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INTERACTIONS BETWEEN NICHE AND REGIME: AN ANALYSIS OF LEARNING AND INNOVATION NETWORKS FOR SUSTAINABLE AGRICULTURE ACROSS EUROPE

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ABSTRACT

Purpose

This paper aims to reveal, and contribute to an understanding of, the processes that connect learning and innovation networks in sustainable agriculture to elements of the mainstream agricultural regime. Drawing on the innovations and transition literature, the paper frames the analysis around niche-regime interaction using the notion of niche-regime compatibility.

Design/Methodology/approach

17 Learning and Innovation Networks for Sustainable Agriculture (LINSA) (engaged in agricultural food production, non-food and rural development) were analysed. In line with the project's transdisciplinary approach data were collected in a series of participatory workshops.

Findings

Five modes of LINSA-regime interaction are distinguished based on compatibility. The level of LINSA-regime compatibility influences the extent of the diffusion of LINSA ideas and practices into the regime. However, interaction processes within these modes reveal multiple and diverse connections between LINSA and regime entities suggesting a more complex relationship exists.

Practical Implications

A range of connecting processes and activities (for example, certification, exemption from regulation, facilitation of networking) can bring about effective LINSA-regime interaction and could be externally supported.

Originality/Value

Empirical evidence from 17 case studies provides valuable insights from a number of different contexts across Europe. By directing analysis of interaction at the level of LINSA (niche project), rather than at the macro level, the study offers an original perspective. It suggests that the

transition to sustainable agriculture might be understood as a complex of interactive processes leading to a series of adaptive changes, rather than as regime change.

Keywords: innovation, transition, niche, regime, learning, network, sustainable agriculture

Paper type

Research

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INTERACTION BETWEEN NICHE AND REGIME: AN ANALYSIS OF LEARNING AND INNOVATION NETWORKS FOR SUSTAINABLE AGRICULTURE ACROSS EUROPE

THE CHALLENGES FACING INNOVATIONS FOR SUSTAINABILITY IN THE AGRI-FOOD SYSTEM

It is increasingly acknowledged that meeting the sustainability challenge in the agri-food system will require system innovation (Elzen et al., 2004) and transition (Hargreaves et al., 2013). Transforming systems of food production and consumption poses considerable challenges, particularly as changes in regimes tend to be incremental and path dependent (Knickel et al., 2009). According to Seyfang and Smith (2007, p588) “entrenched cognitive, social, economic, institutional and technological processes lock us into trajectories and lock out sustainable alternatives. The term ‘socio-technical regime’ captures this complex configuration of artifacts, institutions, and agents reproducing technological practices”.

In agriculture, the notion of transition applies to a shift from the mainstream ‘productivist regime’ having the goal of increasing productivity to a regime built around the principles of sustainable production (Brunori et al., 2013). The former, is characterised as enjoying stronger institutional support, greater economic significance and broader political legitimacy and scientific authority than the latter. Innovation is key to transition but agricultural institutions, such as Agricultural Knowledge Systems (AKS), that are charged with fostering innovation, are often locked into old approaches or trajectories of the incumbent regime and are commonly market-based.

However, alternative and innovative approaches to agriculture, developing around the principles of sustainable agriculture and rural development, are emerging. These innovations are almost invariably responding to concerns about the environment and rural communities and tend to challenge mainstream agriculture. They often occur in the form of networks of individuals and/or organisations experimenting with new solutions that form innovative niche practices on the margins of the mainstream agriculture regime. These can be bottom-up networks emerging in a self-organising fashion and coordinated by farmers and rural actors themselves, coalition networks with regime actors, or emanating from within the regime itself (e.g. Aarts et al., 2007; Knickel et al., 2009). They can include urban networks of citizens-consumers and non-traditional rural actors.

Systems innovation and transition theory considers alternative approaches (or niche initiatives) as sources of innovation which can seed a sustainable regime transformation (Kemp et al., 1998; Smith, 2006). The theory proposes that regime transformation occurs through an accumulation of projects or novelties in niche spaces which allow (through learning and experimentation) radical practices, such as alternative networks, to develop (Schot and Geels, 2008). Development of niches, however, is limited by their compatibility with external constraints, actors, rules and artifacts, components of the mainstream regime (Knickel et al., 2009). Prevailing socio-technical regimes tend to develop incrementally and cumulatively along

trajectories which become entrenched and present barriers to innovations which advocate transformations in a more sustainable direction (Rip and Kemp, 1998; Geels, 2004). Such barriers have been described for sustainable agricultural networks and niches (Flinterman et al., 2012; Brunori et al., 2013). In particular, they face issues of diffusing ideas and practices into the incumbent regime (Seyfang and Smith, 2007; see also Seyfang, 2009; Smith, 2006; 2007).

These challenges can be articulated at the macro-level in terms of the interaction between the niche and the regime, particularly with respect to compatibility. However, whilst such macro-level analysis is useful for understanding major forces in socio-technical change in agriculture, it is also important to reveal the multiple interactive processes operating in the space between the niche and the regime (Klerix et al., 2010; Shove and Walker, 2010; Hargreaves et al., 2013).

This paper aims to reveal, and contribute to an understanding of, the niche-regime interaction and the processes that connect innovation networks in sustainable agriculture to elements of the mainstream agricultural regime. It frames the analysis using the notion of niche-regime compatibility. 17 Learning and Innovation Networks for Sustainable Agriculture (LINSA) are examined. These were identified within the EU research project SOLINSA¹ and are defined as: *networks of producers, customers, experts, NGOs, SMEs, local administrations, as well as official researchers and extensionists, that are mutually engaged with common goals for sustainable agriculture and rural development - cooperating, sharing resources and co-producing new knowledge by creating conditions for communication* (Brunori et al., 2013, p4).

The innovations these LINSA develop range from innovative food production techniques to advocating systemic change in food production and consumption through social innovation, as well as non-food activities (see Table 1 in the Editorial of this issue). Whilst all are value-led to some extent, in that they are mutually engaged with common goals for sustainable agriculture, rural development or social innovation, a number are equally concerned with sustaining agricultural businesses, developing technology and have market-oriented goals. Research into the innovation processes within these LINSA therefore provides rich empirical insights from different contexts.

CONCEPTUALISING LINSA AND NICHE-REGIME INTERACTIONS

LINSA operating in niche spaces

LINSA are multiple and diverse networks of actors experimenting with new practices and ways of doing things. They operate in established sustainable agriculture/rural development niche spaces (e.g. farm energy, care farming, low-input farming), with an environmental, social or economic goal, and develop along traditional and grassroot innovation pathways. LINSA cannot be classified as 'complete niches' or novelties as defined in the transition literature (Kemp et al., 1998; Geels and Scot, 2007)². They are not the outcome of a process of consolidation of

¹ SOLINSA- Support of Learning and Innovation Networks for Sustainable Agriculture

² Niches are variously defined in the literature. They are described as spaces where 'the rules are different' (Seyfang and Smith, 2007, p591). In the transitions literature, dealing with niches of technological innovations that

paradigms different from those prevailing in the dominant socio-technical systems (Seyfang and Smith 2007). Instead they can be considered as constituent 'niche projects', which are developing in a value space distinct from the mainstream agricultural regime. As niche projects, LINSAs can be envisaged as diverse and dynamic sub-niche entities, with equally diverse and dynamic connections to regime components. This is in line with the view of niche-regime interaction as dynamic, irregular and fuzzy, rather than artificially ordered according to static black boxes (Hekkert et al., 2007; Shove and Walker, 2010; Hargreaves et al., 2013). This provides the context for understanding niche-regime interactions, which are considered in the next section.

Niche-regime interactions

Niche-regime compatibility

The nature of the interaction between the regime and the niche provides a useful framework for clustering the 17 LINSAs studied. Transitions are conventionally seen as resulting from external 'landscape' pressures acting upon incumbent regimes to open up 'windows of opportunity' that might be filled by novel, radical, innovations developed in 'niche' spaces (Geels and Schot, 2007). Thus transitions come about through interactions between processes at three levels: niche-innovations, landscape and regime. Of interest here are the processes operating at the niche-regime interface and their potential alignment to enable the breakthrough of novelties into the regime. This alignment is influenced by compatibility between the niche and the regime, and its socio-technical dimensions.

In the context of sustainable development, it is argued that successful niches should not be too radically distinct from the incumbent regime; that good compatibility with the assumptions, practices and rules of existing regimes facilitates rapid niche growth enabling it to develop and diffuse. Where compatibility with the regime is limited, for example, where a (radical) niche is motivated by visions and very different goals to those in incumbent regimes, there is more likely to be poor growth, diffusion and linking potential (Smith, 2006). The notion of 'assumptions, practices and rules' captures the idea of cognitive frameworks, routines and habits, guiding principles, incumbent practices and institutions which define regimes (Geels, 2002) and provides a good basis for assessing compatibility between the niche and regime.

Sustainable agriculture networks, as represented by the 17 LINSAs in this study, exhibit different levels of divergence from the mainstream regime with respect to these assumptions, practices and rules, and thus can be distinguished by their level of compatibility with the regime. The general expectation is that the level of compatibility will affect the extent of LINSAs influence on, and interaction with, the regime. This interaction has been assessed in terms of diffusion, which is understood to be the spread and adoption of practices and ideas, and has been described in terms of expansion and scaling up; enabling replication of projects within the niche, enabling

have developed within commercial arena, these 'rules' are those of the market (Geels and Scot, 2007; Kemp et al., 1998).

constituent projects to grow in scale, and facilitating translation of ideas (Seyfang and Haxeltine, 2012).

However, using the notion of compatibility alone to explain the effectiveness of the niche and its integration into the regime presents a paradox, i.e. that a compatible niche will not demand great changes in socio-technical practices, whilst radical niches demand too many and so are less likely to be successful (Smith, 2007). This needs to be examined in a more refined analysis of *interactive processes* operating between the regime and the LINSAs, as described next.

Interactive processes

Transformative changes depend, both on internal tensions within the regime and, on the development and adaptive processes of the niche itself. Pressure on the regime to become more sustainable makes the diffusion into the mainstream easier. In agriculture, tensions in the incumbent conventional regime (including growing awareness of the environment by consumers and producers, as well as pressures from government through policy) can provide opportunities for the niche to offer solutions and thus assist niche development and diffusion. Niches are described as building up internal momentum and looking for chances to exploit destabilisation in the regime. In this dialectic relationship between regime and niche, linkages can be across any one of a number of socio-technical dimensions. In his study of organic food, Smith (2006) argued that, in addition to growth and displacement, the niche can stimulate transformation by linking up with tensions in the incumbent regime. Thus growth and diffusion is influenced both by compatibility and by the ability to link up with tensions in the regime.

However, although conceptualised at the macro level, this interaction is played out at smaller scales, and at multiple levels, through numerous and diverse mechanisms and pathways (Geels and Schot, 2007; Klerlx et al., 2010). Commentators point out that the regime is heterogeneous with internal tensions and contradictions, different interpretations and operationalisations of policy, and different actor experiences and motivations (Geels, 2004). This has been revealed for the mainstream or industrialised agricultural regime, which although characterised as a monolithic entity, is heterogeneous and has multiple elements and actors who can potentially interact with the multiplicity of sub-niche entities (Geels, 2002; Berkhout et al., 2004; Klerlx et al., 2010).

In studies of niche development, analysis considers processes of social networking, learning and collaborating with powerful groups; also enrolment of actors and resources (Kemp et al., 1998; Hoogma et al., 2002; Roep et al., 2003; Geels and Schot, 2007). Commentators emphasise the reflexive nature of the processes and refer to the translation of ideas and practices back and forth between niche and regime, as well as the feedback mechanisms that operate, and the absorption, adaptation and accommodation of the niche by the regime (Smith, 2006, 2007). Detailed temporal analysis of niche development (e.g. the organic food niche) have also revealed how tensions are multiple and dynamic, enacted by different actors, to different extents and at different times (Smith., 2007). With respect to linking to regime tensions, the relationship between innovation networks and the institutional environment in which they

operate is regarded as important. Creating influential actor networks is a key process in regime-niche interactions particularly with regard to enabling institutional embedding and anchoring (Klerkx et al., 2010; Elzen et al., 2012). Thus, a complex array of interactive processes is operating at multiple levels in the niche-regime space. The development and diffusion of a niche, therefore, is not a simple linear adoption of practices or scaling up of an initiative but is a complex and messy process subject to niche and regime contingencies (Elzen et al., 2012).

The rest of this paper aims to reveal and understand these more complex interactive processes in the context of LINSAs-regime interaction. It uses the notion of compatibility elaborated above to provide a heuristic framework in which to situate this analysis. A large number of diverse LINSAs provides a breadth of empirical data on which to explore these processes.

SELECTION AND ANALYSIS OF LINSAs

17 Learning and Innovation Networks for Sustainable Agriculture (LINSAs) were selected for analysis (see Table 1 in the Editorial of this issue –inserted at end of paper) to represent a diverse range of operational arrangements and thematic fields. Selection was based on criteria derived from a variety of network typologies: from local scale to national or transnational; from small, simple homogenous networks to large, complex and diverse networks with multiple actors; from incremental to radical innovation; and from top-down to bottom-up origins (Ingram et al., 2013a, 2013b).

In line with the transdisciplinary approach underpinning the SOLINSAs project (see Home et al. this issue) data were collected in a series of participatory workshops with each LINSAs. These were supplemented by face to face interviews, focus groups, observation and document analysis. Analysis focused on the following analytical characteristics (Origin and Function; Scale; Level of Integration; Level of Innovation; Governance; Level of Learning; Links between AKIS and LINSAs; Efficiency and Effectiveness of Support and Perspectives on Sustainable Agriculture - detailed in Ingram et al, 2013a, 2013b; Hermans et al., 2013), which influenced innovation processes in LINSAs, as revealed in a literature review and project conceptual development. A report was prepared for each analytical characteristic in each LINSAs. These reports provided the data for this paper.

Using this data, five modes of interaction were identified. These are set out in Table 1, which has been constructed with reference to the key points emerging from the review above concerning niche-regime interaction. Each mode can be characterised by the level of LINSAs compatibility with the regime according to the degree of consensus between the LINSAs and mainstream agriculture with respect to assumptions, practices and rules, and to the nature of the LINSAs goals and ambitions. The modes are described by the nature of the tension in the regime, as well as the actor and network composition. These are not discrete modes, but this framework can be used to capture interaction tendencies. The processes discussed above are examined to reveal the dynamic nature of LINSAs-regime interaction within these modes.

RESULTS

The modes are characterised in each of the sections below and each is exemplified with details of one LINSAs case study. All the LINSAs within each mode are listed. Table 1 presents the defining characteristics of the modes. In the descriptions that follow, the terms LINSAs and regime are used by way of a shorthand, as there is insufficient space here to describe the multiple and diverse components of each.

Compatible Interaction Mode

LINSAs: Charter of Good Agricultural Practices in Livestock Production, France; Fruit Growing Network, Latvia; Association for the Development of Fodder Production, Switzerland; Consorzio Vacche Rosse, Italy; Bavarian Rural Women's Association, Germany; German Agricultural Association, Germany

In this mode, the level of compatibility between LINSAs and regime is mostly high as LINSAs guiding principles (assumptions, practices, rules) are commensurate with many of those of the incumbent regime. LINSAs actors aim to achieve sustainable food production according to the rules of the regime, that is, by ensuring farmers' commercial viability. LINSAs emerge within the regime and, through adjustment in both, are incorporated to different extents. They link with regime tensions with respect to concerns about food provenance. LINSAs develop and grow incrementally utilising, and networking with, existing structures and traditional actors. They diffuse outwards through expansion and up-scaling - slowly and progressively supporting farmers. The LINSAs in this mode have well developed and historical links with the AKS of the regime, but use these in different ways. They tend to have the political support of the regime.

The Charter for Good Agricultural Practices in Livestock production in France (Charter)

The Charter is a network of beef and dairy farmers, farmers' organisations, research and extension organisations created within the mainstream regime in response to consumer mistrust following mad cow disease. The Charter was started by farmer organisations who collaborated with regime institutions (state and commercial), and used state AKS actors to roll out the initiative. The Charter describes 41 good practices or standards that farmers commit to. These are set at a relatively low level and aim at incremental growth, the intention is for *every farmer* to follow the shift, and not only an elite few. This approach has been criticised by founding actors as not sufficiently demanding, and remaining within the productivist paradigm. However, in an attempt to continually improve practice, the Charter reassesses and redefines standards every 3 or 4 years through a consultation process between farmers, citizen associations and the processing industry. An interactive relationship has developed: the regime uses the LINSAs to address regime tensions, while the LINSAs benefits from the regime's support. The standards are re-negotiated and translated as they move into the regime; the LINSAs and the regime both adapt and are re-configured.

Complementary Interaction Mode

LINSAs: Sustainable Dairy Farming, Netherlands; Network for a Sustainable Agriculture, France; The European Organic Data network

In this mode, the level of compatibility between LINSAs and regime is moderately high, connections between LINSAs and regime are enhanced by shared guiding principles to some extent (assumptions, routines) with respect to making commercial farming businesses sustainable, although the values, practices and rules are being challenged. These LINSAs are emerging on the fringes of the regime, yet develop in a complementary way with the regime. Networks include traditional actors, albeit in new roles and ways of interacting. LINSAs exploit environmental and economic sustainability tensions in the mainstream in various ways.

Sustainable Dairy Farming, Netherlands (Dairy)

The low external input approach (LEIA) this LINSAs advocates is challenging conventional practice and the existing rules of dairy farming. It has attracted the interest of farmers, researchers, consultants and politicians at provincial and national levels. Tensions in the mainstream regime (water quality concerns, high input costs) have framed the LINSAs and provided opportunities for interaction with the regime. The LEIA concept has become progressively diffused into the sector at the provincial level through a succession of projects over 10 years. Project evaluation (meeting criteria of both farmers and the authority) has led to repeated funding, in a cycle of positive feedback and raised ambition.

LINSAs actors have utilised selected mainstream practices and rules to formalise LEIA (e.g. the calculation of mineral flows through the farm) and make it acceptable to policy makers. Researchers in the network have also legitimised the approach and so been instrumental in connecting LINSAs and regime entities. The most contested element of their approach, surface spreading of manure, has gained an exemption for some experimental groups which have been able to operate in a protected space for learning and experimentation. Diffusion has brought some tensions, as there is a risk that the founding principles of the approach become diluted. A core of farmers is therefore experimenting and advancing the concept, whilst newcomers implement the approach less rigorously; in this sense some elements have been appropriated by the regime.

Emergent Interaction Mode

LINSAs: Biogas Production Network, Latvia; Cooperative Boer en Zorg: Care Farmers in the Netherlands

In this mode, LINSAs are founded on the basis of agricultural sustainability but operate at the intersection of agriculture with the energy and health sectors and regimes, respectively. They make use of the existing structures in the agricultural regime when appropriate, but they also build up new socio-economic spaces with new actors, rules, artefacts and networks. LINSAs have emerged in response to landscape level changes, which in turn have resulted in regime tensions and led individual entrepreneurs to exploit these by creating new niche projects. Both LINSAs adapt daily farming routines to new health care and energy rules and practices, respectively; they also develop new rule sets.

The Biogas Production Network, Latvia (Biogas)

Biogas production in Latvia was politically initiated, based on the principles of combining energy production and agricultural sustainability (addressing the problems of farmers' low income and

agricultural waste). Government subsidies created a secure and exclusive niche market for the network. However, throughout the network development, business and sustainability interests have clashed. There is limited interaction between regime AKS and producers due to: differing foci of interest (the researchers are interested in experiments in laboratory conditions, while practitioners need fast solutions to practical problems); different value systems (researchers are more concerned with sustainability, promotion of scientific knowledge, while producers are more concerned with economic performance); organisational barriers (researchers unresponsive to producers proposals to conduct research in real production situations). Commercial interests of producers (often non-farming entrepreneurs) thus have constrained linkages with traditional structures. New actors offer more opportunities for interaction through knowledge provision. Foreign research companies and technological advice providers, as well as independent, flexible and responsive boundary spanners and knowledge brokers can stimulate interaction and learning.

Divergent Interaction Mode

LINSA: Association for Solidary Economy Crisoperla, Italy; Naturli Co-operative Cheese marketing platform, Switzerland

This interaction is characterised by weak compatibility between niche and regime with few practices, rules or guiding principles in common. The networks have emerged on the margins of the regime, both in response to farmers' economic needs, and their desire to promote products grown in an environmentally sustainable way to consumers. The networks are therefore responding to different tensions within the regime compared to other modes. LINSA goals are diverging from those of the regime and the practices are not sufficiently flexible to be integrated into it. New networks have emerged with a diversified composition, including actors working together who otherwise would not have collaborated. Networks concern themselves with producer-consumer relations and new marketing channels rather than producers per se. and this is reflected in the composition of the networks. They build up specific new socio-economic spaces with new actors, rules and artefacts, and new interactions. The examples operate at a local level and they show different levels of diffusion through growing in scale, albeit this is limited.

Association for Solidary Economy Crisoperla in Italy (Crisoperla)

Crisoperla, which promotes economic and social innovation, was originally created by the interaction between organic farmers and technicians. It has gradually evolved into an organised structure including consumer groups and civil society organisations, integrating cultural and political functions. Interaction is achieved through a number of events which intend to engage external stakeholders including regime members. The LINSA can be seen to link to the regime yet break the rules in three ways. Agronomists from the AKS are involved but in non-traditional roles. They acted as facilitators, not as technicians, when initially enabling knowledge exchange between farmers. They now act as brokers, exploiting their links with, for example, the Regional Government to find support, and are engaged in co-ordination of the activities within the Cooperative. Secondly, the Crisoperla Association, through the figure of its President, has joined the steering committee of an organisation representing organic farmers nationwide. This is both to strengthen the organic farming institutional framework and to reinforce the position of

the Association in relation to the local policies of territorial development. Thirdly, the relationship with consumers means that non-conventional marketing channels have developed. Some network members have created a new cooperative of farmers and fishermen to enhance the commercialisation of products using a certified brand, thus there is adaptation to the regime and exploitation of regime tensions. Those engaged in these commercial activities have different expectations from those who focus on increasing cultural and political engagement of the Association, and some tensions have arisen.

Oppositional Interaction Mode

LINSA: Brighton and Hove Food Partnership, England; Permaculture Community, England; G7 (Local Food Council of Gödöllő), Hungary; the NATURAMA Alliance, Hungary

In this mode, compatibility between LINSA and the regime is low as they do not share the same assumptions, practices or rules. LINSA include non-regime actors and networks (municipalities, NGOs, activists, volunteers etc) who are concerned with food and social innovations (health, self-sufficiency, and community). Actors' motivations are mostly ideological, in that they have aspirations for systemic change in the incumbent regime's food system and a very distinct set of values that are characterised as being in opposition to those of the regime. In this sense they could be described as radical within the mainstream agricultural context in producing artefacts, rules and actors that seek significantly to influence or change the regime. They are responding to tensions in the regime with respect to food quality, food justice and health concerns. LINSA tend to be hybrid, diffuse networks of networks with multiple actors.

Brighton and Hove Food Partnership in England (B&H)

The goal of this diffuse network is for a sustainable urban food system. There are very few connections (either formal or informal) with mainstream agriculture as the LINSA does not see itself as part of the agricultural system. Actors in the LINSA regard farming as too insular, not just in terms of its working practices (capital intensive and labour scarce), but also in terms of being isolated from its markets, other parts of the food chain and the connection of food to other elements of sustainability. People join the LINSA through the community route via environmentalism or green politics, rather than through land holdings. The City Council (farmland owners) is supportive, but it is very conservative about the use of its farms because their principal value is the generation of income and revenue. The knowledge base is more about networks, holistic sustainability, co-operation, health and waste management than the technology of food production *per se* and therefore the conventional AKS has little to contribute. Networking, linking in influential actors from other networks, is a key process.

Table 1 LINSAs-regime modes of interaction and associated interaction processes

Interaction mode	Compatible	Complementary	Emergent	Divergent	Oppositional
Compatibility Degree of consensus over assumptions, practices & rules	Common assumptions, practices & rules	Some shared assumptions, practices & rules	Some shared assumptions, practices & rules but some differing values within LINSAs New rules, languages, paradigms emerging	Limited sharing of assumptions, practices & rules New rules, languages, developing	No shared goals, values, practices, rules & guiding principles Contrasting paradigms
LINSAs goals & ambitions regarding changing the regime	Common goals. Niches activated by regime representatives to improve regime practices from within	Aspirations to make a difference but mostly within traditional structures	Some shared goals (sustainable development) but equally entrepreneurs following goals of 'intermediary' regimes	Wider societal ambitions than regime. Advocate alternative modes of production & involve consumers & civic society	Radical with respect to mainstream agriculture in producing artefacts, rules & actors that seek to change the regime
Tension in regime addressed	Consumers & policy regulations (food & water quality)	Policy (food & water quality); farm economics & livelihood	Policy in both (sub)-regimes (health/ energy & agriculture)	Consumer awareness, civic interest & cooperation	Health, community, social justice concerns
Main interactive processes	Growing within the regime/AKS Incremental diffusion of practices Negotiation, selection of some practices & some LINSAs reconfiguring Political support & recognition from regime Policy intervention and regulations	Complementary to - regime/AKS Looking for recognition & legitimacy LINSAs use regime practices and rules to formalise or legitimise practices Interact through partnerships and projects	Makes use of the existing structures but mainly builds up new actors, rules Adaptation to farming routines Some political support & recognition from regime Policy space through subsidies Utilises certification	Commercialisation of products using a certified brand Extensive networking Regime actors take on new roles Limited political support or recognition from regime Utilises certification	Little adaptation - rejects regime rules & little acceptance by regime Extensive networking & internal diffusion of ideas No political support or recognition from regime
Actor composition	Traditional actors (e.g. actors associated with the regime: farmers, advisers, researchers, supply chain actors, policy makers)	Traditional actors in new arrangements plus new facilitators	Traditional actors belonging to different spheres + new actors including facilitators	Traditional actors in new roles + new actors	New non-traditional actors
Network composition	Traditional networks	Adapting traditional networks & introducing new networks	New networks activated through integration of pre-existing networks	Diversified & unconventional new networks	Hybrid & diffuse 'networks of networks' operating outside -regime

DISCUSSION AND CONCLUSION

Previous studies of niche-regime interactions have benefited from in-depth temporal analysis of case studies and have elaborated evolutionary processes and niche development phases in detail (e.g. Klerlx et al., 2010). This paper takes a different approach. It synthesises empirical data from 17 LINSAs and as such provides an overview of the range of interactive processes in operation in a number of different contexts. This analysis shows that, at a broad level, the degree of LINSAs-regime compatibility influences the extent of LINSAs diffusion. Where there is sufficient common ground between LINSAs and regime, ideas and practices diffuse more easily, as found in the more compatible modes, where growth in scale, project replication and translation of ideas were apparent. Conversely, where the LINSAs is motivated by very different goals to those in the incumbent regime, there is a fundamental clash of values, ideas, and practices and the potential for diffusing into the regime is low; as revealed in the Emergent and Oppositional modes.

However, the situation is more complex than this simple relationship would suggest. A more nuanced analysis reveals the dynamic and complex processes operating between the LINSAs and the regime entities. The analysis shows that the process of interaction, both within individual LINSAs and within modes, can be irregular and heterogeneous, with the resulting numerous forms and configurations affecting the scope and nature of LINSAs growth and diffusion of practices. As such, the framework of modes can only capture interaction propensities, not define discrete types.

Although an alignment of assumptions, practices and rules (compatibility) does assist LINSAs diffusion, the ability to link up with tensions in the regime is also important in this process. The relationship between compatibility and the ability, and willingness, of LINSAs actors to exploit regime tensions also affects diffusion. Furthermore, the notion of diffusion, as it is usually understood as one-way adoption, scaling up or replication of practices and ideas, does not adequately describe the interactive, dynamic and multifaceted processes in operation, as noted by other commentators (e.g. Elzen et al., 2012). Nor does the term allow a distinction to be made between diffusion of tangible practices and diffusion of intangible ideas, as distinguished by Seyfang and Smith (2007). Moreover the extent of diffusion does not necessarily reflect the sustainability potential of LINSAs.

Compatible and complementary modes

The more compatible modes are able to take advantage of tensions in the regime to a greater extent as they benefit from institutional and political support. In Compatible and Complementary modes, problems in the regime, such as water and food quality issues, define the guiding principles of LINSAs; as such, they exert pressure on the regime on these issues through the advocacy of their members. In this sense they are 'pushing at an open door'. Policy intervention and regulations can articulate the regime tensions and these create channels for diffusion of LINSAs practices and ideas. The regime adapts some of its rules and routines and regime actors make conscious and planned efforts in response to perceived pressures, using

regime-internal resources, as described by Berkhout et al. (2004). The nature of the LINSAs means that discrete solutions can be easily detached from the LINSAs, reinterpreted and slotted into the regime. However, in the process, practices can be diluted; in this case compatibility moderates the innovative and sustainability potential of the LINSAs, with only incremental change occurring. This is aligned to the prevailing first order innovation within the mainstream, which is dependent on technical efficiency and innovations from science and technology (Kemp et al., 1989; Seyfang and Smith, 2007; Knickel et al., 2009).

However, there is diversity in the way these LINSAs interact with the regime entities. LINSAs in the Compatible mode have well developed, often historical links with the AKS of the regime, but use these in different ways. AKS actors are enrolled by LINSAs (or enroll themselves) in collaborations and partnerships with LINSAs, taking on new roles. Such opportunities allow positive feedback from regime actors, enabling LINSAs to interact with the regime further. For example, in the French Charter, the standards are continuously re-negotiated as they move into the regime, a dialogue between LINSAs and the regime enables future strengthening of the standards.

The Dairy LINSAs in the Netherlands, in the Complementary mode, utilise regime rules and scientific authority to formalise their practices, to exploit regime tensions and linkage channels. Selected legitimised practices have been more easily absorbed by the regime, leaving a core of committed farmers experimenting with more radical experimentation. This appropriation by the regime has led to replication of projects with these ideas and practices in other provinces. This process that inserts, and sometimes re-interprets, elements of the LINSAs into the regime detaches the practices from the LINSAs' ambitions and values they are part of. As a consequence, the remaining committed LINSAs actors re-configure and reinforce their ambitions. Thus, although the LINSAs have been successfully replicated, their sustainability ambitions have been curtailed in the process.

In these modes, agricultural policies form a sympathetic selection environment for the LINSAs. Some LINSAs are able to fit into and conform to a relatively unchanged regime (e.g. Charter), while in other cases some features of the LINSAs are institutionalised as new norms and routines in a slightly reconfigured regime (e.g. Dairy). LINSAs actors make their approach compatible with how the regime frames sustainability challenges and this enables better alignment and mutual interdependencies to develop. However, as Smith and Raven (2012) point out, such improved alignment with existing norms or structures can actually be quite disempowering in terms of sustainability. This is evident in those cases where LINSAs actors feel that their ambitions and values have been diluted for the sake of regime alignment. This corresponds to the paradox identified by Smith (2007), who noted that compatibility appears to blunt the scope for niches to be radically innovative. However, it would appear that, while some LINSAs actors conform with the regime entities, often in a process of appropriation by the regime, others dissociate themselves retaining and reinforcing their more radical sustainability ambitions. A similar process was described by Smith (2006) for the organic food movement. Thus, a seemingly simple relationship between compatibility and diffusion masks a more multifaceted and

interactive set of processes which are bringing about change in both the LINSAs and the regime, with different sustainability outcomes.

Emergent mode

LINSAs in the Emergent mode make use of the existing structures in the agricultural regime, when appropriate. They can also attempt to align practices within health and energy regimes with the rules and routines of agriculture, as described by Flinteman et al. (2012) for care farming. However, for the most part they bypass regime elements or create new ones by building up new socio-economic spaces with new actors, rules (and regulations), artefacts and networks. LINSAs contribute to emerging 'intermediary regimes' where rules, language and institutional settings are altered. Pressure on the regime to become more sustainable has resulted in policy instruments (subsidies) making space for LINSAs to develop, such as in the Biogas LINSAs. Channels exploited by the LINSAs are often through connections with new commercial actors, who are exploiting non-agricultural regime tensions. However, the reliance on policy instruments means that the LINSAs are seen as vulnerable. Furthermore, this LINSAs' development highlights the difficulties in achieving sustainability goals in a protected space where subsidies attract entrepreneurs motivated by commercial gains. As with the compatible modes, when examined in more detail, it would appear that the relatively rapid diffusion of practices comes at a cost to the sustainability ambitions and ideas of some LINSAs actors.

Divergent and Oppositional modes

Modes with weaker compatibility with the regime are less able and willing to exploit tensions in the regime. These LINSAs resemble the grassroots innovations identified by Seyfang and Haxeltine (2012), which struggle to maintain a viable sustainable sociotechnical space within a wider unsustainable regime in terms of funding, making effective links and diffusing oppositional ideas. The characteristics of the LINSAs, and of the tensions they could align with, are diffuse (social and community concerns). There are no easy technical practices that can be detached from the LINSAs and provide solutions to regime tensions. LINSAs are also at a structural disadvantage, there are limited opportunities to link with AKS and few resources, mechanisms or incentives to initiate any form of interaction with the regime. LINSAs in these modes tend to focus their efforts on networking with actors and organisations, who share similar 'alternative' values, outside the traditional regime structures. In these LINSAs, as noted in other contexts, a greater variety of advocates will be arguing for support for their particular innovations and they will not be addressing sustainability in the same ways (Shove and Walker, 2007; Seyfang and Haxeltine, 2012). This not only results in internal friction, but can also make the 'external message' less clear to potential collaborators in the regime, curtailing opportunities to link up with tensions in the regime.

In the Divergent mode, LINSAs represent a break with the dominant economic, political, technical, organisational and cultural patterns. New networks have emerged with a diversified composition including actors working together who otherwise would not have collaborated: such as those in the supply chain, marketing, technology industries, municipal and community organisations and citizens. They develop and build alternative marketing channels outside those associated with the regime (e.g. Crisoperla). Such networks enroll multiple actors and whilst

these may include regime actors, they often take on new roles. Concerns about food provenance provide opportunities for LINSAs to exploit regime tensions and use food certification standards to insert practices into the mainstream. However, food quality is just one element of LINSAs, which have much wider social ambitions. Some within LINSAs criticise and dissociate themselves from this certification. Different interpretations of LINSAs' ambitions can lead to internal divisions and diffusion becomes a fragmented process.

Where there are differences in normative rules (norms, values and routines), as well as in cognitive rules (beliefs, paradigms, and languages), as found between Oppositional mode LINSAs and mainstream agriculture, growth and translation of ideas into the regime are limited, as described in other contexts (Flinterman et al., 2012; Seyfang and Haxeltine, 2012; Ingram et al., 2014). LINSAs have alternative visions for food systems framed by social issues of food justice, health and community which lack channels for articulation in the mainstream agricultural regime (Curry and Kirwan, 2014). The regime (and its guiding principles and processes) are geared towards incremental development, while these LINSAs propose paradigmatic shifts which require second order innovation or learning through the raising of awareness, empowerment and capacity building (Knicker et al., 2009). As such, these LINSAs can be thought of as social innovations, in that, rather than aiming for tangible improvement, they are concerned with changes in attitudes, behaviour and perceptions (Neumeier, 2012).

The regime is less likely to recognise the value-led solutions that the LINSAs are offering, putting little effort or resources into interaction. Equally, with a commitment to community action, LINSAs' actors have few political or institutional linkages with the regime. Consequently, LINSAs' actors in this mode create a large 'network of networks' drawing in an array of different actors who share their interests. These networks are more concerned with increasing participation, than with penetrating or diffusing ideas into the mainstream agriculture regime. Equally, the pressure from the LINSAs on the regime to interact is less concerted. In LINSAs where networks are internally more complex or hybrid, there can be differing foci of interest and different actor motivations. Even where opportunities might be available for inserting some LINSAs' practices, these are resisted. Actors in the Permaculture Community LINSAs in England, for example, do not regard the notion of food certification as compatible with their values and philosophy. Thus, at a broader level incompatibility of these LINSAs with the regime, due to a clash of values, can explain poor diffusion. However, framing the analysis in these terms obscures the subtleties of the LINSAs' diffusion, where translation of ideas has been effective within the alternative food system niche, if not the mainstream regime.

In conclusion, this study contributes to an understanding of the interactions between niche and regime, specifically between LINSAs and elements of the mainstream agricultural regime. The challenges of transition to a more sustainable agriculture are often articulated and conceptualised at a macro level. However, this research in drawing on studies of 17 LINSAs, shows that directing analysis at the sub-niche or project level reveals dynamic, diverse and irregular interaction processes in the 'fuzzy' space between niche and regime. The analysis shows that, although the notion of compatibility of niche and regime is indicative of potential niche influence on the regime, a more refined analysis is needed to elaborate the link between

compatibility and ability to exploit tensions in the regime. Furthermore, it demonstrates that diffusion needs to be understood as a complex of dynamic adaptive processes particularly with respect to sustainability goals.

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Table 1 List of LINSAs studied

Agricultural production
<p>Réseau Agriculture Durable– Network for a Sustainable Agriculture, France (F RAD) The Sustainable Agriculture Network is an informal network of farmers groups, created and developed outside the AKS. The main objective of the RAD is improving the effectiveness of the systems regarding ecological, social and economic issues. It emerged as an alternative way of thinking about agriculture in response to gaps in AKS knowledge and practice. RAD involves 3000 farmers (from 2000 farms), mainly from the west of France, gathered in 32 groups. Learning is a top priority of the RAD who gives value to bottom-up view of innovation and participatory learning processes in farmer groups. The RAD is facing different opportunities of development and needs to choose how to grow and expand its knowledge.</p>
<p>Charter of Good Agricultural Practices in Livestock production, France (F Charter) The Charter for Good Agricultural Practices promotes the quality of the cattle profession in France. It accompanies farmers in their practices (traceability, herd's health, food, milk quality, animal welfare and environment), helping them to meet the expectations of both their partners and citizens. The Charter is the leading farmer quality assurance scheme in Europe and brings together 105 000 farmers: over 90% of milk and over 77% of beef produced in France come from a farm that adheres to the Charter. The Charter benefits from the expertise of engineers from the French Livestock Institute and about 2500 technicians from extension organisation and food industry. It was launched after the mad cow crisis in a context of mistrust between food production and society; after twelve years of existence, the Charter needs to define new actions and strategies to answer food chain's, farmers' and society's needs.</p>
<p>Bavarian Rural Women's Association, Germany (G Women) The Rural Women's Group of the Bavarian Farmers Union in South Germany has a long learning and innovation culture. The group was founded in 1948, as a subpart of the Bavarian Farmers Union. Today it numbers ~6.500 local women groups, 72 local chapters, 7 district chapters, and one State Executive Committee. An essential part of the group is a diversified educational work based on topics of direct relevance to farm women. The LINSAs has a good, acknowledged standing in society, but is considered as a small player in the AKS. They link the farm sector with the health-, nutrition- and education-sectors</p>
<p>German Agricultural Association, Germany (G DLG) The German Agricultural Association (DLG) is a LINSAs with a very long history of learning and innovation around agriculture. It was founded in 1839 and very soon became the most important knowledge broker in the German AKS. Today membership is ~25.000, these are mainly farmers but also researchers or representatives from agribusiness. Its main tasks are to collect, discuss, and</p>

rearrange information and innovations related to agriculture and disseminate them among its members. Effective networking is considered to be the key for successful dissemination of information and innovations.

Fruit Growing Network, Latvia (L Fruit)

The Latvian Fruit-growers network formed more than a decade ago around the goal of developing integrated fruit-growing in Latvia. This includes objectives on production, marketing, research, advisory, policy making, consumer education, environmental management. There are about 400 members, both individuals and organizations: producers and their cooperatives, research, business companies, NGOs, etc. The network is nation-wide, with several centres of closer connections around research institutes, the Fruit-growers' Association, regional cooperatives. The network is strong on peer-learning among farmers as well as inter-institutional learning and collaboration between researchers and practitioners. There is a shared set of norms on proper fruit-growing. Innovation is oriented towards private and public good.

Sustainable Dairy Farming, Netherlands (N Dairy)

This is a regional network of dairy farmers experimenting with the implementation of low external input farming practices. The network started in the Dutch province of Drenthe supported by provincial policy, but similar networks have started in other provinces as well. The farmers' goals are to improve the environmental and economic situation using low external input practices (managing and closing nutrient cycles). Over a period of 10 years different projects were organised that applied the concept of low external input farming using farmer study clubs facilitated by a number of expert consultants

Association for the development of fodder production, Switzerland (S ACDF)

The association brings together some of the AKS (research, education and advisory) institutes, seeds firms and farmers with the objective to foster fodder production and conservation based on the natural resources of Swiss farms. The board of its technical commission "CT-ADCF" enables experts with different interests (research, education, extension, seeds sale) to exchange knowledge and to develop practical solutions (based on scientific evidences and field experiences) to address the needs of farmers. Solutions are then shared inside this network through so-called boundary objects, such as labelled seeds-mix for pastures and grasslands, technical datasheets on fodder production, training for extensionists and visits dedicated to farmers.

The European Organic Data network (EU Organ)

This organic market data network consists of a core group of members who formed an OrganicDataNetwork project, and stakeholders, including data collectors and end users, who are involved with organic market data in Europe. The network emerged to enable access to relevant organic market data and seeks to involve stakeholders in the network formation by conducting surveys and hosting workshops.

Alternative food marketing

Consorzio Vacche Rosse, Italy (CVR)

Consorzio Vacche Rosse (CVR) is a cooperative dairy that produces Parmigiano Reggiano (P-R) cheese from milk of Reggiana breed cows delivered by its members. Like most of the local dairy farms and milk processing plants of the territory, CVR belongs to the larger Community of Practice (CoP) whose geographical coverage is defined by the Code of practice of the PDO cheese “Parmigiano Reggiano”. The community is strongly aligned with membership to the “Consorzio di tutela del formaggio Parmigiano Reggiano” (CFP R) that is the depositary of the PDO collective brand.

Association for Solidary Economy Crisoperla, Italy (I Crisop)

The network is a cultural non - profit Association (formalised in 2009) operating in provinces in Tuscany and Liguria regions. The network aims to create an alternative system of knowledge and practices around sustainable production and consumption of food. The network is hybrid and comprises: organic farmers (producers of vegetables, honey, wine, oil, beef), two fishing cooperatives, a cooperative for social farming, two agronomists (initiators of the network), consumers organized in a consumers’ association. In addition it increasingly interacts with local institutions and other networks. The main functions are: creating and reinforcing the links between consumers and producers; organising farmers’ markets, interacting with public institutions and civic movements, to promote initiatives at a local level; providing technical assistance and brokerage activity; lobbying role and promoting a vision for more fundamental change.

Naturli Co-operative Cheese marketing platform, Switzerland (S Naturli)

The Natürli co-operative has evolved around the regional trademark “Natürli aus der Region Zürcher Berggebiet”. A regional entrepreneur-cheese maker and the regional development manager of the Zürcher Berggebiet, a mountainous region in the vicinity of Zurich, Winterthur and St. Gallen, initiated the network in 1993. The main aim – to collect, bundle, distribute and promote high quality regional dairy products in order to keep alive the regional dairy structures – only could be achieved through multifaceted collaboration. The 15 municipalities of the region own the trademark “Natürli” but nowadays e private entrepreneurs, cheese dairies and milk producers, the regional development center and shops are members of the co-operative “Natürli” accesses sporadically public funding and grants of private foundations for specific sub-projects but it also tries to work economically successful on its own.

Non-food focus

The NATURAMA Alliance, Hungary (H Nat)

NATURAMA Alliance is a loose, informal network of networks of 9 Hungarian LEADER Local Action Groups (LAGs). Created through a transdisciplinary action research project in 2009, - NATURAMA soon became a self-maintaining domestic network, with a strong transnational interest. Its main aim – creating knowledge, learning from each other and from best practices in the EU – is in line with the LEADER approach, Hungarian AKS did not support such activities. NATURAMA keeps regular meetings, organised study tours, ran shared development projects, organised big events and provided expertise on various levels of rural policy making and implementation.

Biogas Production Network, Latvia (L Biogas)

The Latvian Biogas network was formed around 2006 to develop production of on-farm biogas, in response to renewable energy policy goals and subsidies. The network is small and dispersed, actor interactions are motivated by the need of technological, economic, agricultural learning to localise the use of borrowed biogas technologies. It is constituted by a diverse range of actors: biogas producers, scientists, equipment suppliers, service providers, investors, consultants, banks, municipalities, environmental agencies, NGOs and demonstrates a new diversified composition of agricultural innovation networks. Currently the sector is based on limited number of state distributed production quotas and it is unlikely that the producer network will extend or that biogas production will increase its scope. A period of rapid up-scaling stimulated by state support has been followed by a period of uncertainty, following debate about efficacy of support.

Cooperative Boer en Zorg: Care Farmers in the Netherlands (N Care)

The 'Boer en Zorg' (Farmers and Care) co-operative currently connects over 130 care farmers in the Mid-Eastern part of the Netherlands. Care farms use their animals, plants, gardens, forests and the landscape to create recreational or work related activities for people in need of care. Work on farms delivers evident results, focusing on the capabilities of each individual patient, resulting in an alternative vision of health care and therapy. The Boer en Zorg cooperative operates on the intersection of two existing policy fields; the agricultural sector and the health care sector. These two sectors provide both opportunities and constraints for innovation.

Alternative food systems**Brighton and Hove Food Partnership, England (E B&H)**

This 'network of networks' was established to create a network of organisations, businesses and residents with a mission to improve the patterns of both food consumption and production in a large urban area. It aims to work across the community to develop a localised food system which promotes social equity, economic prosperity, environmental sustainability, and the health of all residents. There are strong links between voluntary organisations (concerned with school food, organic food and over 60 community food growing projects) and the local state. It now embraces over 200 organisations in the state, private and voluntary sectors concerned with all stages of the food chain. The LINSAs is a social movement or social innovation which is calling for a step change in the food system.

G7 (Local Food Council of Gödöllő), Hungary (H G7)

G7 is an informal network (voluntary partnership) of local organisations, entrepreneurs and citizens in Gödöllő, a major city of the Budapest agglomeration, hosting the largest agricultural university of Hungary. The main objective to which actors in this voluntary partnership are all committed is to achieve a more sustainable and healthy food system for the town. They intend to realise this through: (1) acting as information brokers – organising events, disseminating information and building databases, connecting producers, customers, organisations, entrepreneurs who want

to support food sovereignty and sustainability; (2) acting in the political domain, building social support and negotiating with local authorities for a local sustainable food strategy.

Permaculture Community (Permaculture Association and the Land Project), England (E Perm)

The LINSAs studied comprises: the project Learning And Network Demonstration (LAND), its parent body The Permaculture Association (PA), and the wider community of Permaculture practitioners in England. The Permaculture community has originated outside of mainstream agriculture and is operating outside public funding and established policy and knowledge frameworks. It is a diffuse network of individuals, projects and groups all interested in, or practicing, Permaculture (defined broadly as a design system for creating sustainable human environments).

