Resilient farmers' strategies and policy regulations: the quest for modernization on Dutch and Italian dairy farms

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Abstract: The ongoing modernization, specialization and intensification of agricultural production 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 central question in our case study research in the Netherlands and Italy on the application of agri-environmental management schemes and the processing of primary produce is: do farm modernization and multi-functionality performance go hand in hand, and if so, how? From case studies on the co-evolution between farmers' and policy makers' adaptive strategies we conclude that lasting prosperity and resilience depend on the flexibility in legislative frameworks and modern technologies. In the case studies new institutional arrangements provide monitoring and evaluation of farm activities so that farmers optimize productivity and sustainability of their farm activities. In this context, the concept of farm modernization deviates from its original trajectory. In its reshaped form farm modernization supports family farmers to optimize their productive performance whilst it simultaneously improves the socio-ecological performance of these farm practices.

Keywords: institutional arrangements, social-ecological systems, territorial cooperation

Introduction

The degradation of nature that comes along with the industrialization of farming (Baudry et al., 2003; Cunfer and Krausmann, 2009; Kleijn et al., 2010) calls for territorially rooted adjustments in modern farm practices and food chains (Wiskerke, 2009). Such alternative strategies release farm development from the treadmill of economic pressure (van der Ploeg et al., 2002; Roep and Wiskerke, 2006) and start from practitioners who adapt their farm in a step-by step innovation process (see e.g. De Roest, 2000; Van der Ploeg 2000; Swagemakers, 2002; Wiskerke and van der Ploeg, 2004; Swagemakers et al., 2012), which results in shifting farm boundaries (Ventura and Milone, 2004; Milone, 2009). Case study research in this paper shows how such adjustments also imply the continuous adaptation of legislative frameworks and food processing technologies. The next section identifies departure points that theoretically frame the co-evolution between farmers' and policy makers' adaptive strategies. Thereafter the case study areas are described, followed by the case study research on institutional arrangements that help farmers to optimize productivity and sustainability of their farm activities. Finally we draw conclusions on how resilient farmers' strategies relate to socio-ecological performance of farm practices more in general.

Step-by-step innovation
Adjustments in modern farm practices and food chains can differently impact on the optimization of co-production of humans and nature, i.e. the specific interaction and mutual transformation of humans and living nature in which farmers reshape the natural resource base (van der Ploeg, 1997; 2003; 2008; Gerritsen, 2002; Swagemakers and Wiskerke, 2011). With the improvement of landscapes and biodiversity among the optimization objectives (including e.g. the cow as labor objective) a fundamental re-orientation of the interrelations between society and the economic system is required (Haberl et al., 2009).

Farm development
In such a re-orientation the farm efficiency and multi-functionality performance result from agency of farmers and other practitioners (see also Swagemakers 2008a; 2008b), including consumers and policymakers. Behavioral change, most often driven by social interaction processes (Berger and Luckmann, 1966), results in a step-by-step innovation of the agricultural production process at the farm level. It reflects endogenous knowledge and often differs from the one provided by external institutional bodies. Hence, it reflects a rupture of existing routines (Swagemakers, 2003; Wiskerke and van der Ploeg, 2004; Knickel et al., 2009; Swagemakers et al., 2012) and since the differences in viewpoints, actions and practices determine adjustment processes in general (Long, 1997) the alternative strategy, in the initial phase, might conflict with routines and institutionalized knowledge, that is, scientific understanding of farming, ecosystems and governance structures.

Social-ecological systems
Hence, learning – at the farm and in its wider institutional environment – is a socially constructed (Raedeke and Rikoon, 1997) and negotiated process (Long, 1992; 2001). Strategies in which farmers e.g. apply agri-environmental management schemes or process primary produce require flexible legislative frameworks and technologies (Wynne, 1996; Swagemakers et al., 2009); such a re-orientation of interrelations between society and economy allows for processes of change that last in the long-term, and can be assessed as an "open evolutionary process of improving the management of social-ecological systems" (Rammel et al., 2007:9). Thereby "it is not only the biological components of ecosystems that must be curated […] it is also important to safeguard knowledge of management practices that relate to these conditions" (Barthel et al., 2013:1143). In order farm practices and food chains to sustain, the systems' capacity to adapt (Holling, 2001; Stagl, 2007; Van der Ploeg, 2008) and its ability "to reconcile the impacts of human activity on the environment" (Murphey, 2000:2) are important dynamics.

Governance dynamics
Simultaneously, society demands agricultural production to sustain, and so far the incentives for this type of deviation of farm modernization are mainly provided by public direct support. The EU budget mechanisms for example provide indirect payments for environmentally sound farmers' behavior. In this organizational form the production of public goods is compensated by indirect payments. There is emerging evidence that the public goods coming along with this behavioral change are compensated by direct payments, either by local communities or consumers. In the emerging food chains consumers generate and articulate a demand for the "asset specificity" of food products. Thereby environmental services are paid through hybrid governance forms as quasi-markets or quasi-organizations in which consumers actively participate in the production decision-making process of the farmers. Therefore the central question in this paper is: How do hybrid governance forms such as quasi-organizations or quasi-markets provide (monetary) compensation for environmental protection measures that sustain the process of agricultural production?

Materials and methods

In order to answer this question we document case study research (Yin, 2003), which generates detailed insights about what is happening in the situations studied (Stake, 2000). In the cases we analyze the re-grounding process of farm and community practices (Darnhofer, 2005; Van der Ploeg, 2008; Domínguez and Swagemakers, 2012); i.e. the adaptation of the mix of resources that is used at the farm enterprise, and that includes next to off-farm-income (pluri-activity) the increase of the efficient use of the internally available inputs and new forms of local cooperation. In the case study research we combined desk studies with the application of a qualitative micro-sociological approach, which included in-depth interviews with key informants.

Case study areas

Case study research in the Netherlands and Italy is on the application of agri-environmental management schemes and the processing of primary produce respectively. The case study in the Netherlands focuses on an intensively managed agricultural landscape in the Northern Friesian Woodlands (NFW). Since the 1990s, farmers in the area in cooperation with scientists reshape and recombine the natural resource base for farming (Stuiver et al., 2003; Swagemakers and Wiskerke 2006) and are committed to maintaining the biological components of ecosystems that are part of the agrarian landscape. This is characterized by a small-scale landscape alternated with and surrounded by open areas with dairy farming as the prevailing land-use. On some farms a limited proportion (of up to 5%) of the area is used for forage maize production, while the rest of the area is covered by permanent grassland, rotationally grazed and mown. In the central part of the area the average size of the fields, often surrounded by hedgerows and frequently bordered by ponds, is 2 hectare. These biophysical farm and field characteristics combined with regulations on landscape preservation substantially restricted any opportunities for a widespread conversion to large-scale agriculture. The case study in Italy focuses on a cooperative of dairy farmers that produces Parmigiano-Reggiano cheese: Il Consorzio Vacche Rosse, in Emilia Romagna. The climate and soil in the area make that maize plays a small role in the crop rotation and alfalfa fits better (De Roest, 2000). Further, this second most important milk producing area in Italy (ibid) is characterized by small-scaled and medium enterprises (SMEs), a historical and cultural dynamic in which skills, networks and the desire for self-employment are the main drivers (Picchi, 1994). Central to the regional economic activity is next to pig breeding and fruit growing the production of Parmigiano-Reggiano cheese, which "is characterized by dense and well organized networks of farms, small cooperative cheese factories, and "umbrella type" of consortium and a strong set of interlinkages with regional banks and research institutes" (ibid, 1994:199).

Multi-functionality performance

New forms of local organization mediate between farmers' strategies that protect and improve the environment and funds for agrarian nature management and/or better prices paid directly by consumers. These organizational forms aim at the improvement of the payments for the farmers and alignment of the target indicators to the optimization of the production process. The latter is oriented on the multi-functionality performance assessment at the field, farm and territorial level, e.g. closing nutrient and water cycles, preserve the landscape and conserve biodiversity, and re-localise in- and output relations. In both case study areas farmers are aware of when following the modernization trajectory they might be soon substituted by a person who manages just "technology": knows what button to push while applying standardized routines. Such trend would lead to the situation in which the land will be no longer managed, and hence knowledge will be lost on optimizing multi-functional land-use in combination with future opportunities of marketing its revenues. The alternative implies a re-orientation on agricultural production, which will bring challenging organizational and technical change in the years to come.

Results and discussion

In this section we explore institutional arrangements that provide monitoring and evaluation of farm activities so that farmers optimize the productivity and sustainability of their farm activities.

The territorial cooperative the "Noardelike Fryske Wâlden".

Early in the 1990s farmers in the Northern Frisian Woodlands faced strict top-down implemented regulations on the reduction of ammonia and nitrate emissions. In response, farmers started the first environmental cooperatives in the Netherlands: the "Vereniging Eastermar Lânsdouwe" (VEL) and the "Vereniging voor Agrarisch Natuurbeheer in Achtkarspelen" (VANLA), which developed activities that could reach policy targets by the application of context-specific measures that were far more acceptable to the farmers. Although in the initial phase environmental objectives focused on reducing nutrient losses at the regional scale gradually more attention was paid to developing ecosystem services related to biodiversity and landscape, there by converting (often unintended) landscape amenities that resulted from the optimization of agricultural production. As a result, the cooperatives mediated between farmers' strategies that protect and improve the environment and national funds for agrarian nature management. In the decade that followed this re-grounding of agricultural production has been further stimulated in agri-environmental protection schemes, also elsewhere in the Netherlands.

In 2002, six environmental cooperatives (working area approximately 50,000 ha) merged into the territorial cooperative the "Noardelike Fryske Wâlden". The cooperative has over 1000 members of which 800-850 farmers who make up about 90% of the total farmers in the area. The other 20 per cent consists of private land-users, most often households with a few hectares of land. The members of the cooperative manage 1,500 ha of hedgerow and banks of altered trees, 8,000 ha field bird management, 800 ha of botanic grassland and over 100 'pingo's' (pools created in the ice-time) and 'dobbes' (artificially created pools).

The cooperative is led by a daily board with representatives of the six environmental cooperatives in the area that is chaired by a president. Since 2004 in a so-called "Gebiedscontract" (Regional contract) the Ministries of LNV and VROM, the province of Frisia, the five municipalities in the area, the Water Board, the Federation of the Environment Frisia, the Farmer Union, Landscape Management Frisia, the Frisian Field Bird Organisation and the Wageningen University express to support the cooperative in achieving its ambitious "Werkprogramma" (Working program) in which long-term perspectives are combined with activities that can be carried out on the short term. The Working Program consists of three mayor points of attention:

1. The incorporation of landscape, nature and biodiversity into the characteristics and dynamics of dairy farming in the area;
2. The development of an endogenous "milieuspoor" (the environmental trajectory) that corresponds to the characteristics and dynamics of dairy farming in the area and results into a 'jump' in sustainability performance;
3. The achievement of a significant level of self-regulation in order to be able to efficiently organise 1) agrarian nature management in combination with 2) environmentally sound farm practices.

As a consequence of the program and the organizational structure, the production of ecosystem services such as landscape, natural values, a healthy environment, clean water, mitigation of global warming and the production of agricultural commodities are no longer separated (or at best "positioned alongside each other") but mutually reinforcing activities, with one being a condition for the other and vice versa.

In order to comply with external future expectations and achieve a good position for the dairy farmers in the area the Working program is managed in four thematic groups (landscape and nature; field bird management; Agriculture, environment and water; regional economy) with bottom-up leaders from the field. These groups decide on the issues that are carried out in projects and activities that fit to the objectives and strategy of the territorial cooperative. The board of thematic working groups again is assisted by a "Stuurgroep" (Coordination assembly), which consist of different levels of administrations and control bodies and is consulted on a frequent base and if needed also on demand.

This innovative institutional system that has been developed over the past 15 years reflects a flexible regulatory framework through which farmers successfully apply nature management. In the past two decades, despite public investment the results of for example the measures for field bird management have been limited and are much debated. The management prescriptions in these agri-environmental schemes focused on field scale adjustments such as delaying fertilizer application and mowing dates so as to allow chick hatching and rearing to be completed. On-farm experiments with more complex patterns of field management led by one of the thematic groups resulted in a larger heterogeneity of biomass and increased vegetation height, and consequently better survival conditions for field bird chicks. Consequently, the in-field solutions for field bird protection deliver a substantial contribution to the international obligations in the context of Bird and Habitat directives and the Water framework. Future field bird protection schemes focus on species that depend for their survival on agrarian nature management. In the case study area farmers no longer participate individually in these frameworks. This is in line with expected future funding programs that will be target oriented and efficient, simplified (less bureaucratic) and cost effective (reduce transaction costs). These changes will bring important challenges for the management organisation of the cooperative.

The dairy cooperative "Vacche Rosse"

In Emilia Romagna the concept of *"terroir"* i.e. the interrelations between the mix of natural and human resources in an area and production techniques of local food produce does not withstand the maintenance of a high cheese output in combination with high employment levels (de Roest, 2000). Next to a mere geographical concentration of firms "the nature of economic relationships is decisive for the solidity and the competitiveness of the district" (ibid:10). Although economic sizes of plants and production styles vary (ibid) and globalization and industrialization of food produce impacts on the dairy sector and production techniques in the area, "Il Vacche Rosse", working in line with the general Parmigiano-Reggiano Consorzio production regime, successfully maintains its authenticity and originality institutional system.

In 1991, cow breeders started processing milk of the autochthonous breed "Razza Reggiana" into Parmigiano-Reggiano cheese. In collaboration with the "Centro Ricerche Produzioni Animali di Reggio Emilia" (the Reggio Emilia Research Centre for Animal Production, CPRA) and financial support of the Ministry of Agriculture a first program was started in which milk of the autochthonous breed, delivered by different farmers, was processed separately from other milk processed at the plant.

After the two years program the initiative was followed up and continued as the cooperative "Vacche Rosse". Nowadays, the milk of 24 producers is processed in two plants (one solely processing the milk of the Reggiana breed) and sold in farm shops, groceries, in the online store of the cooperative and even overseas in cities as New York, Montréal, Toronto and Tokyo.

The cooperative started from the perspective to recover the traditional cow breed that in the early 1990s was in danger of extinction. Due to modernization and industrialization processes Vacche Rosse cows reduced in number from about 41,000 cows in the 1950s to 8,000 in the 1970s until in 1981 only 450 cows were left. Thanks to the efforts of the cooperative the breed recovered and

nowadays counts 3,000 cows. With an average 305 days production around 5,500 kg and 3.45 per cent of protein and 3.54 per cent of fat the cow might at first sight be less productive but the percentage of casein makes it very suitable for long aging of the cheese. Cheese produced in the cooperative therefore is at least 2 years old (compared to 1-1.5 year in conventional Parmigiano-Reggiano cheese production), which brings outstanding organoleptic quality of the cheese (flavor and aroma), improves the digestibility, the presence of calcium, phosphorus, protein , essential amino acids, and results in the lack of lactose (Gandini et al., 2010).

The animals that belong to members of the cooperative are fed with only fresh grass, hay and GMO-free feed, and become easily 10 years old (compared to 4 to 5 years in conventional dairy farming). The autochthonous breed and additional production features guarantee consumers of "Vacche Rosse" a level of production standards (written down in a specific regulation) that even goes beyond the ones of the Parmigiano-Reggiano Consorzio. Next to Parmigiano-Reggiano the cooperative processes and sells butter and ricotta under the "Razza Reggiana" or "Vacche Rosse" brand.

Discussion

Both cooperatives in the case studies try to go ahead of market failure; whilst farms had to be larger and become more effective for industries in both situations farm modernization on small and medium sized farms took place differently. The Dutch farmers optimized their farms from the perspective that organic production processes are not only chemically to be improved. Instead, farmers improved soil life, increased biodiversity and diminished the pressure and risk of diseases in their farming system. New technologies can assist in monitoring their efforts. The Italian farmers developed artisanal production technology. Also on small and medium sized farms production should be hygienic, for which modern technologies are used and created and/or adapted by small firms (De Roest, 2000). Although in conventional farm practices technology still plays an important role in the maintenance of soil fertility and levels of production, its role in the alternative farmers' strategies in essence is different: it helps farmers to do their work better. In this context family farming represents, instead of an old-fashioned way of farming, modern and resilience farm strategies in which up-to-date technologies are used. These technologies fit to the activities and maintain the system productive, preserve the natural resource base and make the system competitive in the market. Simultaneously these strategies comply with the OECD "Green Growth Strategy" for the coming decades (OECD, 2011), which implies solving environmental problems while creating economic benefits and human welfare; objectives which also have been taken as EU position (Refsgaard and Bryden, 2012).

The case studies show how the improvement of the multi-functionality performance can be turned into the creation of new and productive revenues, which simultaneously leads to the recognition of farmers being the relevant producers of these values. This is translated into the access to new markets with added value to farm produce and can be related to new on-farm and also regional activities such as education (e.g. school visits) and tourism (e.g. the maintenance of an attractive landscape in combination with the creation of new infrastructure for leisure activities such as host and entertain visitors from outside the region). Hence, biological components of ecosystems (soil fertility, biodiversity et cetera) become dominant factors for future farm optimisation, and create multiplier effects at the territorial level.

Conclusions

Technologies and scale enlargements are needed in order to improve the productive system, e.g. investments in the stable in order to cope with a small increase in production and/or to improve animal welfare. Hence the enlargement of fields and the use of faster tractors, GPS and milk robots are defendable growth factors that contribute to lasting prosperity and resilience provided that agricultural change does not destruct the autonomy of farmers. From the case studies the general lesson can be drawn that lasting prosperity and resilience depend on the flexibility in the application of legislative frameworks and modern technologies. In this context, a conceptual deviation of farm modernization can very well support family farmers to optimize their productive performance whilst it improves the socio-ecological performance of their farm practices. Hence, lasting prosperity and resilience depends on the reshaping modernization, i.e. on the re-invention of the role of farmers and the creation of a parallel market in terms of public goods.

Technology helps also small farms to improve the quality of milk and the quality of life the farmer by means of saving labor; it not necessarily substitutes but helps people to do their job better, e.g. in the case of cheese production in Emilia Romagna or the grassland optimization in relation to the maintenance of the biological components in the agrarian landscape of the Northern Frisian Woodlands. In both cases there is a need for modern technology oriented on small farmers in combination with the establishment of networks and institutional arrangements. Such a deviation of the trajectory of modernization results in the maintenance of the family structure in relation to organizational and technological innovation. This holds not only true for small and medium sized farms; in order to safe production also larger scaled farms look to multifunctionality (De Rooij et al., 2013) and shift from following the rules of economies of scale to the rules of economies of scope. Central to resilience farm strategies is an effective and productive solution to continue farming in the future that is based on the improvement of the socio-ecological performance of unfolding farm practices.

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