Re-orienting rural innovation

Paul Swagemakers[1], Ton Baars[2] and Han Wiskerke[3]

[1] Grupo de Investigación Economía Ecolóxica e Agroecoloxía (GIEEA), Universidade de Vigo, Lagoas-Marcosende s/n, E-36310 Vigo, Spain. Email: paul.swagemakers@uvigo.es, tel.: 0034 986 814005

[2] Forschungsinstitut für biologischen Landbau (FiBL),Mittelweg 9, D-37217 Ziegenhagen, Germany. Email: ton.baars@fibl.org, tel.: 0049 (0)5545 969482

[3] Rural Sociology Group (RSO), Wageningen University, P.O. Box 8130, NL-6700 EW Wageningen, the Netherlands. Email: han.wiskerke@wur.nl, tel.: 0031 (0)317 484507

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Abstract

The ongoing modernisation, specialisation and intensification of agriculture increasingly cause a disconnection between farming, nature and society, resulting in social, economic and ecological crises in the food chain. The development of alternative strategies that release farm development from the treadmill of economic pressure starts where practitioners successfully adapt their farm in a step-by step innovation process. The systemic configurations share the common characteristic that the adaptations – that we conceptualise as novelties – are guided by a re-orientation towards the endogenous (ecological and socio-economic) resource base and can be strengthened when scientists support, explore, test and verify their interrelations whilst politicians and policy makers pursue an objectives-led policy instead of implementing prescriptive measures. The adaptation of the institutional context of unfolding farm practices stimulates the exchange of novelties between producers and promotes scientific research on promising novelties.

1. Introduction

Although the modernisation of agricultural food production has safeguarded food supply at low direct payment for food products by consumers (Brouwer and Lowe 1998, Tracy 1989) it has resulted in the undeniable degradation of the natural resource base (Altieri 2002, Toledo 1990; 2002). In Europe, this is expressed by the fragmentation of landscapes (Baudry et al. 2003), the decline in numbers and diversity of farm land birds (Beintema et al. 1997, Birdlife International 2004, Duncan et al. 1999), a decrease of N-efficiency in agricultural systems (van der Ploeg et al. 2006, Verhoeven et al. 2003) and losses of soil fertility and soil organic matter (Cunfer 2004, Cunfer and Krausmann 2009, van Apeldoorn et al. 2011). This combined with a series of food crises such as mad cow disease, food and mouth, avian influenza, swine fever and blue tongue disease (van der Ploeg 2006) indicates that the contemporary globalized food system is in severe environmental and socio-cultural risk. In the margin of society, practitioners generate alternatives (Wiskerke 2009) that respond to this social, economic and ecological crisis.

In this paper we discuss second order innovation (Brunori et al. 2008, Knickel et al. 2009) and in particular how a socio-technical network is created that adopts rule-sets that come along with the rewritten grammar of innovation (Rip and Kemp 1998) by practitioners who improve the social-ecological performance of their farms (Swagemakers and Wiskerke 2011). In such an alternative conceptualisation of food production farmers are situated at the intersection of society and the natural ecosystem. We describe how endogenous knowledge travels in and between different levels of aggregation and how institutional arrangements support practitioners to further sustain food production. Finally, we draw conclusions on institutional innovation and scientific support at the ‘meso’ level and claim that the revitalisation of territorial capital (Swagemakers et al. 2012, van der Ploeg et al. 2009) should be ‘Leitbild’ for future rural innovation.

2. Unfolding farming

In order to overcome the social, economic and ecological crisis of contemporary food production we focus on farm practices (Swagemakers et al. 2012) that are firmly rooted in the local context (Lang and Heasman 2004, Sonnino and Marsden 2006, van der Ploeg 2003, Wiskerke 2009). In order to increase the understanding of the dynamics of these practices, we focus, both empirically and theoretically, on interactions of two or more systems (Norgaard 1981; 1984). We study how humans and the natural and socio-political environment mutually shape each other in locally specific contexts in terms of ‘co-production between human and nature’ (Toledo 1990, van der Ploeg 2008). Those farmers who remain in farming over a long period have to continuously adapt their farming system (Holling 2001, Stagl 2007, van der Ploeg 2008). This adaptation can take many forms and based on personal interests of thought or their biography includes the mutual adaptation of the social and natural environment of the farm (Baars, 2002). It results in different ‘styles of farming’ (Boonstra et al. 2011, Domínguez García 2007, van der Ploeg 1991; 2003) that can be considered as differently optimised dynamic social-ecological systems (Rammel, et al. 2007): agro-ecosystems that perform differently regarding the use, the reproduction and the improvement of ecological capital (Swagemakers and Wiskerke 2011). The internal processes of change and adaptation (the optimisation of available resources) is related *‘to the capacity, within the region, to continuously improve processes of production, products, patterns of cooperation, etc.’* (van der Ploeg et al. 2009:9) and a range of adoptions and innovations lead in the end to a new farming routine, a new practice or a ‘system that works’ (Röling 2000).

2.1 Novelties

These changes and adaptation, often small and hardly notable for outsiders, we conceptualise as novelties; the unfolding practices, i.e. the development process itself, we conceptualise as novelty production (Knickel et al. 2009, Swagemakers 2003, Swagemakers et al. 2012, Wiskerke and van der Ploeg 2004). A novelty can be considered as a rupture of existing routines. It differs from an innovation as applied to the farm from outside, derived from external institutional bodies, reflects endogenous knowledge, and consequently conflicts with current routines and institutionalised knowledge, that is, scientific understanding of farming, ecosystems and governance structures which generally function along the mechanisms of prescription and rigid control. Hence, novelties should be considered as deviations: as complex sets of alternative management that carry the promise things can be done differently. A novelty is not an isolated promise, but often relates to other novelties which all evolve in practice. Novelties are, in other words, local steps of innovation and adaptation to find solutions for existing questions. Novelties are developed and continuously adapted by farmers, and result from as well as strongly depend on knowledge on both the natural and socio-political environment.

2.2 Knowledge production

The concept of novelty production holds the promise to align two or more systems and to bridge practical, political and scientific insights and needs that potentially contribute to the success of specific systems. We refer to these learning processes on complex social-ecological systems as ‘experiential science’ (Baars 2010). Focusing on the strengthening of the ecological and socio-economic resource base, ‘capital accumulation’ (Bourdieu 1986) is a central notion. How people perceive their social, cultural and material environment is essential part of (local) knowledge construction (Raedeke and Rikoon 1997). Related to the diversity in perception, understanding and action of actors, knowledge production mutually depends on and reproduces this diversity. Knowledge as *‘a cognitive and social construction that results from and is constantly shaped by* *the experiences, encounters and discontinuities that emerge at points of intersection between different actors' lifeworlds'* (Long 2001:71) determines, if managed by 'informed', knowledgeable actors, a continuous process of adjustment (Long 1992; 2001). Hence, differences in viewpoints, actions and practices, especially the mutual interrelations of knowledge and experience in actor-worlds (Callon 1986) can result into the accumulation of knowledge.

Shared viewpoints should not be expected. Instead, people work on a common interpretation of the reality in which there should always remain a wide berth for differing views (Long 1997). The identification of knowledge and the identification of its relevance depend on the willingness to look over the boundaries of a single group, or interest group (Long 2001). Hence, learning is a socially constructed and negotiated process. Novelties and novelty production are both driving forces and a result of the revitalisation of ecological capital and all its implications.

2.3 Optimising the farming system

In mainstream optimisation strategies farmers maximise milk production on the basis of external inputs such as artificial fertilizers, herbicides, antibiotics and concentrates. The external farm inputs lead towards a higher N-content in the cow's urine and in the farm manure as slurry, and consequently relatively high N-emissions. Optimisation of the 'soil-plant-animal-manure system' reduces the losses of N into the soil and the air (Reijs 2007, van der Ploeg et al. 2006, Verhoeven et al. 2003). The system can be considered a promising technical configuration (Rip and Kemp 1998, Van der Ploeg et al. 2004). Its application requires improved farmer capability to observe, adapt, be flexible and with capacity to react to local, fluctuating situations rather than fulfil a standard program to farm 'according to so-called best farmer's practice'. The systems' overall performance and success depends on knowledgeable actors (Long 1992).

Central in this innovation of the farming system are the reduction of bought fertilizers, the delay of mowing dates, and an alternative focus on the principle of dairy cow feeding based on a better rumen digestion within diets poor in protein and rich in fibre. The latter in turn changed the quality of the manure (differing in terms of composition, physical appearance, smell and effects, low N-content and high C/N ratio) (de Goede et al. 2003). The adaptations and the overall adjustment of different elements delivered to farmers similar or even better levels of N-efficiency (Huijsmans et al. 2004, Reijs et al. 2003; 2007, Reijs 2007). The system requires proper application (using machinery adapted to the specific condition, applying manure under specific weather conditions), but when applied correctly the optimisation stimulates soil life, and increases the N-delivery of the soil (Sonneveld and Bouma 2005, Sonneveld et al. 2009).

Hence, the optimisation of the soil-plant-animal-manure system holds promise for meeting the environmental requirements regarding N-emissions, and in fact contributes to achieving the reduction of nitrogen losses and ammonia emission. In addition to the improved N-efficiency the adaptations safeguard biodiversity: grasslands become more heterogeneous, the edges of the fields as well as the hedges and belts of altered trees in between the fields richer in plant species (Weeda 2004), and the increased flexibility in grassland management leads to better survival conditions for farm-land birds.

3. Farm-land bird protection

Due to the accelerated process of modernisation of the last decades, habitat conditions for farm -land birds have worsened. Farm-land bird management entails a complex process of fine-tuning farm activities (grassland management) and the organisation and implementation of protective measures for the birds (mapping the nests, nest protection, delayed mowing dates, and fighting predators). This process of fine-tuning is organised at different levels of the natural and socio-political environment: at the level of single fields, the farm, the fields of neighbouring farm and/or the fields managed by organisations for nature conservation. The adaptations are translated into concrete measurements and/or activities and paid for by means of contracts. So-called mosaic-management entails the creation of parcels of parts of fields with longer grass, which can be created by differentiating grazing activities, the application of manure, and the mowing of (parts of) the fields and/or field margins (delayed mowing dates). Together these measures compose a habitat for farm-land bird species. Next to the endangered Black-tailed Godwit (*Limosa limosa*), among the protected farm land birds are the Lapwing (*Vanellus vanellus*), Redshank (*Tringa totanus*) and the Oystercatcher (*Haematopus ostralegus*).

3.1 Adapting the bird habitat

These birds benefit, when adequately applied, from the soil-plant-animal-manure system. The quality of the manure affects the organic matter content in the soil, improves soil life as well as the water containing capacity of the soil, which prevents the soil from drying quickly. This is crucial to the Black-tailed Godwit (of all European birds of this species, 40% of the world population depends for their survival on the Netherlands (Teunissen and Soldaat 2006)). As well as improved conditions for adult birds that use their long bill to search for worms for egg production (Beintema et al. 1995), the optimisation of the soil-plant-animal-manure system especially improves the condition for survival of the chicks: adapting mowing schemes to the presence of farm land birds (flexible mowing schemes: when birds nest in fields, with delayed mowing in parts of the fields) and grass lengths in the fields differentiated (providing shelter and forage conditions for the chicks). Chicks need shelter against predators as in the first two weeks they are not able to escape from predators (they cannot fly yet). Chicks hunt insects in the top of longer grass, at approximately 15 centimetres. Long grass is crucial for the improvement of habitat of the Black-tailed Godwit but conflicts with intensive use of the grassland in the initial phase of the breeding season. Flexibility regarding grassland management is important as harvesting of the grass as well as the breeding season of farm-land birds lasts from April to July. Farm-land birds need shelter and food, which can best be provided in a mosaic regime of cutting and grazing, where grasslands are in different stages of development. Mowing large areas in a repetitive cutting regime leads towards a desert for these birds. The habitat for farm-land birds erodes: food as well as shelter is no longer present. Early slurry application and early mowing of fields that are too large complicates the survival of young birds. Physiologically, lower N-contents in the improved manure result in slower grass growth and allow for flexible grassland management; the lower N-contents allow for regional application of the manure and results in a better regulation of grass growth and flexible grassland management.

3.2 Having an eye for birds

The application of manure and grazing and mowing activities relate to 'having an eye for birds' (Swagemakers et al. 2009). This refers to practical knowledge on where birds nest and why, what species of bird requires what type of conditions, and an adapted mowing regime. The latter relies on the willingness to wait with mowing the grass, or, if mowing, to mow the grass carefully to protect the chicks. In order to optimise the breeding success of the Black-tailed Godwit, enabling this particular red-list bird species to survive, farmers have to take a range of well adjusted measures. Next to the production of improved manure, based on more organic matter with the possible help from straw, they should apply the improved manure at the right moment and in the right quantities. Before the birds arrive, farmers have to anticipate where the birds will possibly nest, and where chicks possibly can develop. These observations and the interpretation of conditions in the fields affect and influence the farm activities and their evolution through time. In the optimisation of the habitat for farm-land birds, the 'capacity to judge' plays a crucial role. The increase in insights and experiences of practitioners and the optimisation of the performance of the natural ecosystem are mutually reinforcing processes.

3.3 Predation

Next, farm-land bird protection involves preventing the birds from the danger of predation. The possible ways of lowering the risk of predation combined with the capacity to judge whether the habitat conditions are successfully fulfilled finally result in the survival of young chicks. In order to optimise bird protection, different actors (with different backgrounds and interests) contribute to knowledge production on farm-land bird protection (farmers, bird watchers who help to identify bird nests and hunters who assist in the protection of bird life). Further, the optimisation of farm land bird protection might be constrained by national policy frames and regulations, for example fighting predation (predators of the farm-land birds are as the farm-land birds themselves often protected by national laws). Hence, farm-land bird protection involves differences in interests, viewpoints, and practices. Sometimes farmers take the role of bird watcher or hunter. Farmers who combine the different roles can teach us about the optimisation of farm-land bird protection and show the need of 'adaptability' and 'flexibility' in the applications of rules and regulations instead of 'prescription' and 'control' (van Kessel 1990, Wynne 1996).

4. Collective management

Like in other parts of The Netherlands, in the open fields surrounding the Friesian Woodlands (in the northern part of the Netherlands) a precondition of receiving payments for bird protection is the supply of a mosaic-management plan. Consequently, farmers have to decide what fields (or part of a field) should have a delayed mowing date. The provisional extended mowing dates are registered and controlled by the governmental bodies. In order to optimise protection measures, farmers have to change the initial plans as during the season. For example when it turns out that birds nest in other fields, or have not come at all – which makes it nonsense to carry out the plan (especially the application of delayed mowing) that is agreed on in and paid for via contracts. In order to run bird protection in the area smoothly, a territorial cooperative fulfils the role of broker between nature conservationists and farmers, but also between farmers and national regulations and protection schemes (Domínguez García and Swagemakers 2012).

4.1 Territorial cooperative

The territorial cooperative coordinates the mapping of bird nests, the implementation of protection schemes (and all that comes with it), the arrangement of local support (the assistance of the bird watchers and hunters in bird protection), and communicates the planning and implementation of measurements schemes and their results to the national governmental bodies. The cooperative represents an *'intermediary space where actors from different backgrounds, contexts and frames meet'* (Moschitz and Home 2012): a social interface that represents various types of knowledge (ideas about oneself, other people and the context and social institutions) in which *'interactions become oriented around problems of bridging, accommodating, segregating or contesting social evaluative and cognitive standpoints'* (Long 2001:65). It provides the context for more adequate adaptation of farm practices in and between different levels of aggregation. As such it facilitates the process of bottom up innovation, the adequate implementation of rules and regulations, and the integration of different types of knowledge (tacit, codified, synthetic and analytical knowledge).

We analyse this adaptation process (and its learning component) among farmers, the adaptation of governmental procedures and governance structures and 'social learning' (that is second order innovation) in terms of novelty production. The novelties developed at the farm level, such as the application of the improved manure, the adapted grazing and mowing schemes and the increased grassland mosaics in the case study area, imply further application and development of novelty production at higher levels of aggregation: the organisation of flexibility and adaptability in the more structural conditions that allow for and stimulate the further unfolding of farm practices that are based on the principles of farming economically (van der Ploeg 2000) and the revitalisation of ecological capital (Swagemakers and Wiskerke 2011). We present three novelties that on the one hand require the integration of different type of knowledge and on the other hand form a platform for the investigation on bird protection in the area.

4.2 Increasing the local knowledge base: study groups

In order to improve the breeding success of the Black-tailed Godwit, the cooperative organised in different smaller areas with high numbers of farm-land birds study groups (each existing of four or five neighbouring farmers). Aiming at the exchange of local knowledge on where birds nest and why, in the meetings local knowledge was translated into maps with bird nests and measures to be taken by individual farmers to protect the birds and their chicks. Central were the identification, adoption and adaptation of novelties created by farmers and especially the internal adjustments of the soil-plant-animal-manure system on each of the farms in relation to bird protection. Shortly before the breeding season farmers shared their experiences and expectations on where birds would nest and what to do to protect them. In an early phase of the breeding season, when the majority of bird nests were mapped but the grassland not yet mown, the farmers discussed the decisions to be taken regarding the mosaic management. In the course of the breeding season, a research assistant gathered technical data on the spatial distribution of farm land birds, grassland management, and the specific knowledge of the farmers on the presence and survival of young birds in their fields. By the end of the breeding season the farmers met again, but now in the field to see and learn about where and how the young chicks had survived.

4.3 A helpful modern tool: digitalising bird maps

The expected positive effects of the mosaic management require the adequate implementation of delayed mowing dates (in parts) of the fields. Therefore bird nests are mapped, normally marking the nests physically with a wooden stick and indicating the nests on a map. In order to have fast access to information on the distribution of bird nests in the region, bird watchers uses a ‘pocket pc’ (consisting of a GPS receiver with an internet connection) connected to an internet application that reproduced the maps digitally. The GPS receiver placed in or close to a nest, combined with (connected through blue tooth) a mobile phone with an internet application (a normal browser), marked the nest directly on the map at the server of the territorial cooperative. In this way, the distribution of nests could be followed real-time by anyone with a personal computer with access to this digital map. Farmers as well as neighbouring farmers could have a look at the digital map and could adapt their grassland management at the latest moment (before entering to mow the fields). Others, for example bird watchers with an internet connection, could help farmers in their decisions on adapting the grassland management (which was positively received by the farmers in the experiment). By future up-scaling of the use of the pocket pc (see Schotman et al. 2009) in combination with the digital map with grassland mosaics, information can be real-time shared and discussed in study groups. Furthermore, this technical innovation brings complete information on the design of mosaic management and its relevance and allows governmental bodies to control the optimisation of farm land-bird protection ‘regionally’. Besides, data can be used by scientists who aim at contributing to the optimisation of farm-land bird protection.

4.4 Survival of young birds: chasing predators

Predators are also a detrimental factor in the survival of farm-land birds. All involved stakeholders become disappointed by damages caused by predators like crows, ermines, weasels, buzzards and kestrels. Some farmers find an excuse in predation in refusing the application of any delayed mowing date (and consequently to accept losses in grassland production). They argue the impact of efforts made on organising an efficient mosaic management for bird survival will be reduced by the presence of predators: these take eggs out of the nests or eat the chicks. This phenomenon makes control and limitation of predators part of the daily activities of other farmers. They actively protect bird life by the reduction of the amount of predators nearby bird nests. Locals explained buzzards feed the farm land bird chicks to their own chicks. Shaking or freezing buzzards' eggs decreases predation pressure (the buzzard needs fewer chicks to feed the own chicks). Farmers catch crows, ermines and weasels in cages and make these animals 'disappear'. Protectionist of these species (some of them protected by law) actively fight the activities of these farmers; which makes that the measures actively carried out by the fanatic bird protectionists among the farmers 'work' but remain hidden because of their illegal character (predators being protected species as well). It is legal however to take away refugia like trees that serve as lookouts for the predators. This diminishes the risk of farm-land bird chicks becoming caught by predators. The phenomenon of farm-land birds being a protective factor calls for the protection of especially Lapwings: these birds help Black-tailed Godwits to defend their chicks. The Lapwing is more aggressive than the Black-tailed Godwit and chases away predators. Fighting predation, and the resulting clustering of farm-land birds, benefits to the endangered Black-tailed Godwit. The point raised by farmers is picked up by bird watchers: in cooperation with hunters (who dispose also of local knowledge) predators were located and combated. Here the issue of mapping is again relevant: the control of predator populations (and their elimination) only should be applied when these predators frustrate the breeding success of endangered farm-land birds. Next step is digitally mapping of predation, and make local knowledge 'available' and 'action' to be communicated, regulated and controlled at higher levels of aggregation.

4.5 Flexible, integrated mosaic management

Organising farmers in study groups, digitalising bird maps, fighting predators, and creating flexible contracts for mosaic-management allow endogenous knowledge on bird protection to become effective. The adequate implementation requires governmental support to shift from fixed and pre-negotiated grassland management schemes to shaping the pre-conditions for social learning. In this approach, confronting stakeholders with bird life is the pre-condition for learning about its successful protection. Farmers avoid detrimental effects on bird life and can apply flexible mosaic management. Innovative contracts avoid unnecessary restrictions to grassland management, and aim at benefitting to both the production of feed and the protection of farm-land birds.

5. Discussion and final remarks

In processes of social interaction (Berger and Luckmann 1966) local stakeholders (farmers, bird watchers, and hunters), policy makers (at the local, regional and national level) and scientists (of different disciplines) search for how to combine the protection of farm-land birds and productive grassland management. Whilst the breeding success of birds are endangered in mainstream farm practices, the adequate optimisation of the soil-plant-animal-manure system and the production of a series of interrelated novelties holds the promise to contribute to improved foraging and habit conditions and thus for the solid and sustainable protection of Black-tailed Godwit chicks. We conclude that the communication and social organisation of novelties hold the potential to get the use and application of endogenous knowledge by farmers out of its 'illegal' context (for example the on-surface application of manure and farmers chasing 'protected' predators), which requires the capability to adapt, flexibility and capacity to judge of farmers as well as other stakeholders.

Social interaction might create coherence and synergies between the aggregation levels, which benefits to both the social-ecological and economic performance of a region: *'When coherence is obtained, actors can more easily look for synergies.'* (Brunori et al. 2004:321) Multiplier effects are generated, and the mobilisation of social relationships contributes to the improvement of *'economic performance'* and the creation of *'new opportunities for growth'* (ibid). Precondition for its success are shared notions of a group on how it can orient itself to the 'outside world': people need to create an agenda, which might be difficult if that agenda is at odds with dominant development models. The translation of endogenous knowledge potentials between the different levels of aggregation implies institutional innovation. In general knowledge is incomplete and temporarily in nature and therefore has to be continuously renewed and reconsidered (Long 2001). Furthermore, different types of knowledge have to be combined, which is strengthened through scientific and political support to knowledge exchange in and between as well as to the benefit of the different levels of aggregation.

This type of strengthening of the ecological and socio-economic resource base is considered as 'second order innovation' or 'radical change'. Hence, the unfolding of promising farm practices and the adequate translation of endogenous knowledge potentials between the different levels of aggregation imply a fundamental re-orientation on the process of rural innovation.

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