is uncertain, when the concrete nature of problems is in dispute, and when much is at stake for those concerned by these problems (Pohl and Hirsch Hadorn, 2007:16). As such transdisciplinary approaches are very similar to ‘**mode-2 science**’ or ‘**post-normal science**’ (Funtowicz and Ravetz, 1993).

While transdisciplinary approaches allow new insights into complex societal issues, they raise a number of new questions in research, especially regarding the **validity** of the approaches, the adequacy of the conceptual models employed, and the robustness of the analysis undertaken (Nowotny et al., 2004). Further, bridging across disciplines and methodological traditions may result in lack of recognition by the scientific community (Flyvbjerg, 2001; Fry, 2001). These critiques need to be taken into account, e.g. by justifying conceptual developments and by clarifying methodological steps (Vega-Leinert et al., 2009).

As a result, within research projects using a transdisciplinary approach, two issues are given a lot of attention: (1) how to integrate the insights from different disciplines, and (2) how to structure the stakeholders’ participation in the research. The first point was not a major challenge in FarmPath since most partners are social scientists and thus have a common language and theoretical understanding. However, much attention needed to be given to designing and implementing the participation of stakeholders.

Participatory research

Following Arnstein’s **ladder of participation** (Arnstein, 1969), participation may range from ‘information’ (i.e. participants are informed), through ‘consultation’ (use of information-elicitation techniques), to ‘dialogue’ and ‘co-design’ (where researchers and stakeholders design the process together). This typology is often used as a starting point, but has been critiqued as viewing participation as a linear continuum where reaching the higher rungs of the ladder is inherently

desirable. This can be problematic as it hides the fact that different research projects or different phases of a same project would benefit from different participation methods and intensities. Thus e.g. Neef and Neubert (2010) have proposed a framework that can be used to reflect on what is most appropriate for a specific project and decide how and when to involve which stakeholders (Fig A1). This framework allows to clarify which objectives in the research project benefit from participation, whether the institutional framework at a specific site allows for participation, who the potential beneficiaries are, as well as issues on how researchers involved in the project differ in their attitude towards participatory approaches and what their experiences with them are.

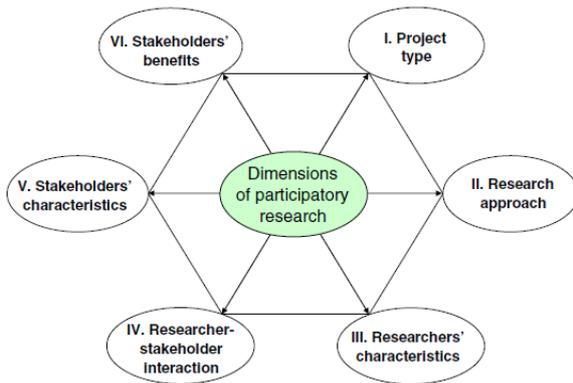


Fig A1: Six dimensions of participatory research, each comprising five attributes (Neef and Neubert, 2010:5)

Indeed, whereas methods to implement participatory research have received a lot of attention, the **attitude of researchers** is sometimes overlooked. However this attitude is decisive for a range of issues, e.g. the willingness to relinquish power. Power in this context is related to “who defines research problems and who generates, analyses, represents, owns and acts on the information which is sought” (Cornwall and Jewkes 1995:1668).

Once researchers have clarified what the overall goal of a project is, and to what extent they are willing to engage in participation, the **ownership of the participatory process** needs to be defined. To help clarify it, Barreteau et al. (2010) have proposed to distinguish between three aspects: the flow of information, the timing of participatory events and the setting of these events. Each of these can be designed very differently depending on research needs and context, and they may change in the course of a project:

- Clarifying who has control over **information flow**. This includes the involvement in generating new knowledge, and involvement in controlling the spread and use of this new knowledge (e.g. can stakeholders decide what information is selected as relevant, and/or what is a legitimate use of the research outcomes, and/or act as filter between the information generated and the policy makers?).
- Clarifying the **timing** of participatory events: obviously the timing of the involvement of stakeholders will strongly affect their ability to influence the research process. Indeed some stages of the research process will provide more framing power than others. For example in FarmPath stakeholders will be involved in selecting the case studies, so that they can influence the criteria what constitutes relevant/interesting cases.
- Clarifying the **setting** in which participants exchange information: that is which individuals participate in what role, who will interact with whom, and how will they interact. There are a range of choices to be made: which stakeholders to involve in the project, which groups (or individual) stakeholder to invite to a specific workshop, and what form the interaction will take.

Given that in FarmPath involving stakeholders (e.g. through the **National Stakeholder Partnership Groups**) takes a central role in the research process, these issues need to be discussed in detail and

agreed upon. The aim of using a transdisciplinary approach was to ensure that transition processes and sustainability issues are not filtered through scientific paradigms used by researchers, but address real-life situations. In FarmPath the effort was made to include analyses of the cognitive frameworks used by different stakeholders to make sense of transition processes, to characterise 'persistent problems' that need addressing, and of the systems and interrelations that need to be changed to address these persistent problems. This contributed to exploring compatibility between niche and regime actors, as well as understanding potential sources of conflict through mismatched definitions or framings.

Field Research Participants in FarmPath will involve two **groups of stakeholders**. Firstly, the National Stakeholder Partnership Groups (NSPG), which have already been constituted, and which met approximately every six months so as to ensure continuing involvement throughout the project. They also participated in the selection of potential case studies. In the course of the project they contributed to the identification of visions for sustainable agriculture, provided feedback on preliminary results, and pilot-tested scenario analyses. Secondly, stakeholders in two geographic regions in each field research country were invited to a workshop where regional-level scenarios for a transition to sustainable agriculture were developed. Some of these stakeholders were involved in follow-up interviews to clarify specific issues. The goal of the scenario workshops was to take into account the ecological, cultural and political context of each field research region, i.e. the specific regional constraints and potentialities. It also allowed identifying governance options, social and technological innovation needs, and supporting measures that would sustain (or could hinder) the emerging transitions.

8 Appendix 2: Glossary

The goal of the glossary was to provide a succinct description of how we use key terms in FarmPath. Unfortunately 'succinct' (i.e. approx. 10 lines) does not allow for a comprehensive explanation of the terms, of their theoretical ground or of their interrelationships. Furthermore, the definitions are per necessity fairly abstract, and will need to be specified/operationalised for the various case studies, clusters and WPs in FarmPath.

Actor: a conceptual term referring to people, organisations, networks. Actors are defined by their ability to act purposefully. Through the identification of actors, stakeholders can be identified.

Anchoring: it is the process through which a niche becomes newly connected (or connected in a new way) to a regime. The concept conveys that an innovation developed in a niche is not passively adopted by a regime, but the links are actively constructed by individuals and organisations at both niche and regime level. The concept thus allows to focus on relations and translations between niches, and between a niche and the regime, which can lead to reconfigurations at the regime level. The concept of 'anchoring' is meant to convey that initial links are still vulnerable and may be broken depending on a range of processes and events. Since in FarmPath we focus on emerging transitions, the focus is on the anchoring efforts by niche actors and the responses by regime actors.

Case study: a method of organizing empirical research. 'Case study' is the field research method by which we are researching the initiatives.

Clusters: In FarmPath we have grouped initiatives into clusters, which broadly address the key process studied that is changed in a fundamental way in the emerging transitions. There are seven clusters: energy production; countryside consumption, new forms of governance, farmer collaboration, alternative marketing channels, high nature value farming, reducing the environmental impact of farming.

Collaboration: To work together, to produce or achieve something. In FarmPath (esp. in relation to Cluster 4 'farmer collaboration') this term is preferred over 'cooperation' to avoid confusion with the 'farm cooperative' as a specific organizational form, and with vertical/horizontal cooperation between businesses (the distinction is also important as in German and in Portuguese there are stronger differences between the two terms than in English).

Farmer, lifestyle: a rural landholder who derives his/her income primarily from non-farm sources, i.e. the income generated from agriculture is not the main driver of land use and the value of agricultural production tends to be low. Lifestyle farmers farm or live on the land principally for lifestyle reasons. Yet, since they manage agricultural, they have a role in managing the physical landscape. The size of the farm is normally small in relation to market-oriented farms in the region.

Farmer, hobby: a rural landholder who derives his/her income primarily from non-farm sources, but who manages the farm for commercial reasons, i.e. agricultural production is clearly market-oriented. Hobby farmers tend to identify themselves as professional farmers (in some countries this group is referred to as 'part-time farmers').

Farmer, new entrant: a new entrant is an aspirant who tries to break into farming. A new entrant is a person or organisation acquiring ownership or occupancy of agricultural land for the first time in their own right, whether through succession, purchase or contractual agreement of whatever form.

Farmer, young: Young farmers can be defined in two ways: (1) those, who are under 40 years of age, possess adequate occupational skills, set up an agricultural holding for the first time and are the head of the holding. This is the definition used in the regulation on support for rural development; (2) Eurostat views young farmers as those who are below the age of 35. The latter approach is often used in the debate on ageing population of farmers in Europe, since it provides quantitative facts.

Function: in FarmPath a regime is defined in relation to the societal function it fulfils. A societal function encompasses the expression of a human need and the way in which this need is met (e.g. the purpose may be food production, energy production, recreation). This corresponds to the OECD definition, where a function is the capacity of agriculture / a farming system / a landscape to (directly or indirectly) provide goods and services that correspond to human needs, demands and objectives (see OECD (2001) Multifunctionality).

Governance: it refers to the steering and ruling of society and the way in which citizens and groups articulate their interests, mediate their differences, and exercise their legal rights and obligations. Governance usually refers to a new type of government, one which is less based on hierarchy and more on networks. It is thus linked to a decrease in the use of command-and-control approaches, in favour of participatory approaches such as brokerage and negotiations. These changes are often linked with a decrease in the role of governments in steering societal change, and an increase in the role of civil society and the private sector.

The European Commission established its own concept of governance in the White Paper on European Governance, in which the term "European governance" refers to the rules, processes and behaviour that affect the way in which powers are exercised at European level, particularly as regards openness, participation, accountability, effectiveness and coherence. These five "principles of good governance" reinforce those of subsidiarity and proportionality.

Initiative: conceptually smaller than a niche. An emerging transition (i.e. a niche engaged in the 'take-off' phase of a transition) that is being studied as part of the empirical work in WP3. In FarmPath there are 21 initiatives studied (three initiatives in each of the seven countries). These 21 initiatives are grouped into seven clusters.

Innovation: It includes (but is not limited to) a new technique, practice, network connection or technology. Niches may build around an innovation, fine-tune it and combine several innovations to address a persistent problem at regime level.

Innovation, social and technological: while innovations are often understood as new technologies developed based on scientific research, this is only one type of innovation. Another type are social innovations, which often emerge bottom-up. Examples would be farmers seeking new forms of organisation (e.g. machinery rings rather than individual mechanisation) or new forms of connection to consumers (e.g. direct marketing). Also, social and technological innovations are often linked, as many technological innovations have social implications (e.g. the ubiquity of the internet has changed the way people (esp. the young) communicate and interact; or the way in which the internet enabled a new form of direct marketing).

Institutional arrangements: a set of rules and procedures that structure social interaction by constraining and enabling actors' behaviour. Institutional arrangements may be formal or informal, and include agreements, networks and organizational structures both within agencies and between agencies. They include the way power related to decision-making is delegated, distributed or shared. Institutional arrangements are simultaneously shaped at local, regional and (inter)national level, and mutually influence each other within a framework of complex interlinkages and strategic feedbacks. Institutions include e.g., social norms, customs, law (e.g. property rights) and legal system, economic institutions such as markets.

Key informants: informed, knowledgeable people who were involved in FarmPath (e.g. for interviews; participants in the focus groups and scenario workshops), but who are *not*

members of the National Stakeholder Partnership Groups. They were selected to represent the views and interests of various stakeholders or due to their particular knowledge of the initiatives. [Based on the level of their involvement in FarmPath we distinguished between →stakeholders, →key informants and →NSPG]

Landscape, socio-technical: In the Multi-Level Perspective of transition studies, it designates the long-term, exogenous trends at the macro-level which influence the regime (e.g. demographic trends, political ideologies, societal values, climate change, globalization). These trends may exert pressures on the regime. In FarmPath we always refer to the 'socio-technical landscape' to distinguish it from the geophysical / cultural landscape (see definition below).

Landscape: an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. It mostly refers to the territorial and spatial dimension of a geographical area, combining its geophysical properties and the human occupation. In FarmPath we differentiated this (usual) meaning of the term 'landscape' from the 'socio-technical landscape' used in the Multi-Level Perspective within transition studies.

Niche: Term used in the Multi-Level Perspective of transition studies to indicate the locus of radical innovations. A niche is usually made up of a small group of actors, usually at the local level, which work on radical innovations. Niche activities usually include articulation of visions, building social networks and developing processes or business models. They are usually the seedling of a transition, although many of these 'seedlings' perish. In FarmPath the initiatives are mostly at the niche level, but they are already engaged in the 'take-off' phase, i.e. engage with regime actors to initiate institutional and structural changes.

National Stakeholder Partnership Group (NSPG): In each country, one NSPG has been formed, which meets regularly with the FarmPath researchers. These NSPG are a key aspect of the participatory processes in FarmPath. Such participatory processes allow to adequately address the legitimate multiple viewpoints as well as the uncertainty inherent in emerging transitions. [Based on the level of their involvement in FarmPath we distinguished between →stakeholders, →key informants and →NSPG]

Policy: A policy is the content-related dimension of politics (e.g. environmental policy, health policy). It is a macro-level framework, based on a formal document (e.g. the Common Agricultural Policy). From a European perspective, policy is the collection of activities and legislation intended to achieve EC aims in specific fields of activity. [conceptually, it is hierarchically lower than →strategy]

Regime: Term used in the Multi-Level Perspective of transition studies for the dominant social paradigms and rule sets that guide developments, as well as tangible elements such as networks, structures, practices and regulations, infrastructures, technological artefacts. The elements of the regime are characterised by being fairly stable over time, i.e. a regime is characterised by lock-in, with a high commitment to 'business as usual'. Innovation occurs incrementally with small adjustments accumulating into stable trajectories. There is both alignment and tension within a regime. The *incumbent regime* designates the regime before it is affected by the pressure from one or several niches; the *emergent regime* designates the regime in the process of transformation through the pressure from niches.

In FarmPath a regime is defined in relation to the societal function it fulfils (see definition of 'function'). The framing of the research question relative to each initiative or cluster will influence the definition of the respective regime (i.e. societal function and boundaries). This definition should be made reflexively, as it will inevitably have implications for the stakeholders to be included, and thus the framing of problems and scenarios. When studying a regime, it might be helpful to distinguish between subsystems which address specific processes involved in fulfilling the human need (e.g. agricultural production, food processing and retail, policy making).

Region: Landscape and spatialized social relations that shape cultural identities. In FarmPath the region is seen as roughly the size of a NUTS 3 level, to ensure fairly homogenous biophysical and socio-cultural characteristics. However, an administrative delimitation may not always be practical for the initiatives studied in FarmPath, nor for the regional scenarios. Indeed, what constitutes a region is necessarily socially constructed and negotiated. In FarmPath the region will thus build on what the NSPG and/or key informants consider a socially relevant spatial entity. This delimitation will ensure that actors and processes that need to be included to understand the transition are included, without the region being larger than necessary.

Scenario: In each country one region is selected to develop several scenarios in the course of participatory workshops. These scenarios will identify visions of regional sustainability of agriculture, as well as a pathway to achieve them. The scenarios focus on two dimensions: activities and people managing agricultural land (i.e. the scenarios are not about addressing 'everything' in the region).

Stakeholders: People who are affected by the initiative or the transition studied in FarmPath, but who are not personally/directly involved in FarmPath. The various stakeholder groups are identified (e.g. through members of the NSPG or key informants), to ensure their interests and views are represented at the scenario workshops. [Based on the level of their involvement in FarmPath we distinguished between →stakeholders, →key informants and →NSPG]

Strategy: Higher level than →policy (e.g. rural development strategies, national sustainability strategies, EU growth strategy - EU2020).

Sustainability of agriculture: There is a general consensus that sustainability implies three dimensions: economic, ecologic and social (some authors add a fourth dimension: institutional). However, there are vastly different narratives to operationalize what this means, and each promotes specific remedies as desirable to avoid various threats and use opportunities. Consequently, sustainability of agriculture has become an ambiguous concept – even a contentious one. In line with the co-evolutionary and systemic theoretical framework underlying FarmPath, we do not assume that technical means will be sufficient to achieve sustainability. Instead, a transition is needed, which implies a systemic change. Innovations for sustainability thus question the dominant agro-food regime, i.e. the current meanings, values and structures (e.g. extension system, research, agri-business, retailers). (In FarmPath the use of 'sustainability of agriculture' rather than 'sustainable agriculture' was selected to indicate that it's a process, not a fixed state).

Sustainability of agriculture, regional: in FarmPath we propose that **contributing towards the regional sustainability of agriculture is best achieved by enabling flexible combinations of models and approaches to farming. These models and approaches vary to reflect the specific opportunity sets embedded in regional culture, agro-ecology, local knowledge, social networks, infrastructure, governance structures etc.** Regional sustainability is a quality of the regional farming system that emerges from adaptive processes by members of the agricultural production and consumption network, who respond to the changing needs and preferences of consumers and citizens. It builds on diversity, cooperation and learning between a wide range of stakeholders. The regional sustainability of agriculture is built on a dynamic mix of farming models, so that farming remains attuned to the resources and needs of the region.

In FarmPath, the identification of the transition paths for the regional sustainability of agriculture is the result of a co-construction involving the multiple relevant stakeholders, within a stepwise scenario work. This is in line with the AKIS approach, where social learning based on co-research relations among various stakeholders is the basis for innovations that increase sustainability (i.e. for niches that lead to a transition).

Transition to sustainability: Transitions are not assessed in a value-neutral way, but based on a normative goal: enhancing the sustainability of a society. In FarmPath, sustainability is not

taken as achieving a pre-defined set of values for selected criteria, but is socially negotiated and regionally adapted. The aim of the initiatives studied in FarmPath are to influence the regional models and approaches to farming towards a transition into a more sustainable direction, i.e. to address situations identified as problematic/unsustainable by the regional stakeholders. Given that any change might have negative side-effects, care will also be taken to assess the potential negative impacts of the initiatives on regional sustainability.

Transition: It is a radical, fundamental change at the regime level (as opposed to incremental change which adapts but do not transform the regime). Such a transition emerges from a succession of systemic changes over a long time period (e.g. 25-50 years); it **incorporates processes of societal, ecological, economic, cultural, technological and institutional co-evolution**. A transition is surrounded by great uncertainty and complexity. A transition implies a system innovation (as opposed to a series of technical add-ons), i.e. it not only involves new paradigms, rule sets and cultural meanings, but also new technologies, markets, market relations, user practices, regulations and infrastructures.

Transition, emerging: In FarmPath the focus is on the ‘take-off’ phase of a transition, i.e. focus on niches that have matured and have started engaging with regime actors to initiate institutional and structural changes, and these changes should be picking up momentum. Changes in the rule sets, technologies, networks, etc. within the regime should be clearly identifiable. However, whether the changes will amount to a transition can only be assessed in hindsight.

Vision: developed in participant workshop are ‘wishable’ or ‘desirable’ futures (may or may not be sustainable futures depending on the definition of sustainable, and no formal assessment, although various aspects covered). Term ‘vision’ selected over ‘scenarios’ as the latter is well defined in the literature, and the process in FarmPath differs .