UNISECO

UNDERSTANDING & IMPROVING THE SUSTAINABILITY OF AGRO-ECOLOGICAL FARMING SYSTEMS IN THE EU

Deliverable Report D5.2
Governance Networks Supporting AEFS

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DATE OF APPROVAL:	30.10.2019
APPROVED BY PROJECT COORDINATOR:	Gerald Schwarz (Thünen Institute)
DATE OF APPROVAL:	31.10.2019
CALL H2020-SFS-2017-2	Sustainable Food Security-Resilient and Resource-Efficient Value Chains
WORK PROGRAMME Topic SFS-29-2017	Socio-eco-economics - socio-economics in ecological approaches
PROJECT WEB SITE:	www.uniseco-project.eu

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ACRONYMS

AEFS	Agro-ecological farming systems
CS	Case Studies
GN	Governance Networks
MAP	Multi-Actor Platform
MoA	Ministry of Agriculture
NGO	Non-Governmental Organisation
SES	Socio-Ecological Systems
SNA	Social Network Analysis
UNISECO	Understanding and Improving the Sustainability of Agro-ecological Farming Systems in the EU

NET-MAP LEGEND

ACTORS CATEGORIES

- CIRCLE: Authorities and Administration
- SQUARE: Farmers
- TRIANGLE: Agri-food value chain
- DIAMOND: Science, innovation, advisory, capacity building
- DOUBLE TRIANGLE: NGOs, civic society organisations, local community representatives
- CIRCLE IN BOX: Consumers
- BOX: Media

MISSING VS. NETWORK ACTORS

- WHITE: Network actor
- GREY: Missing actor

ACTOR SCORE AND ACTOR-ACTOR LINKS

- SCORE: influence is proportional to node size
- LINKS: Source to recipient arrows
- DASHED LINE: Goods/services
- DOTTED LINE: Knowledge/information
- SOLID LINE: Goods/services and Knowledge/information

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1. INTRODUCTION

This document represents the deliverable D5.2 within Workpackage WP5 "Governance and policy assessment" of the EU Horizon 2020 project UNISECO (Understanding and improving the sustainability of agro-ecological farming systems in the EU). The overarching objective of WP5 is to analyse market and policy incentives, with governance mechanisms, supporting Agro-ecological Farming Systems (AEFS). In particular, this report includes the results of task 5.2 "Analysis of governance structures".

In line with the conceptual framework developed in WP2 (Guisepelli *et al.*, 2018; Prazan and Aalders, 2019) and in close cooperation with Task 3.1 (Description and assessment of the SES in the case studies), the analysis carried out for Task 5.2 focuses on the actors, actions, rules and collective organisations enabling agro-ecological transitions.

The overall objective of this deliverable (D5.2) is to identify and analyse the governance structures which characterise the different transition "patterns" in the context of the 15 UNISECO case studies.

The specific objectives of D5.2 can be synthesized as:

- To identify and analyse the most relevant actors for addressing key agro-ecological dilemmas in each Case Study (across the seven main types of actors: farmers; authorities and administrations; agri-food value chain actors; science, innovation, advisory and capacity building actors; NGOs, civic society organisations, local community representatives; consumers; media);
- To identify and analyse the governance networks with relevance for the challenge. The focus is on power relations, conflicts, collaborations, collective action dynamics, the flows of knowledge and tangible goods. The purpose is to understand the decision-making process and how the network and its elements (actors and actor-actor links) can influence pathways of agro-ecological transitions.

Social Network analysis (SNA) is the method that has been used to analyse the governance structures involved in the transition towards agro-ecological farming system (AEFS). The analysis went well-beyond the farm level, by looking at how different stakeholder groups are engaged in the transition processes towards sustainable agriculture and food systems.

The report is structured as follows: Section 2 includes an introduction to the topic with particular attention to governance networks enabling the transition towards AEFS. Section 3 reports on the research method (Social Network Analysis) used for the data collection in the context of the 15 UNISECO case studies. Section 4 presents an overview of all case studies, while Section 5 provides a comparative analysis of the different governance networks. Conclusions are drawn in Section 6. The Annex includes a more detailed description of all the 15 case studies.

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2. NETWORKS IN AGRO-ECOLOGICAL TRANSITIONS

2.1. Background

The main objective of UNISECO is to strengthen the sustainability of EU farming systems. It aims at analysing socio-economic and policy drivers and barriers for the further development and adoption of agro-ecological approaches in farming systems. The UNISECO project relies on a case study analysis carried out in 15 European countries where initiatives are either already in place, or are initiated by the project to foster the development of agro-ecological practices and improve the sustainability of farming systems. The farming systems studied in UNISECO have been selected to reflect the following three criteria (Prazan and Aalders, 2019):

- the diversity of farming systems across the EU;
- the types of agri-food systems and policy context in which the farming systems are embedded;
- the types of agro-ecological practices which have been implemented.

The purpose is to study a broad pool of farming systems at different stages of agro-ecological transitions (see Prazan and Aalders (2019) for further explanation of the transition stages).

To analyse the transition of farming systems, the theoretical framework used in UNISECO is that of socio-ecological systems (SES) developed by Ostrom. This framework provides a holistic approach to integrating both the natural and the social aspects when analysing a complex situation or problem. In the context of UNISECO, it allows the integration of the various dimensions of farming systems transition towards agroecology, be they technical, environmental, social, economic or political.

One of the key aspects developed in the SES framework is the analysis of the social system. It is composed of two sub-systems: the network of actors involved and the governance systems that influence the actions undertaken by the actors. In UNISECO, the analysis of the "actors" sub-system refers to identifying and listing actors influencing agriculture and the transition towards AEFS. The objective is to analyse their roles, positions, points of view and strategies. Various types of actors have been considered.

The analysis of the "governance" subsystem aims at understanding the rules, regulations and decision-making processes which influence the transition towards AEFS in the cases studied. It covers both the institutional rules and regulations (for example for the implementation of a policy measure, a market incentive etc.) and the more informal decision-making processes (for example used for collective action).

To have an overview of the actors and of their links, Social Network Analysis is used to analyse the governance structures of the transition patterns towards agroecology. This methodological choice has different advantages in the context of the UNISECO project:

- to achieve an overall consistency between work packages;
- to provide a consistent framework to build this part of the SES framework, and to address some limitations related to the standard SES approach (i.e. in SES standard approach economic rationality of each actor and institutionalised relations are the main focus and addresses few mutual trust and reciprocal relationships despite their key role);
- to extend the view of agro-ecological transition patterns from the farming system level to a broader view including the diversity of actors and governance structures interacting.

In greater detail, in each Case Study governance structures are analysed by mapping and analysing networks involved in a specific key agro-ecological dilemma. The overall objective is to discuss, through a comparison of the 15 case studies, the current and potential role of the governance networks that are currently in place in different SES.

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2.2. Governance Networks

Governance is defined as "the structures and processes by which people in societies make decisions and share power, creating the conditions for ordered rule and collective action, or institutions of social coordination" (Schultz *et al.*, 2015). The choice of UNISECO to focus on governance issues is due to the fact that the project explicitly aims at addressing the transition towards AEFS not only through (public) policy strategies targeted at farmers, but also through mechanisms stemming from the private sector (value chain actors) and from other forms or societal or local engagement, including different forms of collective action.

FAO (2018), by acknowledging agroecology as an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems, also recognize the importance of partnerships, cooperation and responsible governance as key elements to maximise synergies, trade-offs that occur in natural and human systems. In particular, FAO highlight the need for transparent, accountable and inclusive governance mechanisms to create an enabling environment that supports producers to transform their systems following agro-ecological concepts and practices.

Indeed, the challenge of stimulating the transition towards agroecology, and of supporting AEFS in general, implies a need to govern complex social and environmental problems that in many cases cannot be addressed solely by the central State. There is an increasing acknowledgment that the complex sustainability challenges linked to farming need to be addressed by "new modes of governance". Such new arrangements should be based on participatory governance and collaborative management networks that, amongst others, may enable to integrate different sources of knowledge and competences, as well as fostering collective learning (Newig *et al.*, 2010).

On the analytical level, the concept of governance requires that decision making challenges should be specified, which implies the identification of: (i) the boundaries of the system defining the social and political spaces within which these challenges are located; and (ii) the stakeholders in these challenges. On the operational level, governance relates to the mechanisms whereby these stakeholders drive the system to evolve towards the desired state (Triboulet *et al.*, 2019).

In the literature that is emerging on environmental governance and more specifically on the "hybrid mechanisms" describing the interplay between the different agents that manage sustainability issues (Delmas and Young, 2009), we draw in particular on those relating to the concept of Governance Networks (GN) (Newig *et al.*, 2010; Torfing, 2005; Alexander *et al.*, 2016).

Governance Networks are defined by Torfing (2005) as (i) relatively stable horizontal articulations of interdependent, but operationally autonomous actors who (ii) interact with one another [...] (iii) within a regulative, normative, and cognitive framework that is (iv) self-regulating within limits set by external forces and which (v) contributes to the production of public purpose.

Looking at this definition it is evident that, GN consist of organisations that are able to freely connect to others. Secondly, although GN are described as institutionalised relations, mutual trust and reciprocal relationships play a key role. Finally, GN have a cognitive dimension that involves information transmission and learning processes and, above all, are related to public purposes such as the collective management of natural resources, distinguishing them from other kinds of networks (Newig *et al.*, 2010).

A focus on GN helps to draw attention to the relationships (or lack thereof) among individuals (e.g. farmers, value chain actors, policy makers), organisations (e.g. government agencies), and civil society organisations or individuals (e.g. NGOs, consumers). Such a focus also highlights the (good and bad) interplay of values and interests amongst a diverse range of stakeholders (Alexander *et al.*, 2016; Scarlett and McKinney, 2016).

In particular, when looking at the role of networks in agro-ecological transitions, it is important to consider a broad range of both public and private stakeholders and, above all, it is important to define and analyse the institutional settings where public and private actors interact through negotiations and (non-

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hierarchical) coordination (Hovik, 2008). The composition of each GN is defined by its participants, who may be representatives from different levels of government policy or policy sectors, but also of business actors and civic society organisations (see Section 3.2 below).

2.3. Scales of networks towards agroecology

The concept of agroecology has been approached from different perspectives: as a scientific discipline, as a social movement, or as a set of agricultural practices, alternative to intensive agriculture. Together with the evolution of these different conceptualisations, the analyses of agroecology have also enriched their approaches by diversifying their reference scales from a plot or field (from 1930s to 1960s) to an agroecosystem level (1970s to 2000), and finally a food system scale.

In that respect the typology elaborated in WP 2 of UNISECO (Deliverable report D2.2, Prazan and Aalders, 2019) proposes a typology of agro-ecological farming systems and practices encompassing different implementation scales of such practices namely the field level, the farming system level and the landscape level. This allows the consideration of practices of farming systems respect to field, farming systems and landscape levels. To assess farming systems as a socio-ecological system, Prazan and Aalders (2019) propose to develop a multi-dimensional approach including existing markets, level of cooperation, role of policies in supporting agro-ecological practices, policy tools and key actors. This dimension is complex and difficult to grasp.

In the existing literature, Wezel *et al.* (2016) propose the concept of "agro-ecological territories", in order to characterize certain defined areas in transition towards sustainable agriculture based on agro-ecological practices. These authors indicate three major domains to be considered for the transition: adaptation of agricultural practices; conservation of biodiversity and natural resources; and development of food systems embedded in territories (see figure below). From a different perspective, Therond *et al.* (2017) develop a multi-dimensional approach including environmental and socio-economic aspects of farming systems to consider the wider setting of farming systems referring both to territorial and food systems aspects.

To consider the wider context in which farming systems are embedded remains an open scientific challenge in which UNISECO will contribute. The SNA approach will help to tackle this challenge with a special focus on the diversity of network of actors. As specified in the theoretical framework of the UNISECO project (Guisepelli *et al.*, 2018), two different types of case studies have been included in the analysis of the different SES: 1) network-based case and 2) place-based case. Network-based case studies do not have geographical boundaries (or refer to large area at regional or national levels). It could be a network of farmers to share experiences on conservation agriculture and no tillage practices. Internet exchanges, regular meetings and visits are the main frequent media used in such networks. Place-based case studies are local case studies with specific geographical boundaries such as a biodistricts, a national or regional park, a PDO (product of designated origin) area, a valley, a local community.

Amongst the 15 case studies carried out in the context of UNISECO, there are 11 network-based Case Studies and 4 place-based Case Studies (see table 1). The Case Studies also cover different scopes:

- 4 Case Studies have a country scope which look at the soil conservation farming (HU), at the dairy supply chain (LV and LT) and at the sustainability performance of the national livestock sector (SE);
- 6 Case Studies have a subnational or regional focus, where several agro-ecological issues have been analysed related to dairy sector (CZ), permanent crops (FR and GR) and mixed farming systems (RO, ES and UK).
- 5 Case Studies have a local scope: on arable and livestock farming (AT), on dairy (FI), arable (DE), permanent crops (IT) and livestock farming systems (CH).

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Table 1. Overview of UNISECO Case Studies

Country code	Case study	Scope	Main farming system	CS Type
AT	ECOREGION KAINDORF	Local	Arable and livestock	Network-based
CH	INTENSIVE ANIMAL FARMING	Local	Livestock	Place-based
CZ	DAIRY FARMS	Subnational	Livestock	Network-based
DE	DEVELOPING STRATEGIES FOR AGRO-ECOLOGICAL TRANSITIONS IN ARABLE FARMING	Local	Arable	Place-based
ES	AGRO-ECOLOGICAL FARMING SYSTEMS	Subnational	Mixed	Network-based
FI	PLANNING A DAIRY SECTOR DRIVEN BIO-PRODUCT PLANT	Local	Livestock	Place-based
FR	CONNECTING CUMAs TO FOSTER THE ADOPTION OF AGRO-ECOLOGICAL PRACTICES FOR VITICULTURE	Subnational	Permanent crops	Network-based
GR	PEACH FRUITS FOR CONSUMPTION AND PROCESSING	Subnational	Permanent crops	Network-based
HU	SOIL CONSERVATION FARMING	National	Arable	Network-based
IT	CHIANTI BIODISTRICT	Local	Permanent crops	Place-based
LT	SMALL SCALE DAIRY FARMERS AND CHEESEMAKERS	National	Livestock	Network-based
LV	ORGANIC DAIRY FARMING	National	Livestock	Network-based
RO	HOTSPOT OF BIODIVERSITY AND HEALTHY FOOD	Subnational	Mixed	Network-based
SE	DIVERSIFICATION OF RUMINANT PRODUCTION	National	Livestock	Network-based
UK	MIXED FARMING AND GENERAL CROPPING	Subnational	Mixed	Network-based

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3. RESEARCH METHODS AND DATA

3.1. Social Network Analysis in UNISECO

Recent research has identified the existence of social networks as a common and important denominator in cases where different stakeholders have come together to effectively deal with natural resource problems and dilemmas (Bodin and Crona, 2009). Since network structures influence governance outcomes (and vice versa), Social Network Analysis (SNA) is increasingly recognised as a key tool to analyse Governance Networks from both a theoretical and methodological perspective (Newig *et al.* 2010). Indeed, the social relational approach to natural resources management, as implemented through SNA, allows investigation of how patterned relationships among actors within a system enable and constrain human action on natural resources (Bodin and Prell, 2011).

SNA is defined as mapping and measuring of relationships and flows between people, groups, organisations, computers or other information/knowledge processing entities (Krebs, 2010). SNA is a widespread tool for investigating systems (networks) of interconnected individuals (see e.g. Scott, 1991; Wasserman and Faust, 1994). Network configuration is known as "structure" and depends on the number of nodes and links and on the pattern of node connections.

SNA views social relationships using graph theory where:

- Social entities are represented as points, each known as a 'node';
- Relationships are represented by undirected or directed lines, known as 'ties' or 'edges', respectively.

Study outputs often rely on the combination of graphical analysis with the estimation of a series of network metrics, to evaluate the extent to which actors and actor-actor links contribute to system performance. This underlies the semi-quantitative nature of the method, which may variously combine quantitative and qualitative approaches (Table 2).

Table 2. Different approaches to SNA.

	Quantitative	Qualitative	Combined
Overview	Broad range of methods adopted to map and measure structural properties of social networks using sophisticated quantitative techniques	Approaches focusing on the collection of 'relation' data, including actors' profiles and context, quality, meanings of ties	Quantitative SNA combined with interviews, ethnography and other qualitative methods
Key features	Methods able to map and measure certain aspects of social relations in a systematic and precise way	Methods that generate observational, narrative and visual data on social relations	Methods enabling to explore networks from both an 'outsider's' view ('structure' and 'form') and an 'insider's view ('content' and perception')

Source: Authors' own elaboration, based on Edwards (2010)

Quantitative techniques are used for estimating the structural properties of social networks via dedicated indexes and to generate numerical information about individuals and social relations. **Qualitative** analysis is used for generating observational and narrative information about actors' attributes and their reciprocal relationships, for supporting network analysis with contextual information about issues with relevance for to the construction, reproduction, variability and dynamics of formal and informal relations. The combined approach can improve study outputs by adding knowledge about network dynamics in specific CS contexts.

In UNISECO, the SNA was applied at the CS level to answering the following general research question: "**who are the actors and what are the social structures and governance processes that do (or could) influence the transition towards AEFS?"**.

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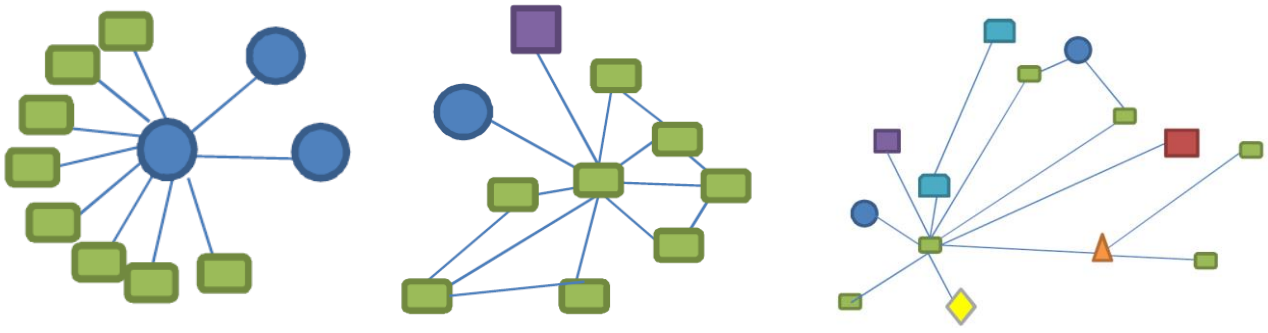
To answer the general research question, the SNA in UNISECO relies on the combination of qualitative and quantitative approaches, via the triangulation of information generated via the calculation of network-level and actor-level metrics, of the visual analysis of sociograms and on semi-structured interviews. Here, the combined approach was considered the most appropriate to pursue the overarching objectives of UNISECO, by:

- Mapping the existing governance networks that may support AEFS and facilitate their transition;
- Understanding the interplay and power relations among the identified different actors;
- Shading light on the role of relevant institutions for boosting the processes of collaboration and learning, as well as for promoting and implementing effective market and policy incentives towards AE transition.

SNA output is a narrative that describes the network in terms of its constituent actors and actor-actor links and delivers a comprehensive 'story' of the case study, including power relations, collaborations, conflicts, management of policy and the role of market incentives.

At the network-level, a key structural property is network cohesion, which describes node closeness. High cohesion levels can lead to trusted relationships amongst actors, thereby speeding up the adoption of AEFS. However, great actor closeness can prevent incoming flows from outside the network, which may prevent additional institutional or private actors, with prospected relevance for addressing the challenge (missing actors) from joining the network. Sutherland *et al.* (2017) identified three primary patterns of network cohesion, as follows:

- Centralised networks, with a central node through which all knowledge flows. Such networks are more likely to transmit codified knowledge, where a central node can channel this information;
- Distributed networks: dense networks of ties where primarily tacit knowledge is exchanged, such networks resemble 'communities of practice' or 'networks of practice' and usually these networks depend on 'social capital';
- Decentralised networks, with multiple nodal points connecting diverse individuals. The actors involved usually have considerable differences and such networks usually involve knowledge from outside of peer group or 'structural holes' to connect disparate groups and their associated knowledge (gatekeepers link diverse groups; brokering these boundaries can be an important function).



(1) (2) (3)

Figure 1. Examples of (1) centralised, (2) distributed and (3) decentralised network structure. Source: Sutherland et al. (2017)

Support relationships to address the challenge should be somewhat decentralised as there is not a high concentration of links towards a single or very few actors. So, centralised and distributed types of networks

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should, ideally, evolve towards more decentralised models with greater link distribution amongst the observed pairs of actors. Decentralised governance networks should be more resilient compared to centralised and distributed networks. For example, when a key actor is removed from a decentralised network, other actors can ensure that the ongoing efforts to address the challenge are continued by most network actors. Additionally, decentralised networks display lower hierarchy, which can improve reciprocity.

For delivering information about cohesion, we used two network metrics, i.e. density and connectedness:

- Density measures the ratio between the number of observed network links and the maximum possible number of links, given the number of nodes. Density values range from 0 to 1; a density of 1 occurs when all nodes are mutually linked among each other. Given the mapped relationships and the purpose of the SNA exercise in Task 5.2, densities exceeding 0.3 are considered high, to pinpoint the risk of the creation of closed systems where highlighting actors that could be reference points e.g. for new comers (missing actors) is difficult, also graphically. National Case Study reports and primary information from the interviews is used to make a final decision about the type of network.
- Connectedness is the proportion of pairs of nodes that can reach each other by any observed path in the network. Information about network cohesion is then synthesised allocating the Case Study networks to the three typologies identified by Sutherland (2017), i.e. centralised (density>0.2), decentralised (0.2<density>0.3), distributed (density>0.3). This classification results from the identification of patterns across the observed networks, based on the combination of qualitative information for Case Study interviews and the graphical evaluations of the sociograms with network-level metrics.

Actor-level metrics deliver information about each actor in the network, based on the number, direction and type of links individual actors and their neighbours are involved in. Positional properties of network actors, collectively known as “centrality”, can help identify who in the network is more or less influential to address the challenge and to promote the transitions towards AEFS. Among the three variants of centrality measures, we concentrate on degree and betweenness centrality:

- Degree centrality is the number of nodes within an actor’s neighbourhood; in case of directed networks, the measure is calculated for both incoming and outgoing links, i.e. in-degree and out-degree centrality, respectively. The measure of out-degree centrality can support the graphical identification of visible actors or opinion leaders, who actively generate flows (gates) within the governance network for addressing the challenge and promoting the transition towards AEFS, given the dilemma. Actors with high out-degree centrality are the ones to whom most individuals turn to for seeking knowledge/information and or goods/services. Preferred recipients of those flows (gated) are actors with high in-degree centrality. With respect to the challenge, actors displaying high in-degree centrality are active seeker of support, e.g. in the terms of formal knowledge (e.g. from advisors), know-how (e.g. from influential peers) and goods (e.g. from public support). To adhere to the overarching objective of UNISECO, we complemented the figures generated via the strict analysis of degree centrality with primary information about actors’ influence towards the challenge, gathered during the fieldwork, via influence towers.
- Betweenness centrality is the number of times a node occurs in network’s paths and informs about the ability of individual actors to bridge network actors. The greater the betweenness centrality the higher the node ability to control the flows through the network; that is to say, network nodes with the greatest betweenness centrality have gatekeeper roles, by bridging the sources and the recipients of network flows.
- To strengthen the identification of network brokers, we combined the measure on betweenness centrality with the evaluation of actor boundary-spanning ability (Lubell et al., 2014). Nodes with

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boundary-spanning relations play multiple roles, generate supply types of flows and can connect actors playing different roles in the network, i.e. owing to different categories. Here, we identify actors with boundary-spanning relations by identifying the type of flow(s) they are involved in and by highlighting the extent to which they are linked to actors owing to different categories (inter-category links). The combination of structural information from network analysis with expert knowledge improves the contextualisation of the SNA exercise and shortens the distance between numerical outputs and experience of the real world. This should strengthen the ability of the SNA study to identify key actors within CS governance networks towards the key dilemmas. Those actors are the potential targets of improved agricultural policy to facilitate the transition towards AEFS.

3.2. Research design and data collection

The specific objectives of the SNA exercise at the case study level may be synthesised as follow:

- **Identifying the type and role of different actors that have some influence on (or that are influenced by) the specific dilemma** (e.g. farmers, farmer's associations, NGOs, cooperatives, nature conservation agencies, local administrations, RDP managing authorities, food system actors, associations of local consumers, etc.);
- **Identifying and analysing the relations amongst the identified actors**, in order to understand the interplay, power relations, trust and reciprocity, knowledge and information exchanges between different stakeholders involved in the main dilemma;
- **Identifying missing actors that would improve governance structures to better address the key dilemma/challenge and then favouring the transition towards agro-ecology** (e.g. institutional arrangements, combination of individual and collective actions, design and implementation of innovative policy and market incentives, etc.).

In order to identify key actors, the first step in the analysis was the identification of a significant and representative agro-ecological dilemma in each CS. A focused analysis of a specific dilemma seemed necessary, since the agro-ecological transitions typically involve a large variety of actors, embedded in various institutions that can diversely interact at different scales. At the same time the dynamics involved in such dilemma could be very useful (and explanatory) as key examples of social structures and governance processes involved in the agro-ecological transitions.

To those purposes, the general SNA research question in UNISECO was targeted at the CS level by **focusing on one specific dilemma for each case** (which corresponds to the Focal Action Situation in the SES analysis) aiming at:

- Providing a detailed analysis of the network currently involved in the key agro-ecological dilemma;
- Discussing on how such network should (or could) evolve, in terms of involved actors and relations amongst them, to better address the key agro-ecological dilemma in the future.

For the analysis of governance networks, actors included in the SNA exercise are generally social/organisational rather than individuals, i.e. representing specific institutions, associations or groups of individuals. However, individuals might play a key role at the local level depending on the socio-economic context and on the dilemma under study, thus being worth including in the study.

The approach followed in UNISECO was selecting actors who have direct or clear links with the dilemma under study, in order to avoid too broad coverage. **Key actors were those involved in activities and/or decision-making processes that are relevant (or potentially relevant) to address the key dilemma.** Although the specific selection was dependent on the case study features, actors were grouped according to seven categories listed in the table below.

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Table 3. Actor categories and examples of actors per category

	Main Category	Example of Actors
	**Authorities and Administration**	Department/ministry of agriculture/environment/industry/commerce and consumption/health/education and research/social rights national, regional, local governments, city councils, policy makers regulatory and managing authorities regional enterprise and planning authorities and technical staff
	**Farmers**	Farmers Producer groups (unions or farmer's representatives)
	**Agri-food value chain**	Integrators, Agri-food clusters, Distribution groups Processors, food-industry groups Wholesalers, dealers, retailers, public-private businesses End-user companies (restaurants, hotels, etc.)
	**NGOs, civic society organisations, local community representatives**	Social entities Environmental/nature conservation groups Citizen groups / local action groups
	**Science, innovation, advisory, capacity building**	Technical advisors: Advisory centres, experts Capacity builders: trainers, educators, vocational training Universities and technical centres: research centres, specific training entities Certification bodies: certification of origin bodies, organic certification bodies, other certification bodies
	**Consumers**	Consumer associations, gender associations, influencers
	**Media**	Press, TV, radio, websites, social networks

Data collection for the SNA exercise drew on NET-MAP, a toolbox developed by the International Food Policy Research Institute (Schiffer and Peakes, 2009), with the purpose of favouring transdisciplinary learning and allowing knowledge co-creation (Hauck *et al.*, 2015; Hauck *et al.*, 2016). The NET-MAP tool can generate both qualitative and quantitative data, thereby improving both the graphical and structural analyses of the sociograms. NET-MAP offers the perspective of interviewees about the goals of network actors and their perceived influence to address the challenge under study. NET-MAP is a low-tech, low-cost, interview-based and participatory network-mapping tool that can be used by researchers, facilitators, and decision-makers to:

- Deduce information from the drawn network by providing explanations for the interplay among actors in complex (formal and informal) networks and by pinpointing power relations and the goals of actors;
- Identify the sources of conflicts and the potentials for cooperation;
- Facilitate knowledge exchange and learning processes;
- Develop ideas and agreed strategies to achieve common goals.

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Operationally, the researcher mediates a group or individual drawing exercise, where sticky notes with actor names on them and directed marker lines (arrows) represent nodes and node-node connections, respectively. Influence towers allow ranking the relative importance of individual actors for the challenge; interviewees can physically build those towers by stacking flat round discs or give each actor a score on their relative sticky note. Actor influence is on a 0-to-5 qualitative scale, where 5 (e.g. a 5 disk tower) shows the highest and 0 the lowest score.

In UNISECO, NET-MAP was used for participatory network building with local stakeholders and for the interactive analysis of actor contribution to address case-study specific challenges. Semi-structured interviews were the core method selected to carry out the social network analysis (SNA). Rather than using traditional name or position generators that are often used in social network research, the questionnaire (see Table 6 below) was structured around open-ended questions. **Researchers invited interviewees to 'tell the story' of the different actors and relations regarding the identified dilemma.** This approach helped to go beyond the simple list of actors and ties, by enabling UNISECO partners to elucidate how the different actors are positioned in the network, the ways in which the ties are found and cultivated, and the conventions which underpin these relationships.

Table 4. Questions for semi-structured interviews with stakeholders

	Questions
ACTORS	Q1 - Please, identify and discuss the number and role of actors that are influencing and/or that are influenced by the key dilemma.
	Q2 - Please, can you describe the main goals and objectives of each identified actors in relation to the key dilemma?
	Q3 - Please, can you briefly describe the decision-making process related to the key dilemma? *(e.g., how the policy and market incentives related to the key challenge/dilemma are managed and by whom)*
POWER	Q4 - Please, judge the influence (power, leadership, lobbying) of each actor in relation to the key dilemma: *0 no influence; 1 little; 2 fair; 3 good; 4 high; 5 very high*
LINKS	Q5 - Please, identify and describe the main links amongst actors regarding the exchanges of goods, services, works. *Specify the type of goods, services, works exchanged amongst actors*
	Q6 - Please, identify and describe the main links amongst actors regarding the exchanges regarding information and knowledge. *Specify the type of information/knowledge exchanged amongst actors*
RELATIONS	Q7 - Please, discuss the relations amongst the actors involved in the network, with particular attention to the shared goals, as well as to the climate of collaboration and trust.
	Q8 – Which are the main conflicts and controversial matters amongst the actors? And between which actors do these conflicts and controversial matters arise?
OVERVIEW	Q9 - Please, can you comment on the system as a whole? What is your interpretation of this network: Is there room for improvement regarding the communication, power relation and exchanges of goods/services to better tackle the local agro-ecological challenges?
	Q10 - Please, identify and discuss the missing actors: those who should be affected/included (also in the decision-making process) but who are out of the network for some reason

The overall aim of the interviews was the analysis of the goals of actors, influences and flows, in order to develop a richer understanding of the governance structure (challenges, barriers, drivers, centrality of actors, institutional and policies issues, etc.) of each case study in relation to the agro-ecological transitions.

SNA outputs included the map of network connections and the description of network structure. The former identifies the involved actors, the nature and direction of the relations, and measure actor

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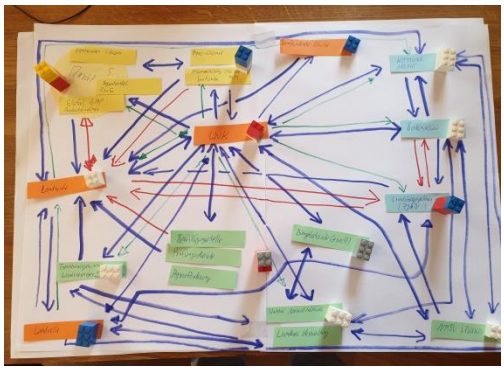
properties, notably their influence (a proxy for reputation/leadership) on the key dilemma identified in each case study. The latter describe the consequences of the observed structure in terms of network outcomes, i.e. the extent to which the network has contributed to addressing the specific challenge/dilemma. Graphically, **source-to-recipient edges** connect actors (directed network).

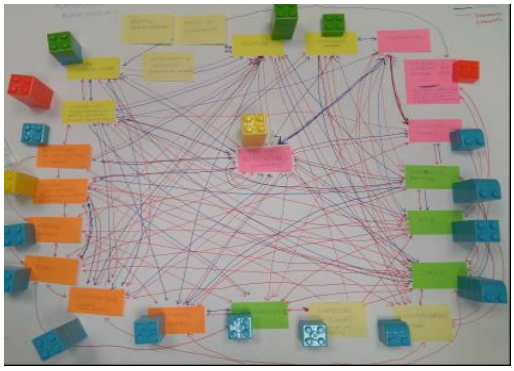
The **tangible goods network** describes the flows of goods and services amongst actors, and includes the supply of machinery, inputs and products, as well as relevant monetary flows for addressing the specific challenge/dilemma in each case study. Edges point towards the beneficiary of the good or service or monetary flow. Financial flows from public support were included when having direct influence on dilemma, such as, e.g. in case of a rural development policy that may help or hinder addressing the dilemma. The standard payments related to market exchanges of goods and services (e.g. payments for the purchase of agricultural inputs and outputs) are beyond the scope of the mapping exercise of tangible goods, and they were not included.

At the end of each interview, together with the notes and comments recorded, researchers developed an interview NET-MAP, that is an overview of the network in place according to each interviewed actor (see Figure 2 for examples).

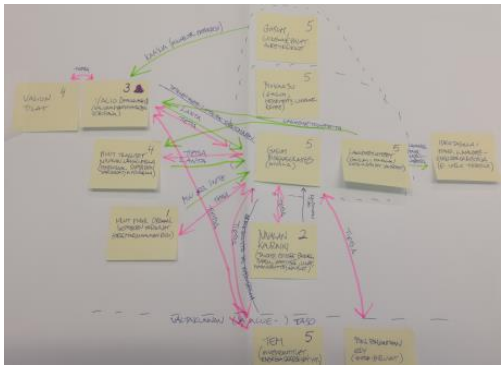
The outputs of such an **interview are a NET-MAP** (Figures 2, 3) which includes all of the identified actors with the influence score, and the links (arrows with one or two directions) between the identified actors representing (by using two different colours): (1) the flows of goods/services; (2) the flows of information/knowledge.

(1) *(2)*





(3) *(4)*



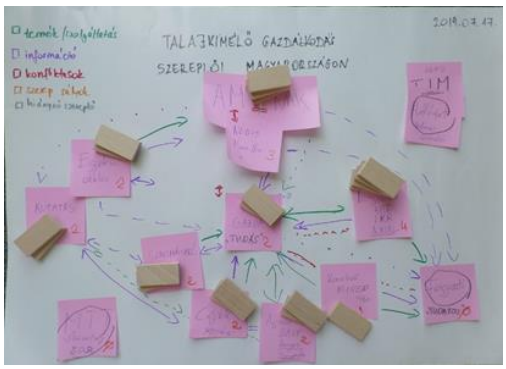


Figure 2. Examples of Interview NET-MAPs (1: DE; 2: ES; 3: FI; 4: HU)

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(1) *(2)*

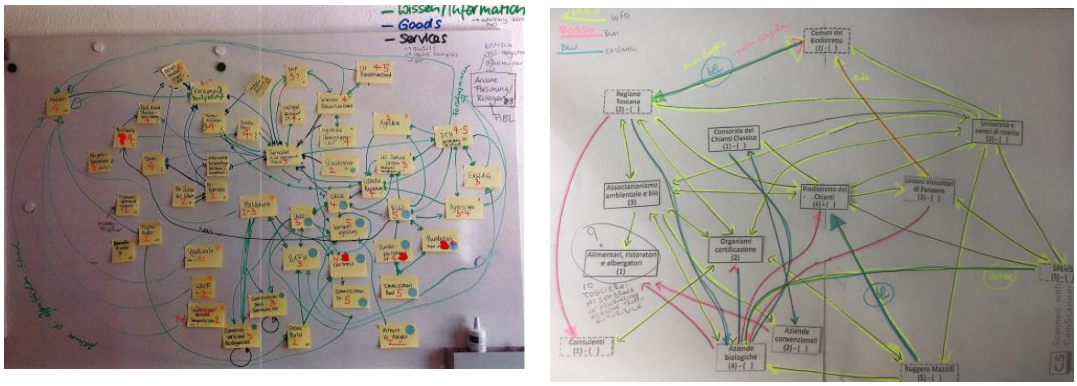

Figure 3. Examples of final case study NET-MAPs (1: CH case study; 2: IT case study)

To allow flexibility based on specific case-study contexts, UNISECO partners could choose between three different approaches to data collection (Table 3), as follows:

- **OPTION 1: individual interviews with at least 3 key actors;**
- **OPTION 2: individual interviews with at least 2 key actors, followed by a workshop;**
- **OPTION 3: individual interviews with at least 7 actors.**

Table 5. Different options for partners to carry out SNA

	OPTION 1	OPTION 2	OPTION 3
Research approach	Individual interviews with at least 3 key actors	Individual interviews with at least 3 actors, followed by one workshop	Individual interviews with at least 7 actors
Participant selection	Identification of key actors	Identification of key actors	Snowball sampling: direct knowledge of experts
Scoring influence of actors	During the interviews	During the interviews and the workshop	During the interviews
Challenges	Bias due to the small number of interviews, aggregation of data collected through interviews in a final NET-MAP	Conducting an effective discussion during the workshop and achieving agreement on the final NET-MAP	Time-consuming, right selection of key actors, aggregation of data collected through interviews in a final NET-MAP
Outcomes	Overview of network patterns and flows, insights on power relations and on social capital	Analysis of network patterns, knowledge flows, coordination and power distribution, insights on social capital Identification of network development strategies, joint learning and common understanding	In-depth analysis of network patterns, knowledge flows, coordination and power distribution, insights on social capital

In **option 1 and 3** the **final NET-MAP** of the case study was obtained after analysis of the information collected through the interviews and a comparison of the different interview NET-MAPs.

Using OPTION 2 the final NET-MAP was co-constructed with the key stakeholders during a workshop. The overall goal of the workshops was the joint development of the final NET-MAP through discussion and

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interactive analysis with selected stakeholders, in order to stimulate co-production of knowledge and joint learning amongst participants.

he Table 4 provides an overview of the 15 case studies with the method used in each case. It can be observed that the data were collected through a total of 79 interviews and 9 workshops in the 15 partners countries.

Table 6. Case studies: overview of data collection methods

Country Code	National Case Studies	Option	Data Collection
AT	ECOREGION KAINDORF	3	8 interviews
CH	INTENSIVE ANIMAL FARMING	3	10 interviews
CZ	DAIRY FARMS	1	4 interviews
DE	DEVELOPING STRATEGIES FOR AGRO-ECOLOGICAL TRANSITIONS IN ARABLE FARMING SYSTEMS	2	4 interviews followed by a workshop
ES	AGRO-ECOLOGICAL FARMING SYSTEMS	3	7 interviews
FI	PLANNING A DAIRY SECTOR DRIVEN BIO-PRODUCT PLANT	3	8 interviews
FR	CONNECTING CUMAs TO FOSTER THE ADOPTION OF AGRO-ECOLOGICAL PRACTICES FOR VITICULTURE	2	7 interviews followed by a workshop
GR	PEACH FRUITS FOR CONSUMPTION AND PROCESSING	2	3 interviews followed by a workshop
HU	SOIL CONSERVATION FARMING	3	11 interviews
IT	CHIANTI BIODISTRICT	2	4 interviews followed by a workshop
LT	SMALL SCALE DAIRY FARMERS AND CHEESEMAKERS	2	3 interviews followed by a workshop
LV	ORGANIC DAIRY FARMING	1	3 interviews
RO	HOTSPOT OF BIODIVERSITY AND HEALTHY FOOD	2	2 interviews followed by a workshop
SE	DIVERSIFICATION OF RUMINANT PRODUCTION	2	1 farmer workshop, 2 individual interviews followed by a workshop
UK	MIXED FARMING AND GENERAL CROPPING	2	3 interviews followed by a workshop

The software used for developing the SNA was UCINET® (Borgatti *et al.*, 2002). Network layouts are based upon a spring embedding algorithm, which defines the relative position of nodes based upon the average shortest path between node pairs and degree: the higher the degree the more central the node. The position of some nodes is adjusted manually to avoid excess superimpositions and improve network visualisation. The analysis is based on complete CS networks, generated by merging the networks for information/knowledge and goods/services, thereby avoiding duplicated links.

In order to identify key actors and to rank them on a based on their contribution towards the challenge, a set of inclusion criteria were applied to the complete actors dataset, including influence scores, as well as centrality measures and boundary-spanning relations. The ranking uses a qualitative three-star scale in which the higher the importance of the actor for the challenge the greater the number of stars. The criteria are as follows:

- Relevant actor: influence score exceeds 3;
- Giver: actor displaying an out-degree/in-degree centrality ratio greater than 1;
- Visible actor: actor displaying an out-degree centrality greater than the median of the Case Study;
- **Influent actor**: the actor should be “Relevant” AND “Visible”; Influent actors are given **two stars**;
- Boundary-spanning relation: the actor should be linked to actors owing to at least two categories other that its own category;
- Gatekeeper: actor displaying a betweenness centrality greater than the median of the Case Study;
- **Broker**: actor with “Boundary-spanning relations” AND “Gatekeeper”; Brokers are given **one star**;
- **Key actor**: “Influent” AND “Broker” actor; Key actors are given **three stars**.

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4. THE CASE STUDIES

This section synthesises SNA outputs per CS, by showing the complete sociogram and providing all actor-level information about the type, number and direction of existing inter-actor flows and provides the complete related NET-MAPs**.** The generated sociograms per mapped flow are available from the complete national reports (Annex).

4.1. AT - Ecoregion Kaindorf

KEY DILEMMA: HOW TO TACKLE IMPACTS FROM CLIMATE CHANGE (E.G., INCREASING WATER STRESS), INCREASE CARBON SEQUESTRATION IN SOILS, PREVENT SOIL DEGRADATION AND REDUCE SOIL FERTILITY LOSS FROM ARABLE LAND WHILE MAINTAINING OR IMPROVING THE FARM'S SOCIAL AND ECONOMIC SUSTAINABILITY AND CONTRIBUTING TO CLIMATE CHANGE MITIGATION.

The "Ökoregion Kaindorf" is located in Eastern Austria (federal state of Styria) where the eastern slopes of the Alps are slipping into the Southeast-Austrian lowlands and hillsides. The background of the initiative is climate change, a certain exposure to periods of water scarcity in recent years and a higher risk in the coming decades as well as declining humus content on arable land. The case study focuses on the "Humus project" of the umbrella organisation *Ökoregion Kaindorf*, which aims at increasing soil fertility and carbon sequestration. The program includes knowledge transfer to farmers (e.g. "Humusakademie"), CO_2 compensation certificates purchased mainly by regional companies, the use of compost and an initiative for biochar, reduction of soil tillage and compulsory greening of arable land, mixed cropping, etc. Experience on increasing soil fertility is exchanged in a group of regulars ("Humus-Stammtisch"). While most activities of the Association *Ökoregion Kaindorf* take place within the region's borders, the farmers involved in the "Humus Project" are spread across the entire north and east of Austria. There are 250 farms participating throughout Austria with 2,500 ha of arable land.

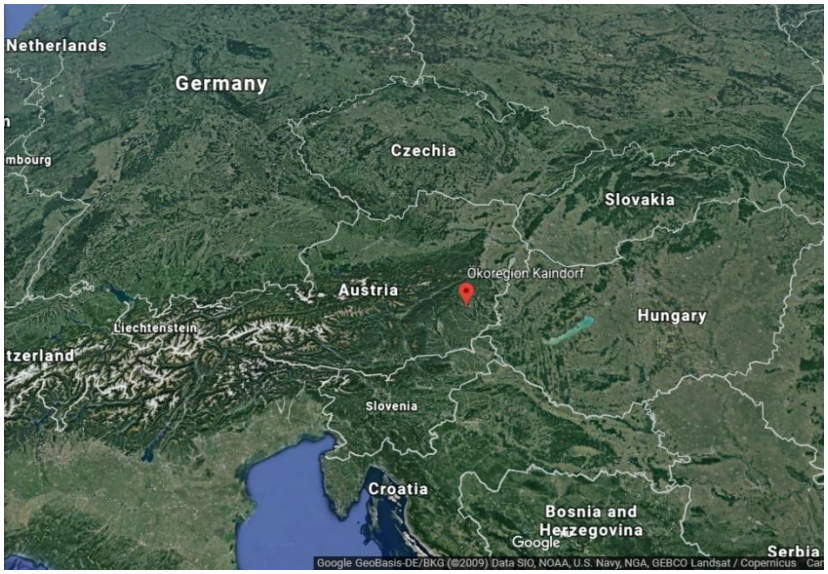

Figure 4. The CS area.

The network is characterized by close cooperation between farmers and a large network of partners from politics, society, consumers, education (schools), business and research. The Association "Ökoregion Kaindorf" plays a crucial role within this network. A trustful collaboration exists between humus farmers, the association Ökoregion Kaindorf, the certificate buyers, local companies as well as the State government of Styria. The most important improvement to address the key challenge and dilemma would be to increase local farmer's participation in the project.

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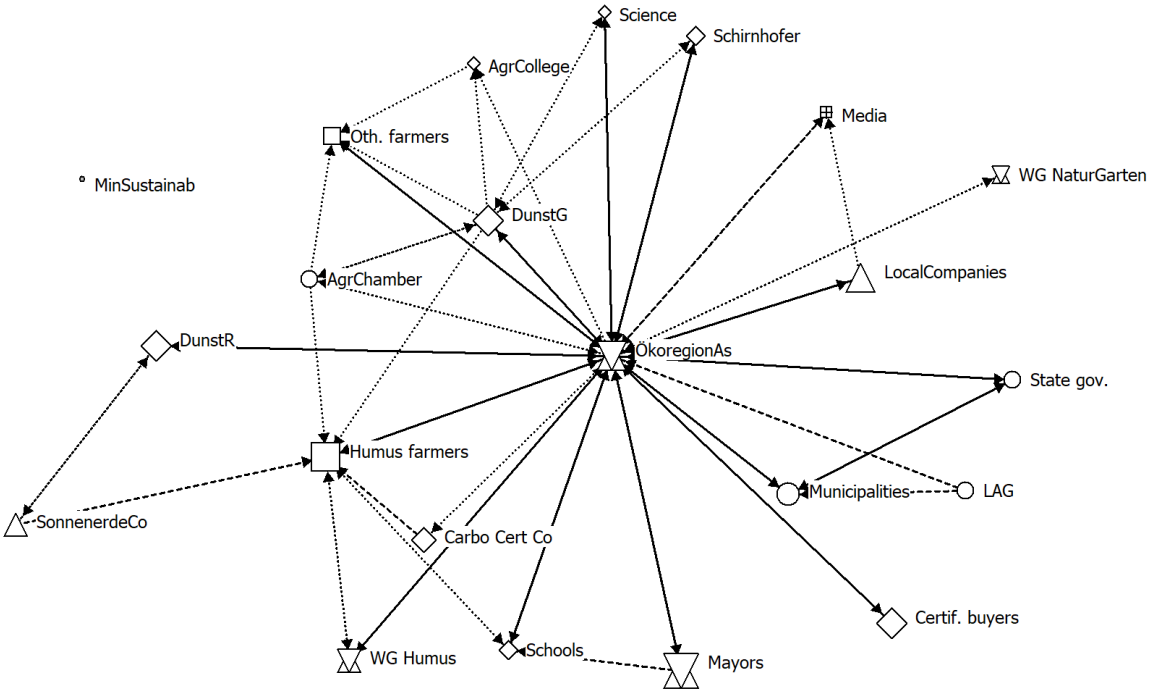

Figure 5. The NET-MAP of AT case study

Table 7. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Centralised	7	0	21	60	0,14	0,95

Table 8. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
WG Humus	3	2	2	G	1	0
WG NaturGarten	2	1	1	I	0	0
AgrCollege	1	1	2	I	2	0
Carbo Cert Co	3	1	1	I&G	2	0
Certif. buyers	4	1	1	I&G	1	0
AgrChamber	2	4	2	I	3	0
DunstG	4	7	4	I&G	3	6,5
Humus farmers	4	3	7	I&G	5	30,5
LAG	2	2	0	G	1	0
LocalCompanies	4	2	1	I&G	2	0
Mayors	5	2	1	I&G	1	0
Media	1	1	2	I&G	2	0
Municipalities	3	2	3	G	1	0,5
Oth. farmers	2	1	4	I&G	2	18
ÖkoregionAs	4	18	17	I&G	5	321
DunstR	4	2	2	I&G	2	26,5
Schirnhofer	2	2	2	I&G	1	0
Schools	2	2	3	I&G	2	0,5
Science	1	2	2	I&G	1	0
SonnenerdeCo	3	2	1	I&G	2	0,5
State gov.	2	2	2	I&G	1	0

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4.2. CH - Intensive animal farming in the Lucerne central lakes region

KEY DILEMMA: HOW TO REDUCE THE HIGH ANIMAL DENSITIES AND AT THE SAME TIME REMAINING PROFITABLE AGAINST THE BACKDROP OF IMPORTANT PATH DEPENDENCIES (BARN CONSTRUCTIONS, DEPTHS, UP- AND DOWNSTREAM MARKET, KNOWLEDGE SYSTEM).

The Swiss case study encompasses the agricultural area in the Lucerne Central Lakes, one of the most intensive pig farming regions in Switzerland as well as in Europe. The detachment of animal numbers from agricultural area causes important environmental problems. The farms buy in a high share of the required fodder and thus create nutrient surpluses (manure). To comply with the nutrient balance required for receiving farm payments, manure is transported to other farms. Emissions from livestock cause different environmental problems. Furthermore, the storage and spreading of liquid manure occasionally result in losses due to leakages, technical failures and wrong application. These so-called „manure accidents" cause important damages to water ecosystems. Finally, the animal husbandry, namely the pig farms produce odour nuisances, which is an issue for neighbours and the local population. Summarising, the central challenge of this case study region is the high animal density, the related emissions and their effects on the environment.

Figure 6. Localisation of the CH case study

It seems that there is a rather general consensus on the need to reduce animal density. The central actors are the farmers. They are connected to the up- and downstream market actors, to the municipality and cantonal actors as well as to actors providing advisory services. To better address the key dilemma, the present network should be improved in different regards: there should be a clearer division between different public offices representing opposing interests. The focus should be less on finding compromises but on the thorough implementation of existing laws. Moreover, the general public, who exerts a high level of influence, should have a more prominent role in the network. There is a lack of communication about the state of the ecosystems and there could be more pressure exerted from environmental NGOs. Moreover, production and consumption are almost completely detached from each other with different actors of the downstream-market controlling the market. There should be a closer connection between farmers and consumers to ensure that consumers get a better idea of how their food products are produced.

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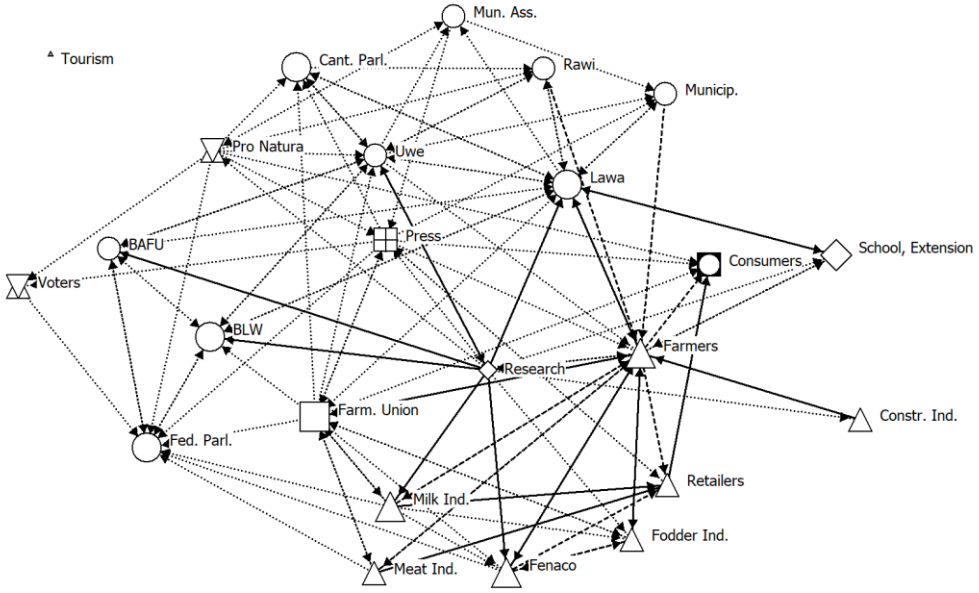

Figure 7. The NET-MAP of CH case study

Table 9. The network

Type of Network	N. categories	N. miss act	N. nodes	N. ties	Density	Connectedness
Decentralised	7	1	23	112	0,22	0,96

Table 10. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Fodder Ind.	3	3	5	I&G	3	1,1
Constr. Ind.	3	1	1	I&G	1	0,0
School, Extension	4	2	3	I&G	2	0,0
Farm. Union	4	12	6	I	4	54,8
Lawa	4	9	10	I&G	3	87,8
Uwe	3	9	8	I&G	4	66,3
Rawi	3	3	4	I&G	2	3,6
Cant. Parl.	4	3	5	I	3	5,7
Farmers	4	10	13	I&G	5	139,3
BLW	4	4	6	I&G	2	23,6
BAFU	3	4	4	I&G	1	20,7
Fed. Parl.	4	2	9	I	4	32,1
Fenaco	4	4	5	I&G	3	2,8
Mun. Ass.	3	3	3	I	2	15,7
Meat Ind.	3	4	2	I&G	2	1,2
Media	3	8	5	I	6	49,8
Milk Ind.	4	6	3	I&G	2	1,8
Municip.	3	2	4	I&G	2	5,2
Research	2	12	2	I&G	4	49,4
Pro Natura	3	8	2	I	3	11,6
Consumers	3	0	5	I&G	4	0,0
Voters	3	1	2	I	2	0,0
Retailers	3	2	5	I&G	2	8,4

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4.3. CZ- Dairy farms in Vysočina region

KEY DILEMMA: HOW TO MAINTAIN THE GOOD PERFORMANCE OF ARABLE LAND MANAGEMENT IN ORGANIC DAIRY FARMS IN VYSOČINA REGION TO REDUCE ARABLE SOIL DEGRADATION AND WATER POLLUTION BY PESTICIDES WHILE ENSURING ECONOMIC VIABILITY

The Czech Republic (CZ) case study is about organic dairy farming (ODF) in the Vysočina Region (NUTS3; figure 1), which faces the challenge of how to balance good farming practices on arable land with economic viability.

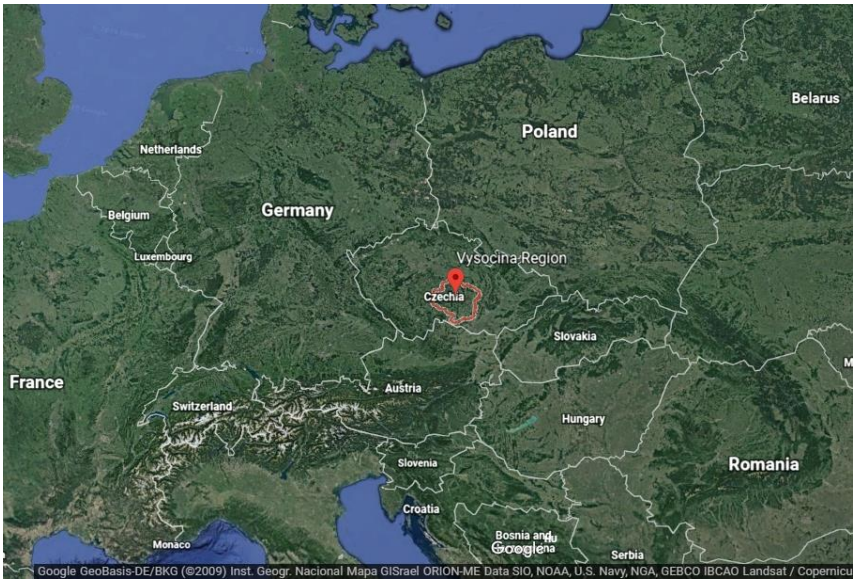

Figure 8. Vysočina Region

Besides the increased soil fertility, major benefits of the adoption of ODF are associated with the improvement of underground water quality, mainly due to the pesticide ban and the replacement of mineral with farmyard fertilizers on arable land. Then, adopting ODF in protection zones for underground water resources could greatly improve the overall performance of dairy farming in CZ, and especially in the CS area, which hosts important freshwater and underground water resources. Dairy farms operating in protection zones have to comply with more restrictive rules for the use of chemical inputs compared to non-protected areas. Adopting ODF may help farmers with rules compliance; however, increasing farmers' motivation to adopt ODF is an issue. Currently, just 1% total milk production is labelled as organic in CZ. Although organic dairy products are one of the most popular categories of organic foods among CZ consumers, the volume of consumption is still small. Moreover, some of the organic goods are still imported by supermarkets from abroad.

With regard to the decision-making mechanisms, all experts agreed that in the Czech Republic, there is relative fixed system from top to down, where the MoA has a dominant position and the change of farming can be enforced either by motivation (subsidies) or by restrictions (regulations, laws and penalties).

It would be possible and probably appropriate to deal the situation/dilemma through greater involvement / better communication of existing actors, complementing the identified missing ones, though (i) greater involvement of actors at local level; (ii) closer communication between organic and conventional farms; (iii) to work more on promotion and sales of organic products.

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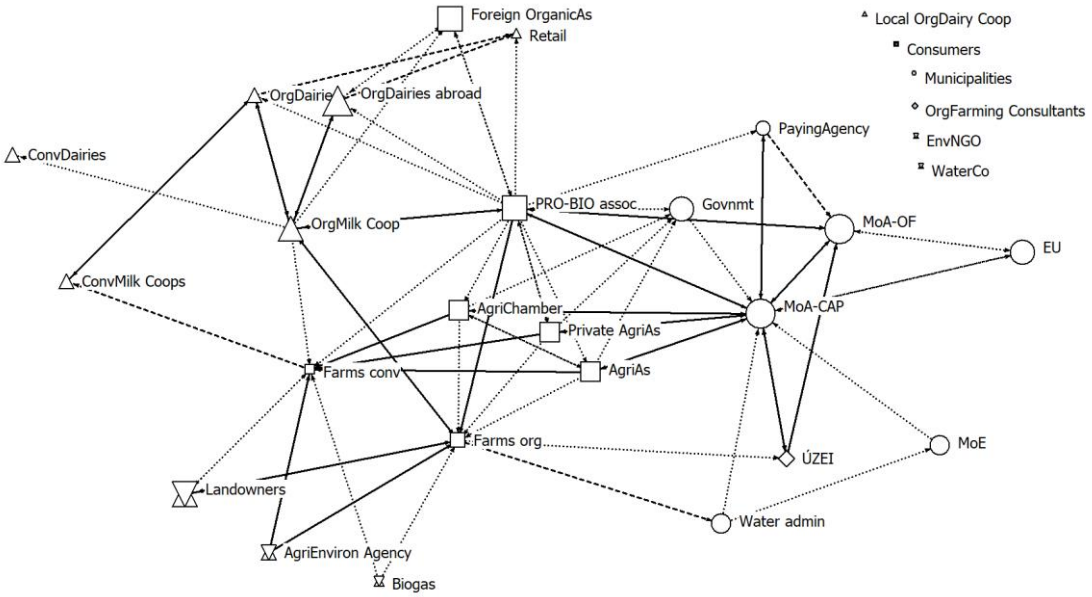

Figure 9. The NET-MAP of CZ case study

Table 11. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Centralised	7	24	6	78	0,14	0,84

Table 12. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Farms conv	1	2	8	I&G	2	26,9
Farms org	2	4	8	I&G	3	118,4
OrgMilk Coop	4	7	4	I&G	1	104,4
ConvMilk Coops	2	1	2	I&G	1	8,9
ConvDairies	2	0	1	I	0	0,0
OrgDairies	2	3	3	I&G	1	31,7
OrgDairies abroad	5	3	3	I&G	1	2,9
PRO-BIO assoc	4	14	5	I&G	2	147,4
MoA-OF	5	3	5	I&G	2	20,6
ÚZEI	2	2	2	I&G	2	17,2
PayingAgency	2	2	2	I&G	1	0,0
Foreign OrganicAs	4	2	3	I	1	4,5
Retail	1	0	3	I&G	1	0,0
AgriAs	3	5	3	I&G	1	9,8
AgriChamber	3	5	3	I&G	1	9,8
Private AgriAs	3	5	2	I&G	1	9,8
MoA-CAP	5	8	11	I&G	2	142,2
EU	4	2	2	I&G	0	0,0
Govnmt	4	1	4	I	1	0,0
MoE	3	1	1	I	1	0,0
Water admin	3	2	1	I&G	1	30,5
Landowners	4	2	2	I&G	1	13,8
Biogas	1	2	0	I	1	0,0
AgriEnviron Agency	2	2	0	I&G	1	0,0

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4.4. DE - Developing strategies for agro-ecological transitions in arable farming systems in Nienburg county, Lower Saxony

KEY CHALLENGE: HOW TO INTEGRATE AGRO-ECOLOGICAL PRACTICES ON ARABLE LAND (CONVENTIONAL AND ORGANIC) IN HIGHLY MARKET-ORIENTED FARMING SYSTEMS TO REDUCE BIODIVERSITY LOSS AND WATER POLLUTION THREATS WITHOUT SIGNIFICANT NEGATIVE IMPACTS ON THE ECONOMIC VIABILITY OF FARMS?

The case study area is an intensive agricultural area with particular sustainability issues regarding biodiversity loss and water pollution threats, and comprises 83,100 hectares and approximately 1,500 farms. The German case study provides an example for the analysis of what is required to initiate a transition process to agro-ecological farming in cases of highly market-oriented farming with relatively low level of agro-ecological innovation. Farmers participate in relevant measures supported under the RDP, but with a relatively low uptake of 'dark green' agri-environmental measures. Therefore, the experience with strong agro-ecological practices such as intercropping, agroforestry and integrated biodiversity is very limited. However, some experience exists with flowering strips and protection strips for wild herps, extensive field margins, cover crops, nutrient management and organic farming. The level of cooperation is relatively low, but multi-actor platforms for biodiversity-friendly farming exist, on which this case study builds.

Figure 10. Localisation of the case study area in Germany

The social network consists of numerous actors. At the centre of the network are the final decision-makers of farm and land management, the farmers. Their decision-making on adopting agro-ecological practices is influenced by the information flow and contractual arrangements with, and rules provided by, the other five types of actors. These include value chain actors from land owners and plant breeders to retailers and consumers, actors providing advice and promoting capacity building, NGOs and local community associations representing environmental concerns and interests of specific groups, and local and regional administration and authorities responsible for the policy implementation and monitoring of policy measures and the legal framework of agricultural land management. In addition, regional media, such as radio stations and local and regional press, have been identified, although with limited influence.

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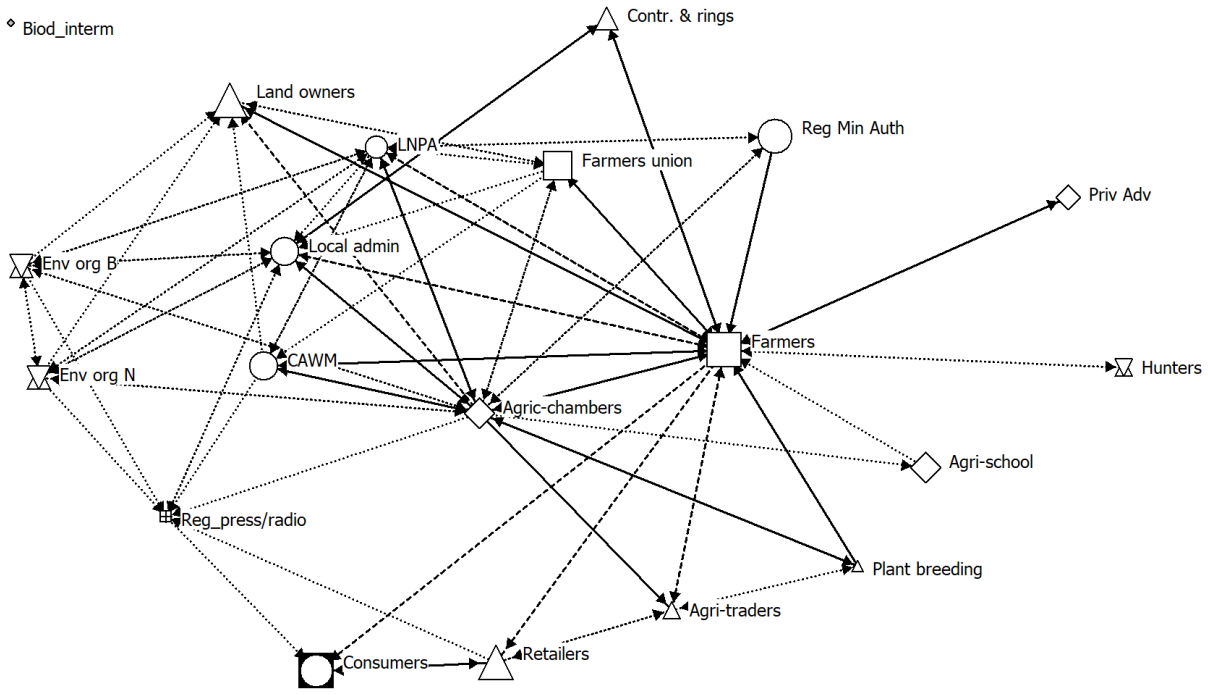

Figure 11. The final NET-MAP of DE case study

Table 13. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	7	1	19	84	0,25	1,00

Table 14. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Farmers	5	12	13	I&G	5	148,4
Land owners	5	2	6	I&G	4	2,8
Farmers union	4	6	4	I&G	3	4,9
Agric-chambers	4	13	9	I&G	5	67,8
Priv Adv	3	1	1	I&G	1	0,0
Consumers	5	1	3	I&G	3	1,7
Retailers	5	3	3	I&G	3	20,0
Agri-traders	2	3	4	I&G	2	25,2
Plant breeding	1	3	2	I&G	2	3,7
Contr. & rings	3	2	2	I&G	2	0,0
Reg Min Auth	5	3	2	I&G	2	0,0
Local admin	4	6	8	I&G	5	37,8
LNPA	3	8	7	I&G	3	17,2
CAWM	4	5	4	I&G	4	2,0
Env org N	3	6	4	I	4	1,4
Env org B	3	6	4	I	4	1,4
Hunters	2	1	1	I	1	0,0
Agri-school	4	1	1	I	1	0,0
Reg_press/radio	1	2	6	I	5	12,9

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.5. ES - Agro-ecological farming systems in the Basque country and Navarra

KEY DILEMMA: HOW TO REDUCE THE FRAGILITY OF AGRO-ECOLOGICAL FARMS WHILE MAINTAINING THE SOCIAL, ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY?

This case study is inspired by the farms that are part of the EHKO association, which is present in the areas of the Basque Country and Navarra. These farms include a wide range of production types, but all of them share the objectives of promoting agro-ecology, being organic systems, with diversification of crops and additional environmental practices, commercialization at local level with short marketing channels, principles of solidarity economy, and being locally based and small sized rural farms. The network focuses on actors that have an influence on reducing the fragility of agro-ecological farms. This is the dilemma that farmers of the case study wanted to address in UNISECO. In this case farmers are already in a farming system redesign and are already at an agro-ecological stage. However, those farms consider themselves as "fragile". Reducing the fragility of agro-ecological farmers is crucial to encourage agro-ecological transition among farmers in conventional farming systems or in the transition pathway.

Figure 12. The CS area. NUTS 2 boundaries in Spain. In yellow, the regions of the Basque Country (left) and Navarra (right). Source: Instituto Geográfico Nacional (IGN, 2019) and Google Earth.

A general system sustainability approach (environmental, social and economic) is addressed by the farmers of the case study. Innovations enabling the transitioning to agro-ecological farming are here not only technological, but also social and institutional. The actors mentioned by stakeholders of the Basque Country and Navarra have been similar in both regions, and even though differences might exist among both areas, the main links and conflicts of the network to address the dilemma are related. Relationships are already established so there is the ability to improve with actions and communication. There are commercial and information relations but forums to work towards common goals are missing.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

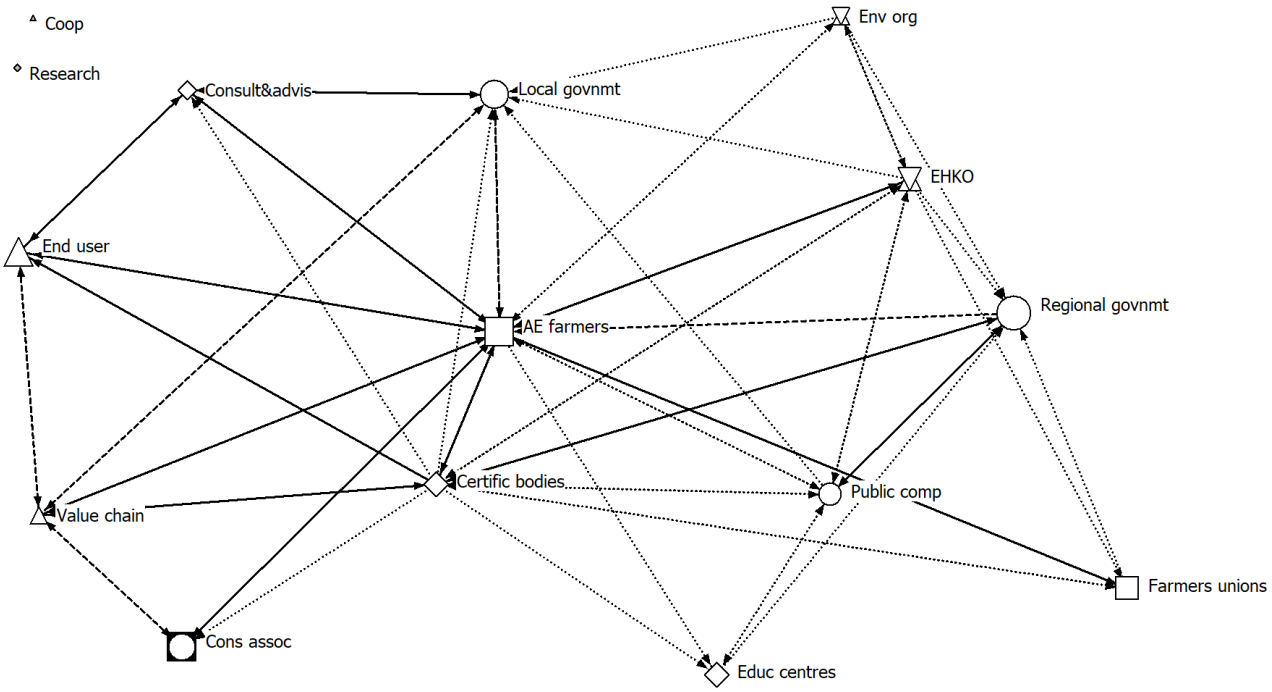

Figure 13. The NET-MAP of ES case study

Table 15. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Distributed	6	2	13	62	0,40	1,00

Table 16. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
AE farmers	4	11	10	I&G	5	52,5
Value chain	2	5	5	I&G	4	4,6
End user	4	3	4	I&G	2	0,6
Cons assoc	4	2	3	I&G	3	0,0
Regional govnmt	5	3	6	I&G	3	5,5
Public comp	3	6	5	I&G	3	8,6
Local govnmt	4	3	7	I&G	4	3,3
Certific bodies	3	11	6	I&G	5	22,8
Consult&advis	2	3	4	I&G	3	0,7
Farmers unions	3	2	3	I&G	3	0,8
EHKO	3	7	4	I&G	3	4,1
Educ centres	3	2	3	I	2	0,8
Env org	2	4	2	I	2	0,8

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.6. FI - Planning a dairy sector driven bio-product plant in Nivala

KEY DILEMMA: HOW TO REDUCE HARMFUL CLIMATE, SOIL AND WATER IMPACTS OF DAIRY FARMING IN NIVALA REGION WITHOUT SACRIFICING ECONOMIC VIABILITY OF THE DAIRY SECTOR, BY MEANS OF ENVISIONING AND IMPLEMENTING A MULTIPURPOSE BIO-PRODUCT PLANT ALONG THE LINES OF CIRCULAR BIOECONOMY, WITH THE AIM OF PRODUCING BIOENERGY AND ORGANIC FERTILIZERS FROM MANURE

This case study involves dairy production on grass silage which is relevant for several EU level sustainability issues (climate change mitigation, nutrient losses, energy saving). The farms are planning to implement circular nutrient flows under the umbrella of a farmers' dairy cooperative providing manure nutrient

The agro-ecological transition of dairy farming in the Nivala region is expected to be catalysed, and eventually realised, by the development of the bio-product plant. The plant is envisioned to serve several functions: the overall aim is to produce bioenergy and organic fertilizers from the manure of dairy farms (and possibly other bio-waste) and to circulate the sustainable energy and fertilizer products back to users without burdening the environment with emissions. The general agro-ecological goal, and ideal consequence, would thus be the reduction of harmful climate, water and soil impacts of dairy farming, without sacrificing the economic viability of the dairy sector.

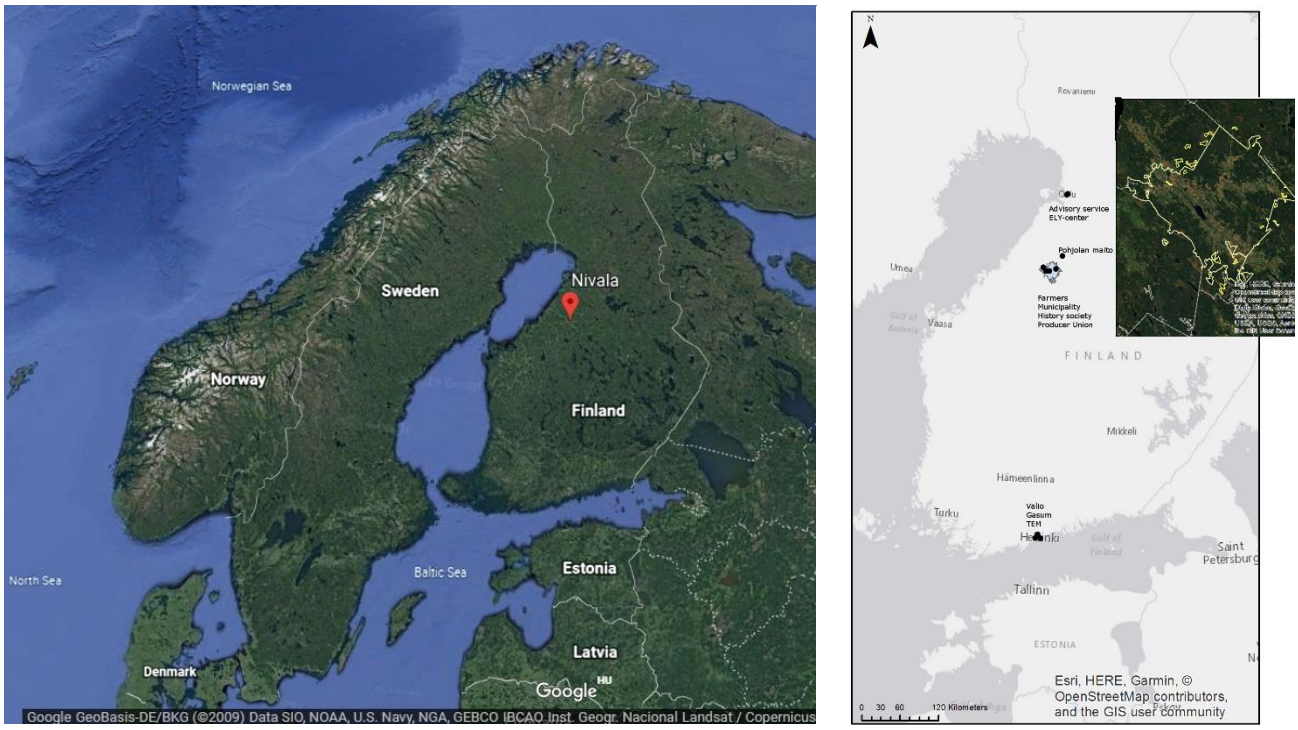

Figure 14. The case study area in Finland

The interactions and relations between various actors in the network are commonly described as functioning rather well; the overall goals of the network are perceived rather similarly by key actors. However, interactions also involve considerable unpredictability and uncertainty, because the network formation is only in its early stage and some important decisions (e.g., concerning investments in the building of the plant) are yet to be made. A critical issue for the network and its management (with regard to the agro-ecological transition via the planning of the bio-product plant) seems to concern the commitment of key actors to the process.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

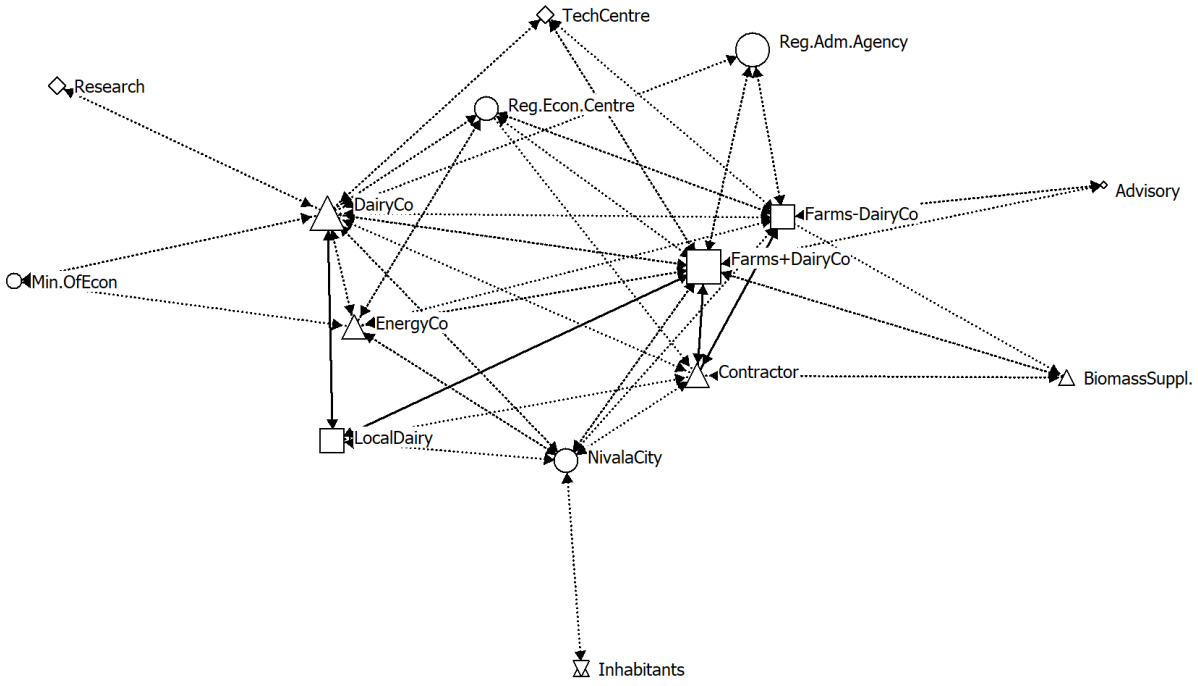

Figure 15. The NET-MAP of FI case study

Table 17. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Distributed	5	0	15	71	0,34	1,00

Table 18. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
EnergyCo	4	6	6	I	2	7,9
DairyCo	5	11	11	I&G	3	55,4
LocalDairy	4	4	3	I&G	2	0,0
Farms+DairyCo	5	10	10	I&G	3	38,3
Farms-DairyCo	4	9	8	I&G	3	23,1
BiomassSuppl.	3	2	3	I	1	0,1
Contractor	4	5	7	I&G	3	6,7
NivalaCity	4	7	7	I	3	28,5
Inhabitants	3	1	1	I	1	0,0
Reg.Econ.Centre	4	5	4	I	2	0,4
Reg.Adm.Agency	5	3	3	I	2	0,2
Min.OfEcon	3	2	2	I	1	0,0
Research	3	1	1	I	1	0,0
Advisory	2	2	2	I	1	0,2
TechCentre	3	3	3	I	2	0,2

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.7. FR - Connecting CUMAs to foster the adoption of agro-ecological practices for viticulture in Auvergne Rhone Alpes

KEY DILEMMA: HOW TO REDUCE DEPENDENCY ON EXTERNAL FERTILISERS AND TO REDUCE PESTICIDES USE (ESPECIALLY GLYPHOSATE) THROUGH AGRO-ECOLOGICAL PRACTICES INCREASING SOIL ECOLOGICAL SERVICES (SOIL BIOLOGY) WHILE MAINTAINING THE ECONOMIC PROFITABILITY OF FARMS?

This case study is a network-based case study involving several French farm machinery cooperatives (CUMAs) aiming at working together. An innovative aspect of the case study is the aim to interconnect different territorial groups. This network is starting. Depending on the area and on individual choices, farmers sell their grapes to cooperatives while other do on-farm wine processing and direct sale. The farming practices are currently rather conventional. Locally some farmers are already implementing agro-ecological practices, but the majority of farmers intend to start implementing agro-ecological practices such as using green manure to reduce external fertiliser use and using combined cropping to reduce pesticides use (wine shrubs and other crops).

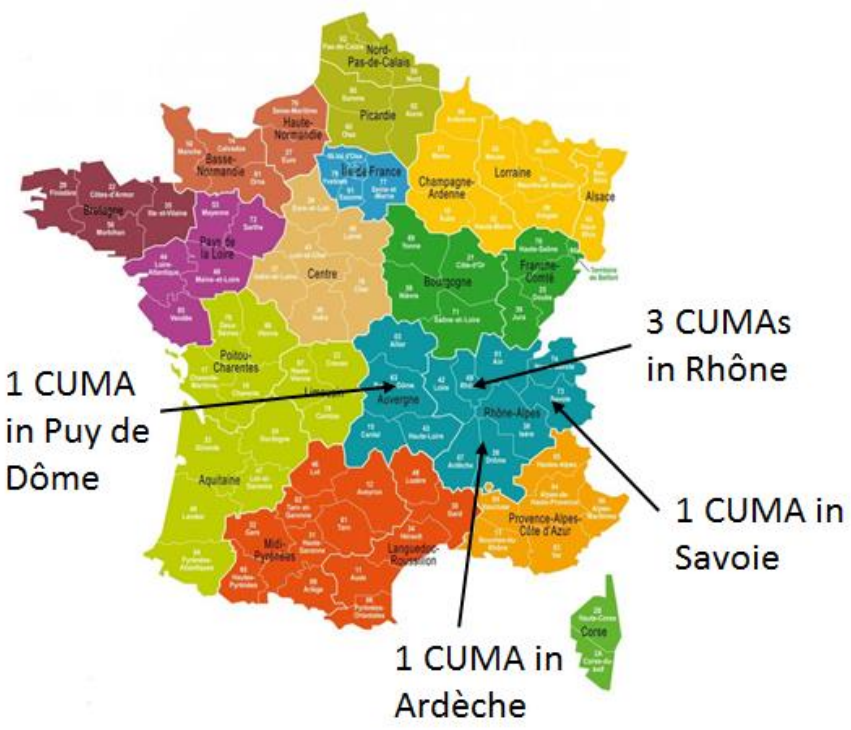

Figure 16. Localisation of the CUMAs being part of the network

The social network is complex with numerous actors. In this complex network, the main controversial matter that we observe concerns the consequences of agro-ecological and environmental practices on agricultural productivity. We face conflicts of interest between agricultural and supply chains actors and other actors, each of those having different priorities and visions.

The decision-making processes are sectorial with some gaps between decisions related to marketing strategies on one side, public support towards agroecology on the other side and finally on the side of local dynamics.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

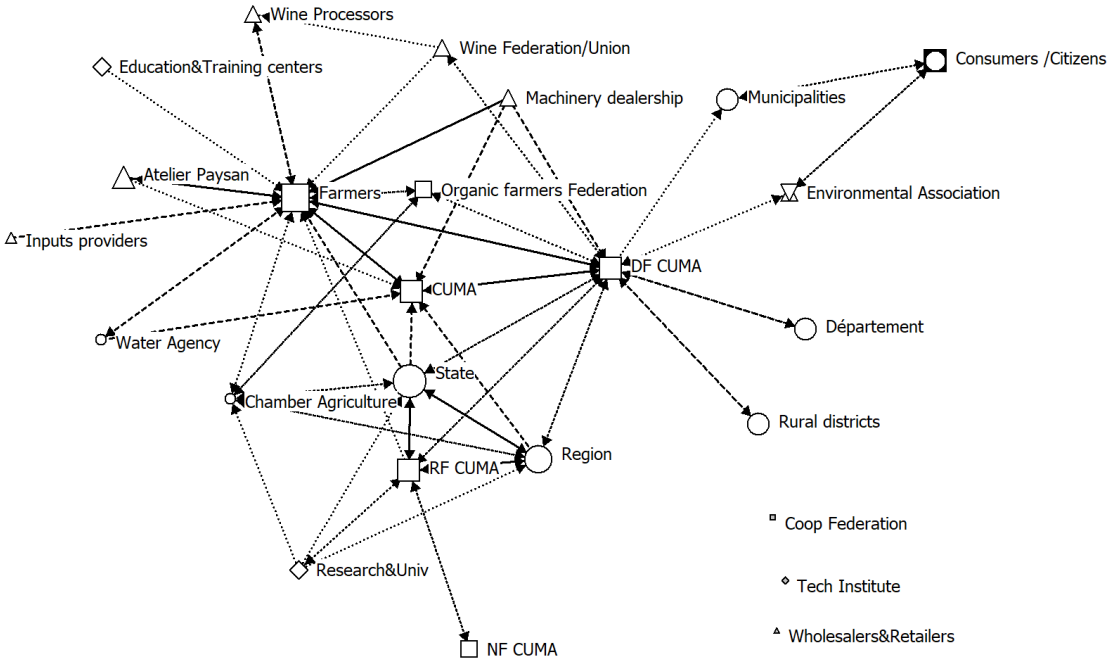

Figure 17. The NET-MAP of FR case study

Table 19. The network

Type of Network	N. categories	N. mis act	N. nodes	N. ties	Density	Connectedness
Centralised	6	1	22	69	0,15	0,86

Table 20. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Municipalities	3	1	2	G	2	9,5
Rural districts	3	1	1	I	1	0,0
Département	3	1	1	I	1	0,0
Region	4	5	5	G	2	8,9
State	5	6	5	G	2	11,0
DF CUMA	3	11	11	I&G	3	223,9
RF CUMA	3	6	5	G	2	60,4
NF CUMA	2	1	1	I&G	0	0,0
Chamber Agriculture	1	4	5	G	2	10,3
Organic farmers Federation	2	3	3	I&G	0	3,3
Consumers /Citizens	3	2	2	G	2	17,5
Wine Federation/Union	2	3	1	I	1	3,2
Wine Processors	2	1	2	I	1	0,0
Inputs providers	1	1	0	I	1	0,0
Research&Univ	2	4	1	G	2	0,5
Education & Training centers	2	1	0	I	1	0,0
CUMA	3	2	7	G	2	12,1
Farmers	4	7	13	I&G	3	128,9
Atelier Paysan	3	2	1	G	2	0,0
Machinery dealership	2	3	0	I	1	0,0
Environmental Association	2	2	2	G	2	41,5
Water Agency	1	2	1	I	1	0,0

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.8. GR - Peach fruits for consumption and processing in Imathia

KEY DILEMMA: HOW TO SUSTAIN THE LONG-TERM ECONOMIC VIABILITY OF FARMS WHILST PROTECTING THE NATURAL RESOURCES? HOW TO PROTECT BIODIVERSITY AND WATER QUALITY IN ORCHARDS WHILST ALSO IMPROVING COMPETITIVENESS AND MARKET ACCESS?

The case study area is located in Imathia, in Northern Greece. The dominant farm production type is permanent crops, fruit orchards, mainly peach trees both for fresh fruit production and canning. An environmental sustainability issue is the high pressure on natural resources due to pesticide use resulting in biodiversity loss and deterioration of water quality. On the other hand, economic sustainability is closely dependent on the production of low to zero pesticide fruit in a highly competitive market environment.

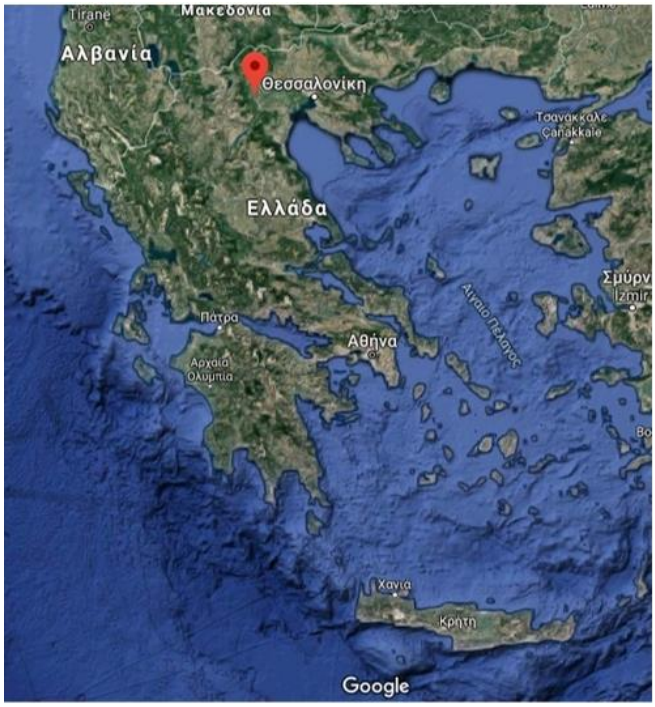

Figure 18. Localisation of GR case study: Imathia

The network was considered weak; thus, it should be restructured and the actors who are involved in should reconsider their attitude towards food quality in order to be competitive in the marketplace. Based on the influence score for each actor, participants seem to agree that the actors who have the highest power to support agro-ecological farming practices producing high quality, competitive goods are the strong agricultural cooperatives along with the agronomists-consultants. Key initiatives are much easier to be adopted by strong and large agricultural cooperatives, run by pioneer leaders who are open to innovation and can motivate and influence others. In general, most of the farmers adopt innovative agricultural practices only if they are convinced for their benefit and understand that the change has a positive impact on their farm. Thus, farmers should be motivated in order to adopt new farming methods and produce in a more sustainable way. For this reason, the role of agronomists-consultants is crucial, as they are the ones who can properly advise farmers, spread the innovation as well as transfer the knowledge.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

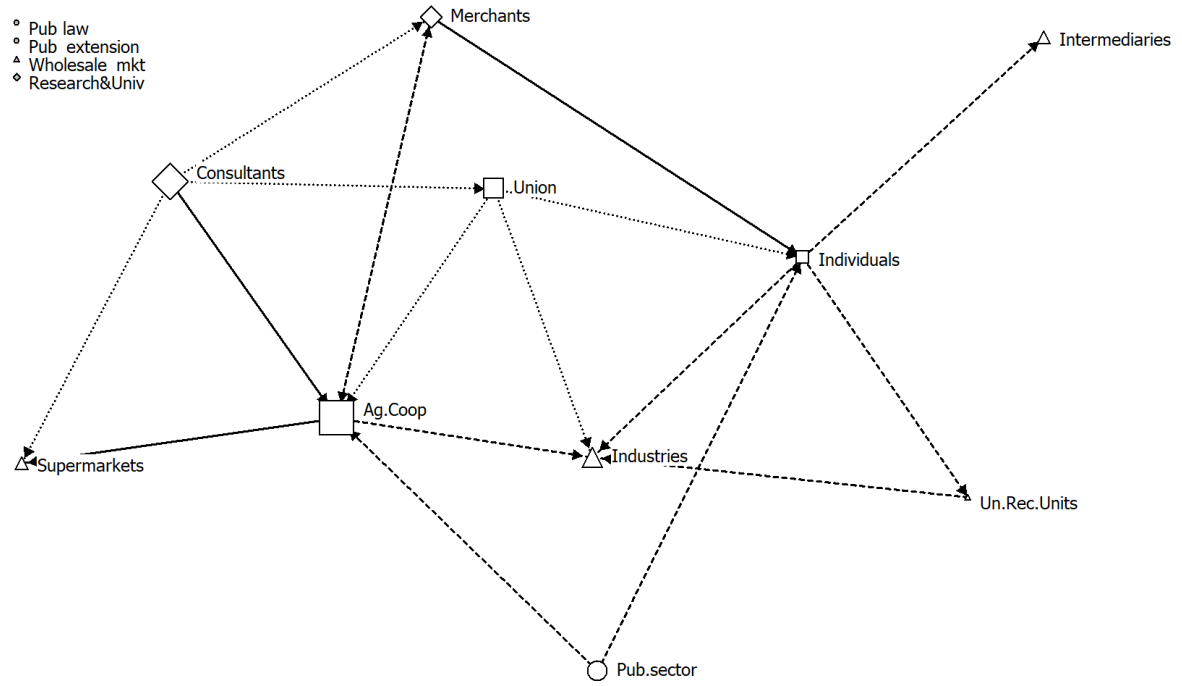

Figure 19. The NET-MAP of GR case study

Table 21. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	4	4	10	18	0,20	0,42

Table 22. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Union	2	3	1	I	2	2,0
Industries	2	0	4	I&G	1	0,0
Un.Rec.Units	0	1	1	G	1	0,0
Ag.Coop	4	3	4	I&G	3	6,5
Individuals	1	3	3	I&G	2	11,0
Intermediaries	1	0	1	G	1	0,0
Consultants	4	4	0	I&G	2	0,0
Merchants	2	2	2	I&G	1	4,5
Supermarkets	1	0	2	I&G	2	0,0
Pub.sector	2	2	0	G	1	0,0

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.9. HU - Soil conservation farming

KEY DILEMMA: HOW TO INTEGRATE AGRO-ECOLOGICAL PRACTICES ON ARABLE LAND IN HIGHLY MARKET-ORIENTED ARABLE FARMING SYSTEMS TO MAINTAIN AND IMPROVE SOIL QUALITY WITHOUT SIGNIFICANT NEGATIVE IMPACTS ON THE ECONOMIC VIABILITY OF FARMS?

This case study explores the network of actors in Hungary related to the topic of soil conservation farming. From a land use perspective of the 9,303 thousand ha total area of the country 5,309 thousand ha is utilized by agriculture of which 4,317 thousand hectares are occupied by arable lands[1] . From an economic perspective: market oriented arable farming systems are dominant. Agro-ecological conditions for crop production in Hungary are generally considered to be good. However, water shortage during the growing season, climate adaptation and, in particular, deterioration of soils poses increasing environmental challenges to farmers.

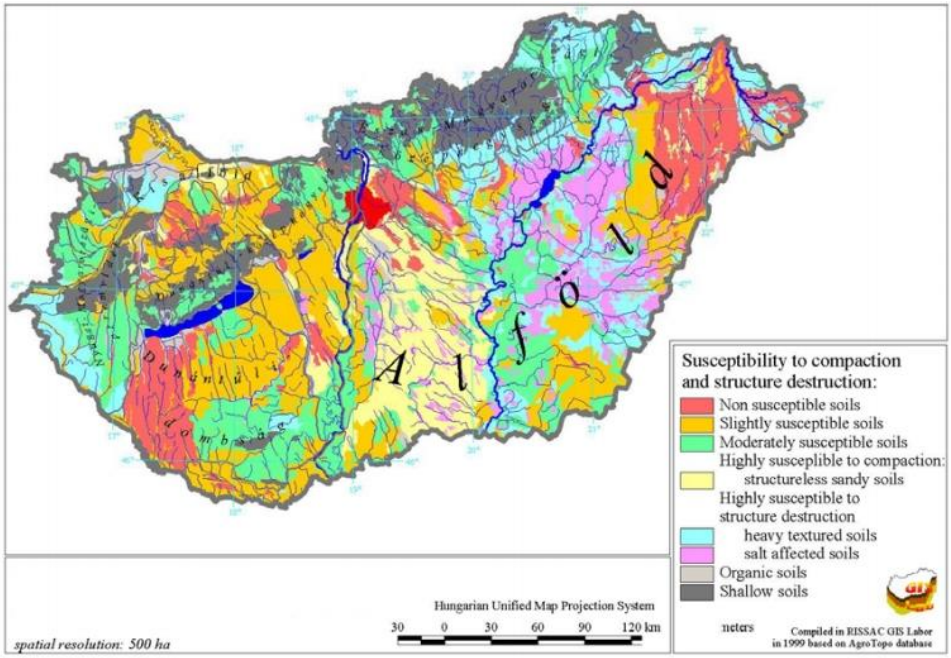

Figure 20. Susceptibility of soils in Hungary[2]

There are some relevant organisations that indirectly are relevant to the topic of soil conservation. This topic is however not explicit on their agendas as they main focus is on other themes. Organic farmers are movements are a specific group somewhat mutually isolated from conventional farmers. Cooperation between NGOs and/or civic society organisations related to the topic of soil conservation is not characteristic neither at a national nor local scale. More cooperation would be needed within and between authorities and science to serve the practical needs of the sector in terms of climate mitigation and preparation for the transition to agroecology in the long run. Lack of skilled agricultural employees with specific knowledge (e.g. precision agriculture) is a big problem. Innovations and digitalisation of the agricultural sector precedes the structure and contents quality of agricultural education both at secondary and higher levels due to old structures in courses and topics, as well as, lack of capital for demonstration and training. Farmers need to be encouraged by the government to participate in research projects. When the research bears immediate benefits (e.g. agrotechnics) to them it is somewhat easier to involve them.

[1] HU Central Statistical Office: Tables (STADAT) - Time series of annual data – Agriculture; Use of land area by land-use categories and by legal forms

[2] Várallyay Gy. Soil Survey and Soil Monitoring in Hungary. EUROPEAN SOIL BUREAU RESEARCH REPORT NO. 9

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

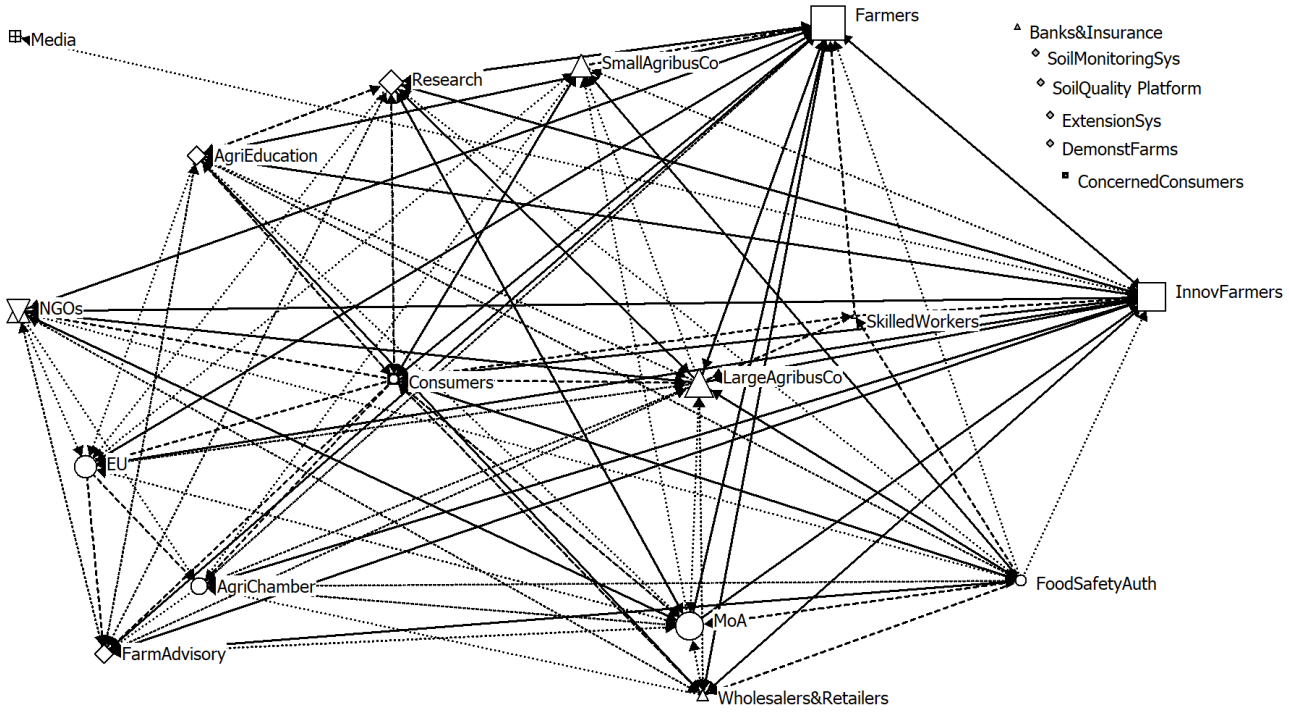

Figure 21. The NET-MAP of HU case study

Table 23. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	7	6	16	135	0,27	0,31

Table 24. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
EU	3	7	8	I&G	5	1,2
MoA	4	12	10	I&G	5	6,0
AgriChamber	2	7	9	I&G	5	1,8
FoodSafetyAuth	1	12	7	I&G	5	8,1
InnovFarmers	4	12	14	I&G	5	26,7
Farmers	5	10	14	I&G	5	11,0
LargeAgribusCo	4	12	13	I&G	5	11,7
SmallAgribusCo	3	3	7	I&G	4	0,7
Wholesalers&Retailers	1	8	8	I&G	5	1,3
SkilledWorkers	0	3	2	G	3	0,0
NGOs	3	9	6	I&G	4	1,4
Research	3	8	8	I&G	4	0,8
AgriEducation	2	10	9	I&G	4	2,2
FarmAdvisory	2	8	11	I&G	5	3,4
Consumers	1	14	8	I&G	5	14,6
Media	1	0	1	I	1	0,0

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.10. IT - Chianti Biodistrict

KEY DILEMMA: HOW TO PROMOTE CROPPING SYSTEM DIVERSIFICATION IN A HIGHLY SPECIALISED AND MARKET-ORIENTED WINEGROWING AREA VIA THE ADOPTION OF AGRO-ECOLOGICAL PRACTICES, TO INCREASE BIODIVERSITY AND IMPROVE LANDSCAPE MANAGEMENT WHILE MAINTAINING THE PROFITABILITY OF FARMING THROUGH LOCAL VALUE CHAINS.

The CS area and Chianti Biodistrict (BD) share the geographical boundaries. A biodistrict is a geographical area where farmers, citizens, tourist operators, associations and public authorities formalise an agreement for the sustainable management of local resources, based on production and consumption of organic food. In Chianti area, in Tuscany, the creation of the BD allowed the adoption and diffusion of key agro-ecological practices in winegrowing, such as e.g., inter-row grassing, selection of local varieties, maintenance of semi-natural features, as well as the use of organic fertilisers and pesticides and green manure, among others. Despite that, the CS faces the critical challenge of increasing the diversification of the cropping system, to increase biodiversity and improve landscape quality. A possible way towards addressing this challenge is supporting the revitalisation of under-utilised agricultural areas, notably via the restoration of abandoned olive groves, the recovery of arable cropping and pasture land, and the development of the related local value chains. The latter could also increase the resilience of the local farming system, by reducing the dependence on the export of a single product, i.e. wine.

Figure 22. Chianti area in Tuscany

The network of actors involved in the key dilemma in this case study is under development, since the BD is still in the process of developing and extending the information and knowledge connections for the main actions relevant for the key dilemma. At the same time the existence of the BD and the promotion of an innovative governance model make the CS an interesting example of transition towards an agro-ecological farming system, since the overall, objective is to re-design the local food system by decreasing the external inputs and increasing the provision of ecosystem services.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

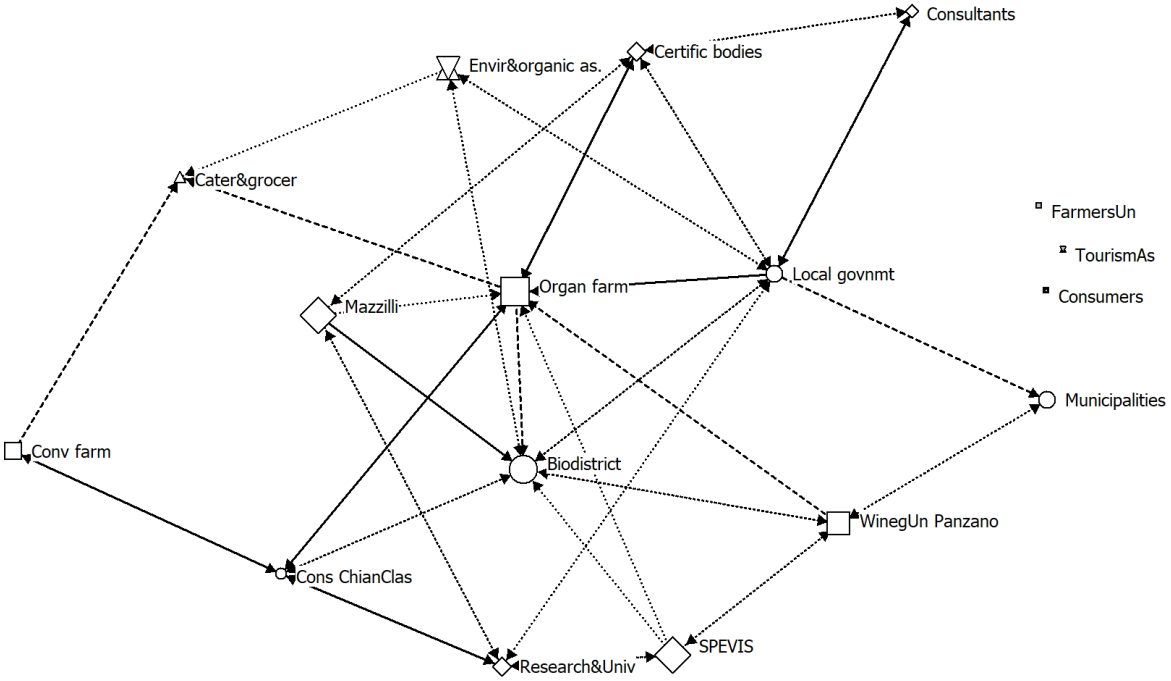

Figure 23. The NET-MAP of IT case study

Table 25. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	6	3	14	47	0,26	0,93

Table 26. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Municipalities	2	1	2	I&G	1	1,3
Local govnmt	2	7	5	I&G	3	33,1
Biodistrict	4	4	7	I&G	3	30,1
Cons ChianClas	1	4	4	I&G	2	25,5
WinegUn Panzano	3	4	3	I&G	2	17,1
Research&Univ	2	4	4	I&G	1	18,9
Organ farm	4	4	6	I&G	4	22,9
Conv farm	2	2	1	I&G	2	0,7
SPEVIS	5	4	2	I	2	4,7
Mazzilli	5	4	2	I&G	2	2,8
Consultants	1	2	2	I&G	1	0,0
Envir&organic as.	3	3	2	I	2	2,0
Certific bodies	2	4	4	I&G	2	11,1
Cater&grocer	1	0	3	I&G	3	0,0

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.11. LT - Small scale dairy farmers and cheesemakers

KEY DILEMMA: HOW TO MAINTAIN AND ENCOURAGE EXTENSIVE MANAGEMENT (GRAZING) OF GRASSLAND HABITATS? HOW TO BECOME (OR REMAIN) COMPETITIVE IN THE MARKET WITHOUT INTENSIFYING THE FARMING PRACTICE?

Dairy sector in Lithuania comprises of raw dairy producers, middle-men that collect milk from producers (around 60 companies) and over 20 dairy processing companies with 5 of them accounting for around 95% of production. The number of farms has sharply declined from ~165 thousand in 2005 to ~25 thousand in 2017 while the average farm size has increased from 2.7 cows in 2005 to approximately 9 cows per farm as of 2018. This decline represents small farms mainly. The increasing of the farm size has its typical associated drawbacks related to intensification and ecological pressures as well as changing farming practices from grazing to growing fodder for cattle kept indoors in larger farms. Milk producers that are of major interest to the investigation not only produce raw dairy but also further production, namely cheese or other products and are involved in direct selling their own produce. This group is chosen as a good example of improving value chain. In these farms, not only cows are kept for dairy production but also sheep, goats. The artisan cheese products are becoming more and more popular in the market. Besides growth of the direct selling market, there is a possibility to grow the market by selling these products in restaurants and street food producers. Several barriers that would need to be overcome in order to improve the conditions for the extensive dairy farms and address the dilemma were identified: (i) there is a lack of stable and continuous agricultural policy, strong vision, strategic goals and concrete plans to address the issues of and support the development of agroecology; (ii) there is a need for stronger and more influential representation of the interests of the extensive dairy farms and sustainable agriculture (agroecology); (iii) there is a need to strengthen formal and informal forms of cooperation among farmers. Network currently addresses the dilemma to a small degree only – in a form of market and several policy initiatives. Discussions regarding sustainable farming and new policy/market incentives are taking place more in recent years and even more with new CAP developments with some potential changes in the future. However, there is an urgent need for more favourable policy for extensive dairy farming practices, since environmental conditions during the last two years, on top of socio-economic situation have been the cause of number of small farms declining at unprecedented rates.

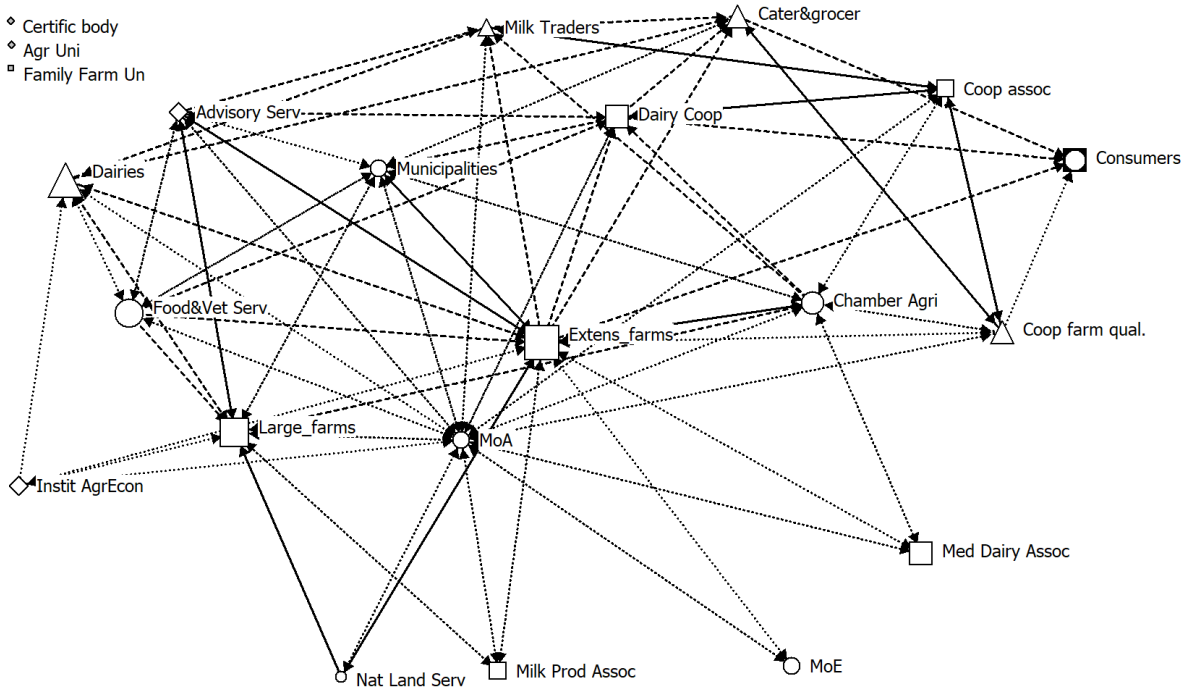

Figure 24. The NET-MAP of LT case study

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

Table 27. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Distributed	4	3	19	105	0,31	0,95

Table 28. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Dairies	5	5	6	I&G	3	6,8
Extens_farms	5	13	11	I&G	4	66,0
Large_farms	4	5	9	I&G	3	6,8
Milk Prod Assoc	2	3	3	I	1	1,2
Nat Land Serv	1	3	1	I&G	1	0,2
Food&Vet Serv	4	7	4	I&G	3	1,9
Municipalities	2	7	8	I&G	3	17,8
Chamber Agri	3	9	6	I&G	2	9,4
Cater&grocer	3	3	6	I&G	4	4,4
Instit AgrEcon	2	4	1	I	3	0,3
Med Dairy Assoc	3	3	3	I	2	0,4
MoE	2	2	2	I	1	0,4
Dairy Coop	3	5	6	I&G	4	5,4
Milk Traders	2	4	5	I&G	3	2,7
MoA	2	14	15	I	3	93,2
Advisory Serv	2	7	5	I&G	3	3,9
Consumers	3	0	4	G	2	0,0
Coop farm qual.	3	6	5	I&G	3	10,0
Coop assoc	2	5	5	I&G	2	3,2

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4.12. LV - Organic dairy farming

KEY DILEMMA: HOW TO INCREASE THE ECONOMIC VIABILITY OF CONVENTIONAL AND ORGANIC, LARGELY GRASS-BASED, DAIRY FARMS WHILE PRESERVING BIODIVERSITY IN GRASSLANDS AND WATER RESOURCE QUALITY? HOW TO ENSURE THAT ALL ORGANIC MILK IS PROCESSED INTO ORGANIC DAIRY PRODUCTS?

Dairy sector productivity is increasing, but remains comparatively low due to the fragmented small-scale farming structure. Fragmentation results in weak position of producers in the milk food chain (dominated by big processors and retail chains), and overly high competition in the processing sector - Latvian dairies have excess processing capacity. Although Latvian farmers produce enough milk for local consumption, 40% of milk sold in Latvia is imported due to the regional nature of the dairy market with Estonia and Lithuania. Domestic dairy product consumption is stable although organic dairy product consumption remains low.

The dilemma being considered in the case study is related to the fact that although approximately 10% of milk produced in Latvia is organic only 38% is processed into organic dairy products.

The case study is relevant to the transition to agro-ecology in Latvia from the perspective of strengthening and expanding cooperation between relevant actors in the supply chain. To date, farmers have demonstrated good uptake of agro-ecological farming practices. The number of certified organic dairy farming operations has steadily increased and the share of organic milk production has grown. The supply of organic milk has outpaced dairy product production with the resulting dilemma that more than half of the organic milk being processed with conventional milk. This has occurred due to slow growth in consumer demand for organic dairy products. To ensure that existing organic dairy farms remain in operation and conventional farmers continue to transition to organic farming, it is recognized that there is a need to more fully involve all relevant supply chain actors in the process of growing support for organic dairy product consumption and production.

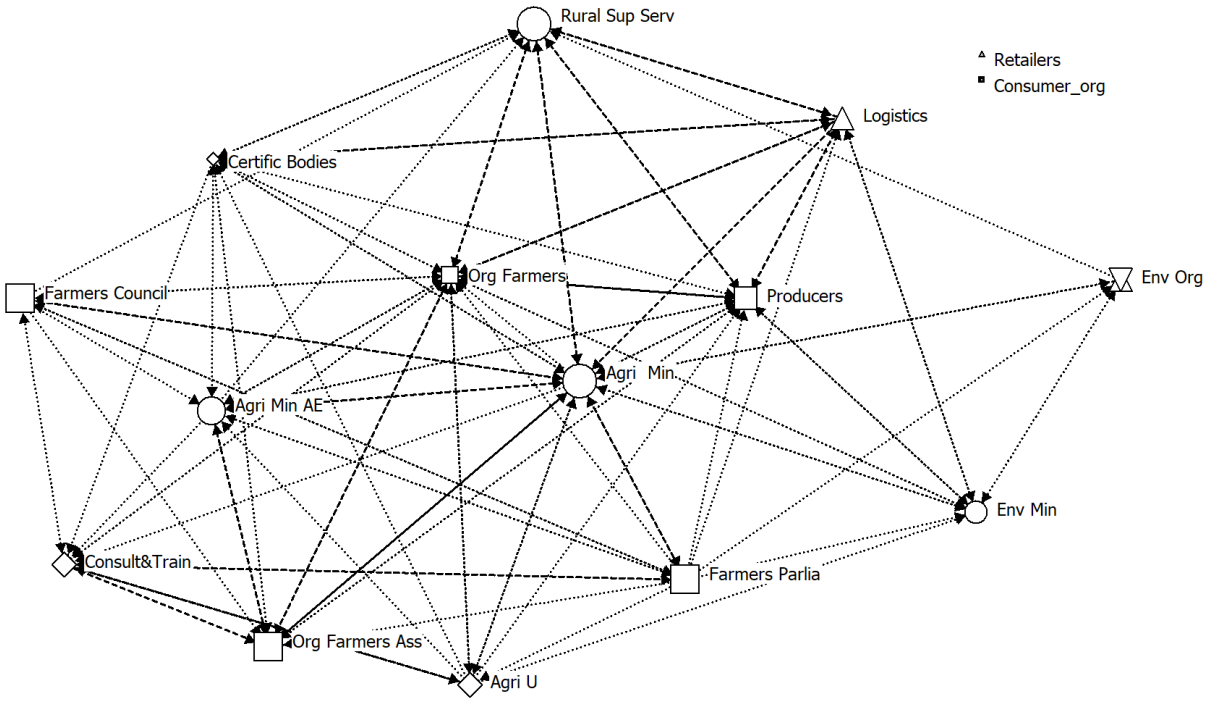

Figure 25. The NET-MAP of LV case study

Table 29. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

Distributed	5	2	14	100	0,55	1,00

Table 30. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Agri Min	5	12	11	I&G	4	30,5
Rural Sup Serv	5	5	8	I&G	4	2,8
Agri Min AE	4	8	8	I&G	3	3,8
Certific Bodies	1	8	8	I&G	3	3,8
Consult&Train	3	5	7	I&G	2	2,9
Env Min	3	5	7	I&G	5	4,2
Agri U	3	7	4	I&G	3	1,6
Farmers Council	4	7	4	I&G	2	1,5
Farmers Parlia	4	11	4	I&G	4	5,7
Org Farmers Ass	4	5	8	I&G	3	1,7
Env Org	3	3	3	I	2	0,3
Producers	3	8	10	I&G	3	5,1
Logistics	3	6	6	I&G	3	1,3
Org Farmers	2	10	12	I&G	3	16,6

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773901.

4.13. RO - Hotspot of biodiversity and healthy food in Transylvania area

KEY DILEMMA: HOW TO INCREASE THE ECONOMIC VIABILITY OF SMALL- SCALE FARMING WHILE PRESERVING THE CULTURAL LANDSCAPE AND BIODIVERSITY?

Case study in Romania will focus on Transylvania Highlands, an area characterised by fragmented agricultural landscape, mosaic patches of semi natural grasslands created and maintained by traditional livestock grazing systems: cattle and sheep, small plots of cultivated land with rather low intensity/extensive management. The high biodiversity in Transylvania is tightly linked to the structural diversity and the specific management practices that can be found in that landscape. However, like many cultural landscapes, Transylvania is changing rapidly, which poses a range of challenges for sustainability in general, as well as for biodiversity conservation in particular. The traditional landscape is dependent on continued traditional management by small-scale farming communities, and on cattle farming to maintain hay meadows. As long as traditional management provides decent local incomes, incentives will maintain the management and the farmers will preserve the habitats and associated species, as they have done for centuries.

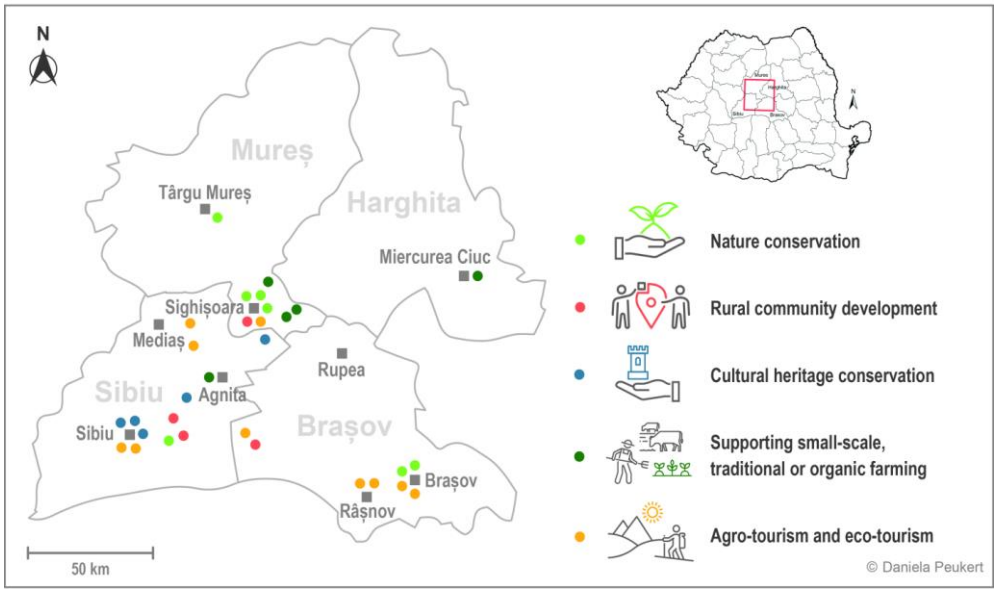

Figure 26. The CS area

Trust and collaboration are very weak in the region due to the social trauma left by the nationalized, collective agricultural system imposed by the communist regime. Associations exist, but in low numbers and they have been founded only to be able to comply with eligibility criteria in accessing agricultural subsidies through CAP; cooperatives, which could be regarded as an "upgrade" to associations, are missing. Due to this unwillingness to develop economic activities together, farmers are stuck in a regime of low productivity, with no means to add value to their raw agricultural output and create or access the market, and representing the weakest player in the supply chain.

All actors pinpointed on the network map have a role to play in the future too, in order to overcome the mentioned barriers and weakness chains, but efforts need to be intensified and the governance and public information systems have to be greatly improved. Missing actors listed in the table above also need to become part of this network to perform on the needs that others cannot cover, and which influence the transition to a competitive/economically sustainable agro-ecology paradigm.

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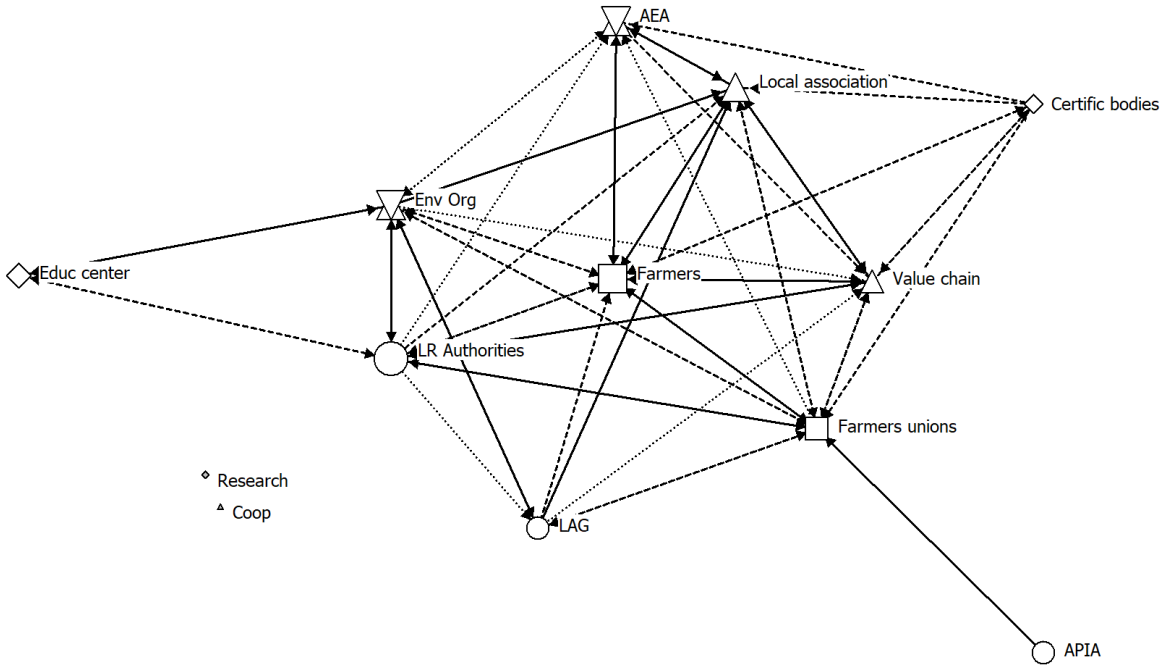

Figure 27. The NET-MAP of RO case study

Table 31. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Distributed	5	2	11	56	0,51	0,91

Table 32. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Farmers	4	7	8	I&G	4	7,6
Value chain	3	5	8	I&G	4	5,8
Local assoc	4	4	8	I&G	4	0,7
APIA	3	1	0	I&G	1	0,0
LR authorities	5	8	5	I&G	4	8,4
LAG	3	5	3	I&G	3	0,0
Certific bodies	2	5	2	G	3	0,2
Farmers unions	3	7	8	I&G	4	14,9
AEA	4	4	6	I&G	4	1,0
Educ centres	3	2	2	I&G	2	0,0
Env org	4	8	6	I&G	4	10,4

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4.14. SE - Diversification of ruminant production

KEY DILEMMA: WHAT ARE THE CHALLENGES AND POSSIBILITIES TO DIVERSIFY SPECIALISED RUMINANT FARMS (CONVENTIONAL AND ORGANIC) TO INCLUDE MORE CROPS FOR DIRECT HUMAN CONSUMPTION WHILE SIMULTANEOUSLY INTEGRATING MORE AGRO-ECOLOGICAL PRINCIPLES TO ENHANCE SUSTAINABILITY PERFORMANCE IN AN ECONOMICALLY STRAINED PRODUCTION SECTOR?

Swedish agriculture needs to move towards less environmentally impacting farming systems with a higher integration of livestock and crop production, and towards producing more crops for direct human consumption and less livestock. Considering this, a desired path for current livestock farms would be to instead of increasing animal numbers, reach profitability by diversifying their productions towards including more crops for direct human consumption. There is no general shortage of cropland in Sweden limiting this development and there is certain, and potentially growing, consumer demand for Swedish plant-based products. There are, however, a range of other challenges for diversified livestock production, including climatic restraints, limited sales and investment opportunities, as well as a low level of cooperation. The Swedish case study aims to increase understanding of these limiting factors and how they can be overcome.

The issue of diversifying livestock farms includes many important actors with many links between them. Although diversification of farms is central to agro-ecology and has been discussed substantially, few projects or initiatives have previously dealt with this topic in depth and from a systems perspective, at least not with the focus on increasing the production of plant-based foods. There is therefore currently no established network related to this key dilemma that could be easily described. To successfully overcome the main obstacles, several actors have to work together, and policies have to be directed to support this transition. There is a need of political leadership to shape a coherent and supportive policy environment to steer developments in the desired direction. This includes increased support to holistic extension services, investment in research and needed processing facilities and infrastructure. The awareness among consumers have to be also increased and further development of alternative sales channels where consumers more closely meet farmers. In addition, food environments (including pricing of food) in which the more sustainable choices are the easy ones needs to be established.

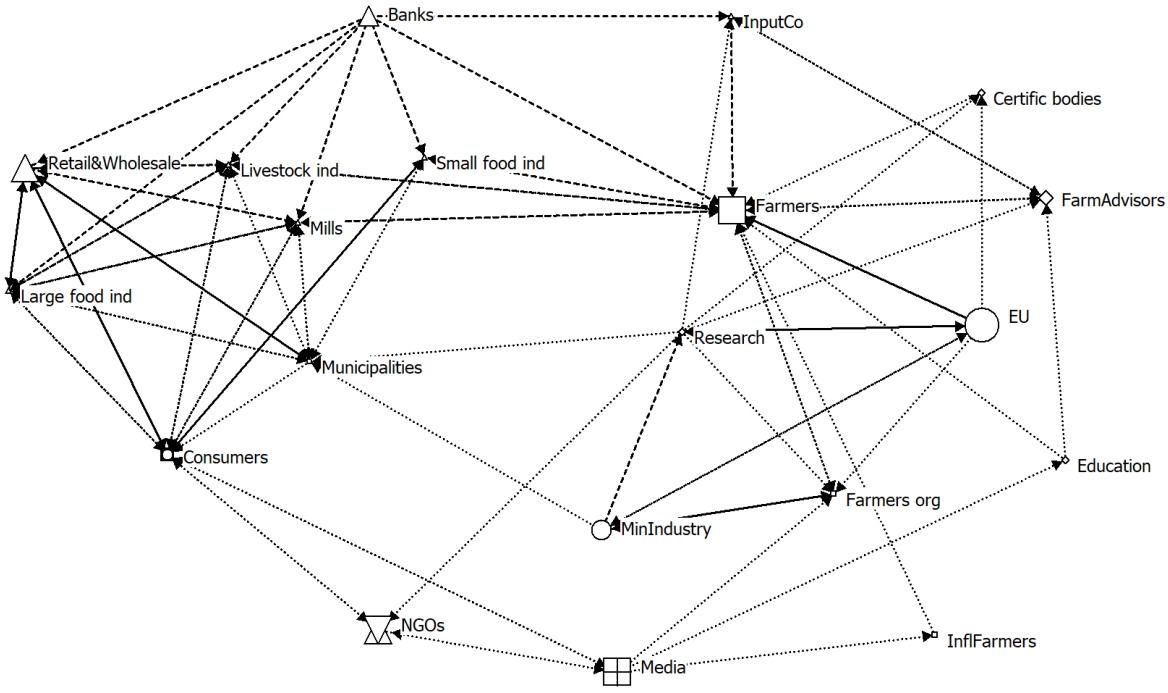

Figure 28. The NET-MAP of SE case study

Table 33. The network

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Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	7	0	20	81	0,21	0,95

Table 34. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Farmers	4	5	11	I&G	3	140,5
InflFarmers	1	1	1	I	1	0,5
FarmAdvisors	2	2	4	I	2	13,7
Education	1	2	1	I	2	5,0
Farmers org	1	2	5	I&G	3	64,9
Certific bodies	1	1	2	I	2	0,2
EU	5	5	2	I&G	2	9,7
MinIndustry	3	4	2	I&G	2	56,0
Research	1	7	2	I&G	3	21,9
InputCo	1	2	3	I&G	2	0,7
Municipalities	1	6	7	I&G	3	19,6
Large food ind	1	5	6	I&G	2	2,2
Small food ind	1	3	4	I&G	3	17,4
Retail&Wholesale	4	5	6	I&G	2	2,2
Livestock ind	1	5	6	I&G	3	30,9
Mills	1	5	6	I&G	3	30,9
Banks	3	7	0	G	2	0,0
NGOs	4	2	3	I	3	8,8
Consumers	2	7	8	I&G	4	74,6
Media	4	5	2	I	4	53,6

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4.15. UK - Mixed farming and general cropping in north-east Scotland

KEY DILEMMA: PRODUCING PUBLIC GOODS WHILST MAINTAINING VIABLE PRODUCTION OF PRIVATE GOODS, AND SECURING ECONOMIC AND SOCIAL SUSTAINABILITY AT A FARM LEVEL

The case study represents sustainability issues relevant to the EU (soil degradation, climate change adaptation, animal welfare, environment pollution by pesticides). The farming production systems represented by this case study are relevant across the EU (i.e. mixed farming and general cropping). The agro-ecological farming practices used to address the sustainability issues are, for example: biodiversity support practices, nutrient budgeting, organic farming, permaculture and agroforestry. Farming contributes significantly to the attractiveness of Scottish landscape, evidence of which is recorded in surveys of visitors and their annual expenditure in the region. There is a strong tradition of cooperation between farmers (e.g. machinery rings for mixed farming and general cropping). An example of an innovative policy is the Knowledge Transfer and Innovation Fund, supporting initiatives including environmental performance. The case study will provide an example of a process of transformation in its initial stage. The size of the case study area is is 291,826 hectares with 4,366 farms.

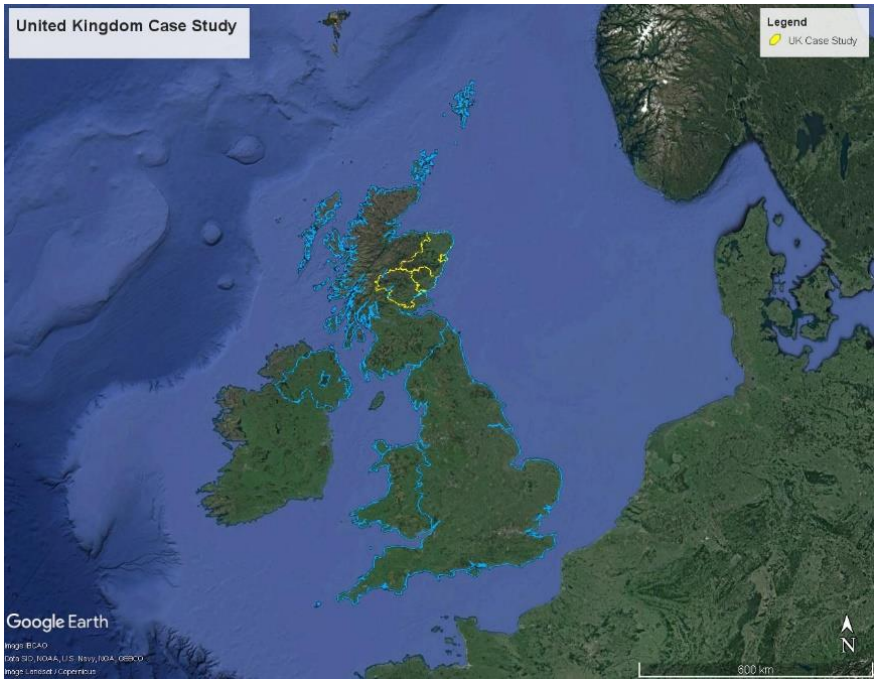

Figure 29. The United Kingdom Case Study Area.

The network as a whole is subject to external drivers and pressures (i.e. political, economic, social). It operates in an open economy, with significant national and international exports into agri-food markets, and the area is one with a significant number of tourists and migrant workers attracted to the area for its economic and environmental benefits.

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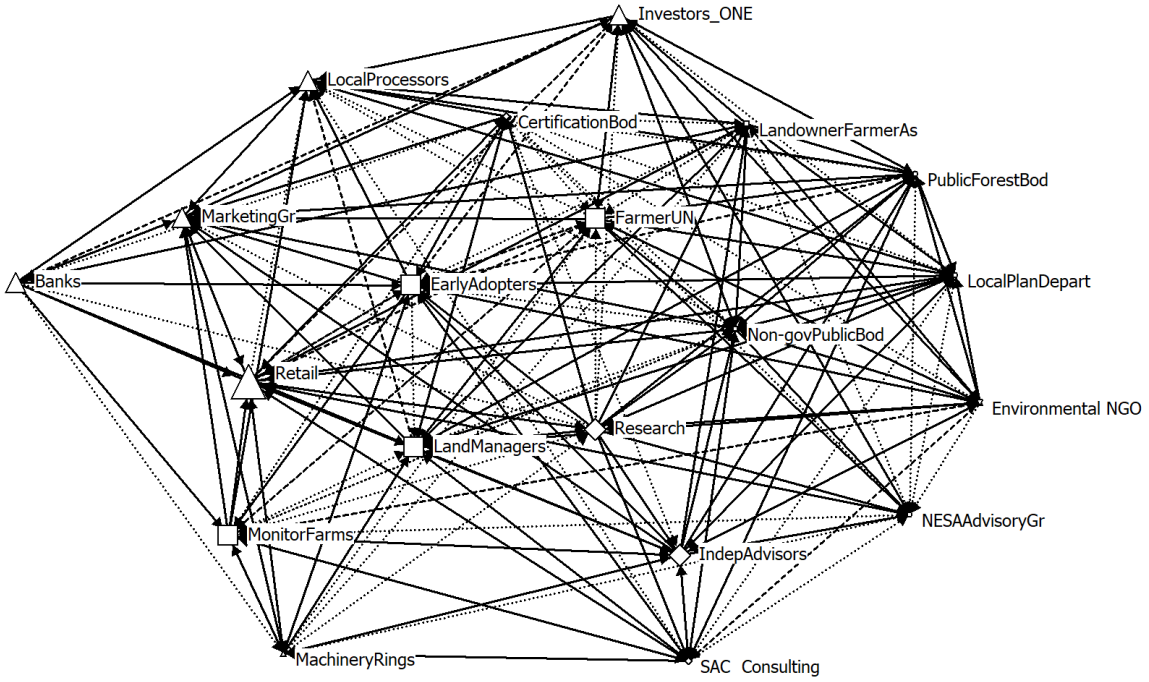

Figure 30. The NET-MAP of UK case study

Table 35. The network

Type of Network	N. categories	N. miss act	N. nodes	N. links	Density	Connectedness
Decentralised	5	0	20	187	0,49	1,00

Table 36. Actors metrics

Actors	Influence	Out-Degree	In-Degree	Flows	Inter category links	Betweenness
Retail	5	12	16	I&G	3	78,7
LandManagers	4	4	15	I&G	4	3,6
Banks	4	10	2	I&G	1	3,5
EarlyAdopters	4	8	13	I&G	4	9,6
LocalProcessors	4	1	13	I&G	3	0,3
MarketingGr	4	1	14	I&G	3	18,3
MonitorFarms	4	12	9	I&G	4	14,0
FarmerUN	4	13	9	I&G	4	17,2
Investors_ONE	4	8	11	I&G	4	23,5
Research	4	15	6	I&G	4	12,0
IndepAdvisors	4	13	8	I&G	4	11,5
MachineryRings	3	10	4	I&G	2	4,2
Non-govPublicBod	3	10	11	I&G	4	4,9
PublicForestBod	3	8	10	I&G	4	2,0
NESAAdvisoryGr	3	2	14	I&G	4	1,5
LocalPlanDepart	3	10	10	I&G	4	7,8
Environmental NGO	3	13	6	I&G	4	4,1
SAC Consulting	3	11	6	I&G	4	5,9
LandownerFarmerAs	3	11	7	I&G	4	3,7
CertificationBod	3	15	3	I&G	4	9,5

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5. ANALYSIS OF GOVERNANCE NETWORKS

This Section is based upon the results of the SNA of Case Study NET-MAPs, based on national Case Study reports (Annex). The three paragraphs below synthesise the key features of each Case Study network and describe them based on the types of networks identified (5.1); present and discuss the governance structures, focusing on the current role of key actors and on the potential role of critical missing actors (5.2); reflect on methodological choices and on their implications in terms of research outputs and gives recommendations for future research (5.3).

5.1. Comparative analysis of networks

Table 37 describes the composition of Case Study networks, including key structural properties, such as cohesion (density and connectedness) and network type.

Table 37. Summary characteristics of the 15 case study networks*

Case study	Network	Categories	Missing	Actors	Links	Bidirectional	I&G	Density	Connectedness
AT	Centralised	7	1	21	60	0,77	0,27	0,14	0,95
CH	Decentralised	7	1	23	112	0,39	0,13	0,22	0,96
CZ	Centralised	5	6	24	78	0,54	0,29	0,14	0,84
DE	Decentralised	7	1	19	84	0,96	0,19	0,25	1,00
ES	Distributed	6	2	13	62	0,74	0,21	0,40	1,00
FI	Distributed	5	0	15	71	0,96	0,08	0,34	1,00
FR	Centralised	6	3	22	69	0,76	0,17	0,15	0,86
GR	Decentralised	4	4	10	18	0,11	0,17	0,20	0,42
HU	Decentralised	7	6	16	135	0,13	0,25	0,27	0,31
IT	Decentralised	6	3	14	47	0,77	0,13	0,26	0,93
LT	Distributed	4	3	19	105	0,76	0,10	0,31	0,95
LV	Distributed	5	2	14	100	0,78	0,21	0,55	1,00
RO	Distributed	5	2	11	56	0,75	0,25	0,51	0,91
SE	Decentralised	7	0	20	81	0,72	0,09	0,21	0,95
UK	Distributed	5	0	20	187	0,40	0,56	0,49	1,00

** including the share of bidirectional links over the total number of observed network links and share of double flows (I&G), i.e. those involving both information knowledge and goods/services*
Source: Authors' own elaboration using UCINET® (Borgatti et al., 2002).

The networks display approximately 20 actors each, the smallest number of which were in Greece (10 actors) and the largest in the Czech Republic (24 actors). The actors identified are in to seven actor categories (Table 5). Over half of the networks contain at least 6 categories.

The types of actors which are most often missing from Case Study networks are Consumers and Media, while Authorities and administrations and Agri-food value chain are those which are included most frequently, i.e. they include the greatest share of network actors. Actors belonging to NGOs, civic society organisations, and local community representatives are represented in most networks, although with a very low frequency. National Case Study teams identified missing actors, based upon primary information gathered during the field work. Those actors may be relevant for the network structure which was observed to evolve towards a configuration that might help to address the challenge and facilitate the evolution of the current Case Study stage towards AEFS. Most of the missing types of actors belong to the

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Agri-food value chain and Science categories. Most of the national networks have a couple of types of actor missing, but Hungary and the Czech Republic each identify 6 missing types of actors, mainly belonging to the Science and Agri-food value chain categories.

The distribution of actor-actor relationships differs markedly across the 15 networks, both in terms of the number and direction of links and type of flow.

For example, Greece shows 20 links and an average number of links per actor of 1.8 (average network degree); Hungary and United Kingdom each exceed a hundred links and their average network degree is ca. five times that of Greece (approximately 9 in both Case Study). Bidirectional links occur between pairs of actors in the case of a mutual relationship, i.e. when the flow is bidirectional. In the Case Study, there is a prevalence of bidirectional links, with 70% of flows being mutual in most networks. This mutuality is low in just the three case studies of Switzerland, Hungary and Greece. In terms of flow type, the share of double flows is generally low, ca. 20% on average, except for the United Kingdom, where over half node-node links involve two simultaneous flows.

With respect to network cohesion, network actors tend to be well connected, displaying connectedness values that approach 1, with two notable exceptions, i.e. Greece and Hungary. In the network of both Greece and Hungary, the pattern and direction of links observed create paths amongst fewer than half of the nodes. Node closeness is measured via network density. The classification exercise returned four centralised, six distributed and five decentralised networks.

Apart from the network as a whole, single actors matter in each Case Study. The visual analysis of the sociograms can help identifying hot spots in the network, especially when link density is rather low, and it is easy to identify the actors who are channelling the majority of the mapped flows. A notable example is Austria, featuring a central node, i.e. the association Ökoregion Kaindorf, through which all channels flow.

To support the visual analysis of sociograms, the study uses actor-level information. For example, when looking at primary information about actor influence, different actors may emerge with relevance to the challenge. In Austria, for example, Mayors have the greatest influence amongst actors, although they have a peripheral position and very low involvement in network flows. Additionally, formal measures of the structural properties of nodes may help identify key actors in case of very complex and dense networks, such as the United Kingdom, where the number of actor-actor links and the close influence scores hinder the graphical analysis.

The following sub-sections consider the key actors and missing actors of these three groups.

5.1.1. Centralised networks

Study findings highlighted three centralised networks with a sub-national scope, i.e. Austria, Czech Republic, and France (Table 38).

Centralised networks display only one or very few actors with special relevance to addressing the challenge. There is one fundamental actor in each of the three case studies, although other key actors exist that significantly contribute to the challenge.

In Austria, the network is structured towards the **Ökoregion Kaindorf**, the mission of which is to help climate change mitigation through local actions. The core of those actions is to support interventions that increase carbon sequestration and the formation of humus on arable land. To implement those actions the actor promoted the creation of the “working group on humus formation”, a platform of the ecoregion that works to increase soil quality and fertility. The platform includes 30 “Humus farmers”, who aim to study and evaluate new ideas for increasing the humus content of the soil and are key actors in the humus formation project. Famers who participate in the project are compensated by carbon certificates sold to companies. The provision and trading of certificates is managed by the association Ökoregion Kaindorf. Idealistic supporters, such as G. Dunst, have driven the project of Ökoregion Kaindorf through their

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motivation for change. Dunst developed and guided the founding process. The **Ministry for Sustainability and Tourism** is the *missing* actor, as it has the power to push the humus project further, by setting legislative frameworks, providing incentives that can guide farmer's decisions and introducing the topic at the EU level.

Table 38. Centralised case study networks*

Country	Category	Code	Key	Missing
AT	Authorities	MinSustainab	-	•
	Farmers	Humus farmers	***	-
	Science	DunstG	***	-
	NGOs	ÖkoregionAs	***	-
CZ	Authorities	MoA-OF	***	-
		MoA-CAP	***	-
		Municipalities	-	•
	Farmers	Farms org	*	-
		PRO-BIO assoc	***	-
	Value chain	OrgMilk Coop	**	-
		OrgDairies abroad	**	-
		Local OrgDairy Coop	-	•
	Science	OrgFarming Consultants	-	•
	NGOs	EnvNGO	-	•
		WaterCo	-	•
	Consumers	Consumers	-	•
FR	Authorities	Region	**	-
		State	**	-
	Farmers	DF CUMA	*	-
		Farmers	***	-
		Coop Federation	-	•
	Value chain	Wholesalers&Retailers	-	•
	Science	Tech Institute	-	•

**Key actors (star scale) identified via social network analysis and missing actors (black dots) identified during the fieldwork. Source: Authors' own elaboration.*

In the Czech Republic, the Ministry of Agriculture is the core of the network, alongside the PRO-BIO association. The Department for Agricultural Policy of the Ministry has the strongest position to determine the changes in agricultural management. Additionally, the Department responsible for organic farming of the same Ministry has a special role. It mediats the relationships with other Ministry departments, being responsible for implementing the Action Plan for organic farming, and providing support to NGOs and organic farming projects, such as e.g. about public procurement to which the PRO-BIO association contributed. The PRO-BIO Association is more important in this Case Study, in relation to the diffusion of organic dairy farming. PRO-BIO negotiates with trade associations representing supermarkets in the Czech Republic to shift organic food from luxury goods to regular ones with lower margins. The major focus of the

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association involves relaxing the compliance criteria for the recognition of sales organizations in organic farming and stabilise the dairy market to improve the diffusion of organic dairy farming in the Czech Republic. A number of actors are *missing* from the network, such as a **Local Cooperative of Organic Dairies**, **Farm Consultants specialised in organic farming**, **Environmental organisations**, the local **Water Company**, and **Consumers.** Adding those actors to the network may raise awareness amongst farmers and promote knowledge exchange and data availability about the challenge, narrow the science-practice gap, and improve education and training.

In France, Farmers are key actors for addressing the challenge, although displaying inter-category differences about the perspective about the agro-ecological challenge in viticulture. Despite that, farmers require the production system to change, as they need to improve soil fertility and face the increasing demand for more environmentally friendly practices. For forward-looking farmers, accelerating their response to the challenge might be a way to solve the dilemma, by anticipating upcoming regulatory changes, such as the likely ban of some pesticides.

Authorities are important actors in the network. Of particular significance are the State, given its role in policy-making and policy-implementation (e.g. the agro-ecology national plan; financial support), and the Region (local administration), which is in charge of the Rural Development Programme of the CAP and manages policy actions and tools related to AE and its implementation.

Actors who are missing are the: i) **Technical Education Institutes**, the teaching programmes of which should be updated to include AE to promote its principles amongst young people; ii) **Wholesalers and Retailers** which should be included in the decision-making processes to bridge gaps between marketing strategies and public support for AEFS; iii) The **Federation of Farmer's Cooperatives,** participation of which would improve the visibility of the interests of farmers.

5.1.2. Distributed networks

Six national Case Studies belong to the group of distributed networks (Table 39), for which the analysis could not identify definite cores.

The distributed networks cover one at a local level (Finland), and five sub-national networks (in Spain, Latvia, Lithuania, Romania, and the United Kingdom). Although few key actors exist, the high density of actor-actor links does not permit the identification of clear central or peripheral nodes for the purpose of addressing the challenge. **The questions about how to address the challenge and solve the dilemma to move towards AE have not been given specific answer by any network actors yet.**

In Spain, Authorities have different objectives and do not generate confidence in the Agri-food value chain and Farmers actors, given the large dependence of policy goals of the party at the head of the government. However, recently, **Local Government** has attempted to promote the adoption of AE amongst farmers. Two *missing* actors who could play important roles in the network are **Cooperatives** and **Research Centres**. The former could link the farmers with the rest of network actors and may facilitate an increase in the supply of food from AEFS, and so increase the bargaining power of farmers and improve their position in the market. The latter could strengthen the visibility of AEFS through the dissemination of appropriate study findings, which can explain the benefits compared to conventional management.

In Finland, several actors influence and are influenced by the planning and construction of the envisaged bio-product plant, due to the multifunctional nature of the project. For **Local Dairy Farmers**, a key motivation of the dairy farmers participating in the bio-product plant planning process is to ensure their future possibilities to invest in milk production, without being forced to acquire more agricultural land for the purposes of spreading manure. The **Local Dairy Cooperative** originally initiated the planning of the bio-product plant and is actively involved in the visioning, planning and possibly also the construction of the bio-product plant. The administration of the **City of Nivala** is involved as a key communication link between local actors and the local arena. At the regional level, the **Regional Centre for Economic Development,**

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Transport and the Environment, is the authority that evaluates the environmental impacts associated with projects such as the bio-product plant.

The network of the Lithuanian case study might appear to be centred around Extensive farms and Large farms. However, an equilibrium has not been reached between the interests of those two farmer types and the possibility to jointly address the challenge. **Large farmers** (intensive) have greater bargaining and lobbying powers compared to smaller **Extensive farms**. The former are more economically competitive and have control over more powerful sectoral associations. The latter are facing the issue of economic viability, with a steeply decreasing number of dairy farms in recent years, due to the decrease in the price of milk paid to farmers. A range of different actors are present in the network including market actors, farmers and their associations, purchasers and processors, municipalities and the government structures, as well as national research, advisory and educational institutions. However, important *missing* actors are the **Certification bodies** and **Agricultural Universities**, which seem to be outside the discourse about how to deal with the dilemma at the national level.

Table 39. Distributed case study networks*

Country	Category	Code	Key	Missing	Country	Category	Code	Key	Missing
ES	Authorities	Public comp	*	-	LV	Authorities	Rural Sup Serv	***	-
		Local govnmt	***	–		Farmers	Org Farmers Ass	***	-
	Value chain	Value chain	*	-		Value chain	Logistics	*	-
		End user	***	-			Retailers	-	●
		Coop	-	●		Science	Certific Bodies	*	–
	Science	Certific bodies	*	-			Consult&Train	*	-
		Consult&advis	*	-			Agri U	*	-
		Research	-	●		Consumers	Consumer_org	-	●
FI	Authorities	NivalaCity	**	–	RO	Authorities	LAG	*	–
		Reg.Adm.Agency	**	–		Farmers	Farmers	***	–
	Farmers	LocalDairy	***	-		Value chain	Value chain	*	–
		Farms-DairyCo	***	–			Local assoc	*	–
	Value chain	DairyCo	***	-			Coop	-	●
	NGOs	Inhabitants	**	–		NGOs	AEA	***	–
LT	Authorities	Chamber Agri	*	-		Science	Research	-	●
	Farmers	Extens_farms	***	–	UK	Authorities	LocalPlanDepart	*	–
		Large_farms	***	–		Farmers	EarlyAdopters	*	-
		Coop assoc	*	–			MonitorFarms	***	-
		Family Farm Un	-	●			FarmerUN	***	–
	Value chain	Cater&grocer	*	-		Value chain	MarketingGr	*	-
		Milk Traders	*	-			Investors_ONE	*	–
	Science	Advisory Serv	*	-		Science	Research	***	–
		Certific body	-	●			IndepAdvisors	*	–
		Agr Uni	-	●			CertificationBod	*	–

**Key actors (star scale) identified via Social Network Analysis, and missing actors (black dots) identified during the fieldwork. Source: Authors' own elaboration.*

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In Latvia, the study identified some actors as having important roles in the transition towards AE. The actors identified have largely administrative roles and do not have much leverage with respect to the resolution of the dilemmas. The **Rural Support Service** has the greatest relevance with respect to the overall direction of agricultural and rural development policy and support payments in Latvia, including for AEFS. This is especially through collaboration with the Ministry of Agriculture Rural Development Support Department. The **Association of Latvian Organic Farming** is the lead driver behind organic farming in Latvia. It is the issuing agency of the Latvian organic product logo. It organizes information events and training for organic farmers, and is linked with many governmental and non-governmental actors in the network.

In Romania, **Farmers** were recognised as the most relevant and influential actors in relation to the Case Study dilemma, since through their practices they can ensure the preservation of local habitats and associated species. However, there is an increasing need to re-configure relationships and empower other actors to ensure a decent income to farmers by means of selected and targeted incentives. Over the last four to five years, important initiatives have been organised by **environmental and agro-tourism NGOs** to develop the market for local products, such as weekend events marketed towards urban consumers. Unfortunately, trust and collaboration are very weak in the region due to the social trauma left by the nationalised, collective agricultural system imposed by the communist regime. Associations exist, but in low numbers which were founded only to ensure compliance with eligibility criteria in accessing agricultural subsidies through the CAP. **Cooperatives**, which could be regarded as an "upgrade" to associations, are the key missing actors.

Similarly, in the UK, actors belonging to the category of farmers and farmer's organisations have a very important role in the transition towards AE. **Monitor farms** were identified as a key source of advice and knowledge, principally based upon demonstration and trials and sources of best practice and sharing of knowledge. The NFUS (the **farmers union** in Scotland) is also a source of advice to its members, as well as lobbying politicians in the Scottish and UK Governments, the European Union, and public agencies. Amongst actors belonging to other categories **research, innovation and advisory groups** produce new and relevant knowledge to address the dilemma in the form of advice, evidence, and tools (e.g. maps and data), often delivered through the monitor farms.

5.1.3. Decentralised networks

There are five decentralised governance networks (Table 40), which operate at different scales:. The networks in Switzerland, and Germany are local, in Greece it is sub-national, and in Hungary and Sweden they are national.

In decentralised governance networks, a set of relevant nodes have a prominent position and relevance to the challenge. **Those actors have the ability to channel multiple flows across the network and to attract flows and actors from outside of the network.**

In Switzerland, the different cores of the network are represented by two actors which belong to Authorities, although at different administrative levels, and one belonging to the Agri-food value chain. The former are the **Federal Office for Agriculture (BLW)** and **Office for Agriculture of the Canton of Lucerne (Lawa)**. The Federal Office is the primary authority for the implementation of policy of a high level of relevance to the challenge. Such policies are payments for resource efficiency, including nitrogen efficient feeding strategies for pigs, and investment credits for barn construction. The Cantonal Office has a similar role but with a greater impact locally, such as the allocation of interest-free loans for (barn) constructions, the control of water pollution from agriculture, and the implementation of counter-measures such as the phosphorus project. The key actor belonging to the Agri-food value chain is the **Milk Industry**, including mainly large-scale dairies. The industry pushes farmers to increase the cost-effectiveness of milk production, by abating costs. The influence of this actor on the challenge is largely *negative*. The **Tourism** sector is acknowledged amongst *missing* actors as it benefits from well-kept landscapes and from extensive agriculture.

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In Germany, Landowners, the Chamber of Agriculture and the County Association of Water Management are the three hot-spots of the network. **Landowners** have control over the conditions of land rental agreements with farmers. Aiming at land profitability, Landowners can restrict the choice of farmers about what to grow and how to manage the land. This actor has a *negative* influence on the challenge, such as the adoption of agro-ecological practices which would reduce the economic value of the agricultural land and be excluded from the rental agreement. Farmers can decide against the implementation of AE practices because of the perceived risk that Landowners are not willing to renew the rental contract. The **Chamber of Agriculture** offers advisory services and develops ideas and concepts for the implementation of AEFS. Such services are specific biodiversity and water protection advisory services, which have a high potential to further promote AE transitions.

Table 40. Decentralised case study networks*

Country	Category	Code	Key	Missing
CH	Authorities	Lawa	***	-
		Uwe	*	-
		Rawi	*	-
		BLW	***	–
	Farmers	Fenaco	*	-
	Value chain	Milk Ind.	***	-
		Tourism	-	●
	Consumers	Consumers	*	-
DE	Authorities	LNPA	*	–
		CAWM	***	–
	Farmers	Farmers	*	-
	Value chain	Land owners	***	-
		Agri-traders	*	–
		Plant breeding	*	–
		Contr. & rings	*	–
	Science	Agric-chambers	***	–
		Biod_interm	-	●
GR	Authorities	Pub law	-	●
		Pub_extension	-	●
	Farmers	Individuals	*	-
	Value chain	Supermarkets	*	-
		Wholesale_mkt	-	●
	Science	Research&Univ	-	●
HU	Authorities	AgriChamber	*	-
	Farmers	InnovFarmers	***	-
		Farmers	***	–
	Value chain	LargeAgribusCo	***	-
		SmallAgribusCo	*	-
		Banks&Insurance	-	●
	Science	FarmAdvisory	*	-
		SoilMonitoringSys	-	●
		SoilQuality Platform	-	●
		ExtensionSys	-	●
		DemonstFarms	-	●
	Consumers	Consumers	*	-
		ConcernedConsumers	-	●
IT	Authorities	Biodistrict	***	–
		Cons ChianClas	*	–
	Farmers	WinegUn Panzano	*	-
		Organ farm	*	-
		Conv farm	*	-
		FarmersUn	-	●
	Value chain	Cater&grocer	*	-
	NGOs	TourismAs	-	●
	Consumers	Consumers	-	●
SE	Value chain	InputCo	*	–
		Large food ind	*	–
		Retail&Wholesale	*	–
		Mills	*	–
	Science	Research	*	–
	NGOs	NGOs	**	–
	Media	Media	**	–

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**Key actors (star scale) identified via Social Network Analysis, and missing actors (black dots) identified during the fieldwork. Source: Authors' own elaboration.*

Concerning the dilemma, the Chamber pays particular attention to the economic impact of any intervention at the farm level, to ensure the viability of successfully achieving biodiversity and water protection benefits. The **County Association Water Management** is responsible for the management of the water bodies and measures under the Water Framework Directive, and cooperates with farmers in the Case Study area in the management of water protection strips. A trusted **Intermediary** actor with skills in biodiversity conservation is *missing* from the current network. Such an actor could improve the Governance Network by bringing together the information, knowledge and evidence from different actors fostering cooperation towards a transition to AEFS (Zilans *et al.*, 2019).

In Italy, the study identified three cores. The **Biodistrict Organising Committee** has the greatest relevance. The mission of the Biodistrict is to adopt a territorial approach for conceiving and developing organic farming. The Biodistrict promotes events and initiatives for disseminating knowledge about organic farming and for introducing organic food in public and private sector canteens, as well as for raising environmental awareness in the public. The **Winegrower's Union of Panzano** has been involved in the development of the Biodistrict in the Case Study area from the beginning and is still very active in finding the solution to the case study dilemma, which is reconciling the specialisation on wine production with the adoption of agro-ecological methods and principles. The **Chianti Classico Consortium** represents the interests of almost all wine producers in the Case Study area and is one of the principal representatives of the institutional organisations in Italy and in the EU in the grape-growing and winemaking sector.

Three *missing* actors are identified which may benefit the Case Study network. These are Consumers, Tourism associations and Farmer's unions**. Consumers** should be actively involved in the network, via awareness campaigns, which can improve the popularity of food produced locally in the Biodistrict. **Tourism** associations can help solve the dilemma by diversifying the financial resources of the local population thereby reducing the reliance on wine exports. Apart from the wine sector, formal and structured agricultural organisations such as **Farmers unions** have not played any relevant role in addressing the challenge. The roles of the Farmers unions have been mainly administrative, and they have not developed any practical and policy actions to accelerate the processes of transition to AE practices in the area.

In Greece, a prominent role in the network is played by **individual farmers or farmers involved in small producer groups**, typically conventional farms that produce and sell fruit for consumption, and/or for processing so as to secure short term (annual) revenue. Most such farmers are not interested in, or even aware of, policies and initiatives related to agro-ecology, and do not have any long-term farm planning. In comparison, environmentally friendly practices are mainly adopted by large agricultural cooperatives/producer groups that sell to **large retailers and supermarket chains** which demand products that are certified in accordance with quality and safety standards. The role of the **public sector** is limited, with a lack of a legal and institutional frameworks controlling the strong and powerful agricultural cooperatives/PGs and to provide protection against an underground economy. Agro-ecological practices and green infrastructure projects should be promoted through **public extension services** in order to guide and inform farmers about farming methods as well as market conditions.

The Swedish case study presents a decentralised governance network with key actors belonging mainly to the value chain, NGOs and media categories. The **large food industries, retailers and large wholesalers** are very influential actors, since their power brings them in a dominant position compared to farmers. Such actors have the power to set premium prices and quality programme to stimulate more organic production. On the consumer side, in Sweden there is a lively debate amongst **NGOs** about the strategies that could reduce the environmental pressure from meat and dairy production, through the adoption of more sustainable diets. This message is often counterbalanced by several agricultural actors that put

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considerable emphasis on competitiveness and increased production as being the most important pathways to reach sustainability goals. This polarisation of the public debate is exacerbated by the **media** which contributes to the production of mixed-messages of the future needs for sustainable food production, making it difficult for farmers to know who to believe. To a lesser extent **research** is also influential by creating and disseminating knowledge to many actors in the food system.

5.2. Overview of Governance Networks

All the 15 UNISECO Case Studies contain a key dilemma associated with the transition to AEFS. The dilemmas identified are mainly related to the trade-off between the different dimensions of sustainability that are challenging the AEFS. This report aims to improve our understanding of the extent to which Governance Networks are addressing or providing solutions to such dilemmas.

A better understanding of the role, functioning and structures of Governance Networks can contribute to understand the barriers that are currently preventing appropriate solutions to the dilemmas identified, and the key actions to be undertaken in the future. As described in Section 5, actors may have different resources and different positions in the networks that can create asymmetrical power relationships. This situation may generate conflicts and controversies that affect the transition towards AEFS. Since the complex dilemmas identified cannot be solved by single actors, Governance Networks show how public and private actors interact through the exchange of knowledge, information, goods and services, and through negotiations that involve conflicts, power and forming compromise (Torfing, 2015).

Table 41 summarises the key features of the Governance Network under study only on the basis of the qualitative data collected through the SNA semi-structured interviews. The table shows, for each Case Study, both the main barriers and the key actions to be undertaken to address the dilemmas identified. In many cases, especially those characterised by a low level of cooperation between actors and at an initial stage of transition, authorities (e.g. Ministries of Agriculture) were identified as the key actors which are in the position to initiate, manage and direct Governance Networks towards the AE transition pathways.

By comparison, in countries characterised by the long-standing traditions of involving civil society partners in the decision-making process, the interactions between public and private actors seem to be a pre-requisite to overcome current barriers and to develop effective actions in the future.

When identifying the Governance Network involved in AEFS, it is important to analyse the types of stakeholders present and of their relationships. If the overall objective of AEFS is achieving a system re-design based on agro-ecological principles, it is clear that the technical improvement of farming practices is not sufficient. However, such a re-design will require collective thinking, the involvement of new actors and different forms of coordination between stakeholders. Indeed, agro-ecological transitions require technological innovations, and the mobilisation of several stakeholders, their cooperation, and new governance structures (Tittonell, 2014).

At the core of the analysis carried out for this deliverable there is a systematic analysis of the role of different categories of actors and two types of relationships between them: the exchanges of goods and services, and the exchange of information and knowledge.

On the basis of the evidence collected in the 15 Case Studies, Figure 31 summarises the categories of actors currently involved in supporting the AEFS under study, and Figure 32 shows a possible evolution of the roles and relationships amongst categories which could improve how the key dilemmas are addressed in the future.

Figure 31 shows that in the UNISECO Case Studies there is already an active engagement in the networks of the value chain, farmers and public sector actors. The research, innovation and advisory actors currently have an important role as mediators that link categories. The NGOs and other civil society organisations were observed as having limited roles, with very reduced or no interaction at all with farmers and authorities. Few case studies pinpointed media as a crucial node of the network, for spreading knowledge

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and raising consumer awareness. However, in most CS media is a missing actor. A similar discussion applies to consumers. To effectively mediate the adoption of AEFS via an increase in the demand, consumers need proper education about the different options available, in terms of their potential benefits for the environment and for rural development. This is a responsibility of Authorities, via the delivery of proper educational campaigns, and of value chain actors, via the effective reduction of information asymmetry B2C, e.g. by designing clear and easy to understand food labels, e.g. AE from organic or other types of low input agriculture.

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Table 41. Key features of Governance Networks and their role in addressing the dilemmas

CS	Network	Level of Cooperation	Conflicts and Barriers	Key Actions for the Future
AT	Centralised	Strong	The decision-making process is concentrated on Ökoregion Kaindorf association	Increasing farmer's participation; favouring exchanges amongst farmers; ensuring additional support from the state and federal authorities
CH	Decentralised	Low	No agreement on the extent and relevance of the dilemma and on the roles that should be played by private and public actors	Increasing the role of general public, also through a better communication from public authorities and a strong involvement of NGOs
CZ	Centralised	Low	MoA has a dominant position through a top-down decision-making mechanism; lack of cooperation amongst farmers unions	Improving communications amongst organic and conventional farms; stronger involvement of local actors
DE	Decentralised	Moderate	Decision making at farm level, lack of trust on implementation of AE policy measures; conflicts on property rights of agricultural land use and implication for public goods	Stronger role of local actors (municipalities); involvement of trusted intermediary actors with particular focus on biodiversity
ES	Distributed	Strong	Authorities and value chain actors have in mind different food systems compared to the network of agro-ecological farmer	Promotion of favourable public policies committed to small scale agro-ecological projects (e.g. public procurement)
FI	Distributed	Moderate	Network is in its early stage; high dependence on the decision of authorities; two large industrial actors are acquiring power at the expenses of local farmers	Mediating interest between national and local actors to reach a common understanding on the mutual benefits of the bio-plant
FR	Centralised	Strong	Combining agro-ecological principles with viticulture productivity: conflicts of interests and legitimacy amongst actors	Overcome a sectoral decision-making process by unifying public and private actors, also through an efficient implementation of the regional network of agroecology in viticulture
GR	Decentralised	Moderate	Presence of illegal economic transitions; presence of agronomist-merchants	Supporting the role and actions of agricultural cooperatives and agronomist-consultants that promote agro-ecology
HU	Decentralised	Low	Authorities are failing in providing a comprehensive and effective policy agenda on soil conservation	More cooperation between science and authorities would be necessary to provide knowledge and advisory to farmers to accompany their transition
IT	Decentralised	Strong	Conflicts amongst large conventional farms and small-scale organic farms; inadequate involvement of Consortium	Increasing the role and capacity of networking of biodistrict especially with NGOs and other local actors
LT	Distributed	Low	Interest of small-scale dairy farms are not adequately represented; MoA is not taking any strong initiative to address the key dilemma; lack of trusted and active cooperatives	Design and implementation of a national strategy (MoA) that includes a vision and concrete plans to support extensive farming and agro-ecological principles
LV	Distributed	Moderate	High dependency on continued EU support to agro-ecological farmers	Ensuring that the demand for organic product will continue to grow, also through a strong involvement of all relevant value chain actors
RO	Distributed	Low	Very weak collaboration; presence of conflicts between local organisations and public institutions, uneven distribution of CAP payments	Stronger involvement of NGOs in the decision-making process, especially on agricultural and RDP policies
SE	Decentralised	Low	The livestock sector is dominated by few powerful actors; there is not an established network related to the key dilemma	Stronger involvement of retailers and a supportive policy environment to promote agro-ecological principles
UK	Distributed	Moderate	Presence of very influential market forces; conflicts between actors for funding and pressures on land managers to solve the dilemma	Improving the design and implementation of key regulations and policies

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Figure 32 illustrates that evidence collected in the field suggests that, in order to address the agro-ecological transition, authorities should improve how they help to overcome conflicts and facilitate coordination between NGOs and farmers, as well as ensuring a stronger role of media and consumers and other civil society associations. Furthermore, actors identified under the science and innovation category (including AKIS and advisory services) should improve how they involve actors of the media and consumer to stimulate new forms of learning and knowledge production. This will raise public consciousness, people's empowerment and political action to facilitate the transition towards AEFS. Especially, evidence from the CS suggests that skilled farm advisors (e.g. on AE practices) are necessary for farm level adoption of AE practices. Then targeting incentives to advisors might improve their ability to drive AE innovation, e.g. by supporting advisors' further education. Education has a crucial role itself, especially for the future generations of farmers and advisors. The diffusion of AE programs in formal secondary and tertiary education is uneven throughout Europe. This is due to many institutional and cultural diversities across countries; overcoming those differences may help improving the knowledge base of producers and practitioners. Besides, extension services did not show up as relevant themselves in any of the CS. This might be due to AE not being a formalised agricultural method yet. Often, extension is associated with the activity of farmer associations, which sometimes tend to be the voice of risk averse farmers. The transition towards AE is a knowledge-intensive process, which, to date, has not guaranteed producers a better position on the market of their products, compared to other types of sustainable farming system. This is due to a difficulty in the identification of clear-cut criteria to differentiate the products on the market and to communicate that difference to the bulk of consumers.

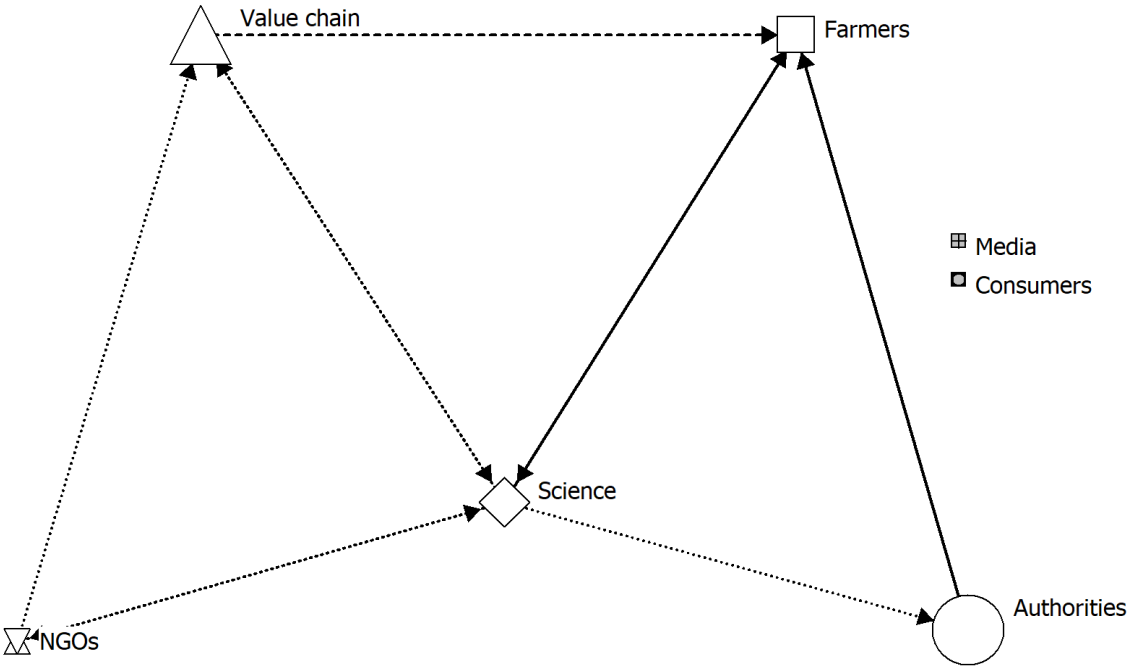

Figure 31. Key categories, and their relationships, currently involved in supporting the AEFS under study

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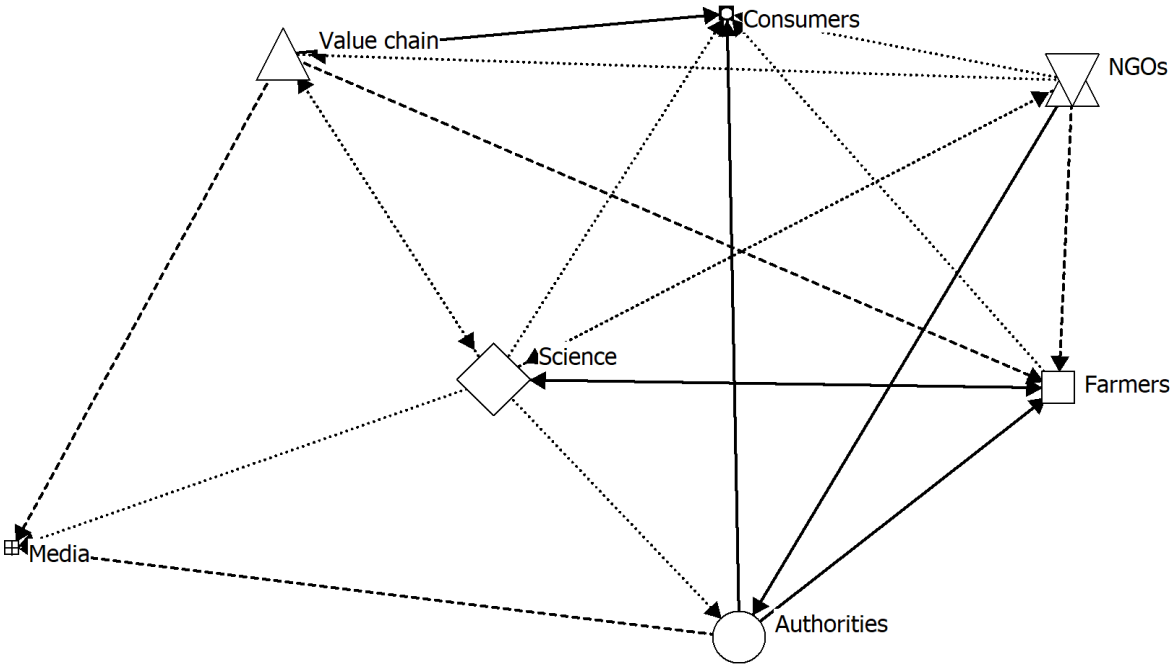

Figure 32. Recommended evolution of the roles and relationships of categories to improve how the key dilemmas should be addressed

5.3. Reflections on method used

Most case study researchers and stakeholders reported the SNA exercise as being very useful. Overall, the use of the SNA in the methodology for the Case Studies was valued for its ability to direct the attention of the relevant actors involved in specific agro-ecological dilemma. In particular, the methods facilitated an increase in the perceptions amongst researchers and Case Study Multi-Actor Platforms, that tackling the different dilemmas requires the involvement of a broad range of stakeholders, and that the design and implementation of agro-ecological practices is usually confined to the farming sector. The approach used enabled the identification of actors which make a difference in supporting AEFS (i.e. brokers and influential actors) and those which could play a crucial role in the future, even though currently they are outside the networks (i.e. missing actors).

The key strengths of the method identified by Case Study researchers were:

- the method and the questionnaire, structured around the open-ended questions which enabled the collection of a significant amount of valuable information (reported in Spain);
- that once the final NET-MAP was defined, the context of the dilemma was well visualised, and it helped to reduce the effects of preconceived ideas (reported in Spain);
- that partners which collected the data through Option 2 considered the workshop a good opportunity for a lively discussion with informed stakeholders (Switzerland, Greece, Sweden, United Kingdom and France). In the case of Greece such a discussion helped to connect missing parts of the network and to clarify misconceptions.

With regard to the limits of the method used, it can be argued that the three options differ to a large extent in terms of the robustness of the data collection process. A key difference is in relation to the joint development of the NET-MAP in Option 2, compared to the aggregation of data made by researchers in Options 1 and 3. The process confirmed what has been discussed in previous research using a similar approach (Hauk *et al.*, 2015) which is that, to different extents, all three options the process and the design

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of NET-MAPs created space for interaction and co-production of knowledge between researchers and stakeholders.

Specific limitations and methodological remarks identified in the Case Studies were:

- the interpretation of links between actors (influencing or being influenced by the dilemma) sometimes created difficulties and blurred the delineation of the Case Study boundaries;
- some partners (e.g. in Austria and Spain) noted the difficulties of interviewees having the same level of understanding regarding the key dilemma. Although some interviewees expressed similar views, different categories of actors had different perceptions. For further analysis as well as for cross-analysis between case studies it was suggested to better show if the interviewees belonged to a specific category and to what extent they were involved in the Case Study dilemma.
- there is a need to have efficient coordination to produce comparable graphs between Case Studies to enable analysis at a European level. Feedback to the WP Leader from each partner was necessary to produce comparable graphs and to achieve a consistent analysis.
- different interpretations by the interviewees of the list of actors, their influence and links, with some contradicting each other. The greater the number of interviews conducted, the more variants and combinations were obtained, which made the creation of the final NET-MAP more difficult (Spain).
- difficulties were experienced in cases where the dilemma was considered too narrow or too specific by some interviewees. In such cases, the discussion often turned to the general challenges of the local and regional farming systems rather than around the key dilemma (Czech Republic and Italy).
- Partners which also carried out the workshop (Option 2) reported the added value of this method for increasing the understanding between people with different views or interests, although in some cases reaching consensus on the final NET-MAP was not straightforward (e.g. United Kingdom).

Overall, the Case Study partners agreed that the final NET-MAPs satisfactorily reflect the overall impressions received in the data collection process.

6. CONCLUSIONS

The overall objective of this deliverable was to identify and analyse the Governance Networks that support or (that might support) AEFS in the context of the 15 UNISECO Case Studies. Social Network Analysis was used to achieve the aim, with the objective of carrying out an analysis that goes beyond the farm level by looking at how different stakeholder groups are engaged in the transition processes towards sustainable agriculture and food systems.

The process provided insights to the decision-making processes and Governance Networks in place in each case study and the mapping of how the network and its elements (actors and actor-actor links) can influence transition pathways of agro-ecological transitions.

The aim of the deliverable was also to contribute to the analysis of the governance (sub)system of SES in each Case Study (Task 3.1). This was to explore the key institutional settings beyond the agro-ecological dilemma, with particular attention paid towards actors, actions, rules and collective organisations that could enable agro-ecological transitions.

The main evidence collected through this task shows that each agro-ecological dilemma involves a complex mix of different, and often conflicting, views and interests. Mapping the key ‘nodes’ and ’flows’ of each

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network can provide important insights on how to improve the communication and other types of exchanges between actors and on how to develop common strategies and to solve key conflicts that characterise the UNISECO Case Studies.

The actions are strongly influenced by the structure of the networks. For example, larger networks usually exhibit stronger resilience such that, for example, the exit of actors or the termination of relationships can be more easily replaced by others. Similarly, a denser network usually enables the easier transmission of goods and information. Very dense and strongly cohesive networks tend to be worse at adapting to change since 'structural holes' may offer opportunities for emergent leadership and innovation (Newig *et al.*, 2010). In comparison, centralised networks are usually more vulnerable, because of their strong reliance on a few heavily linked actors or specific institutional frameworks (for example a specific policy measure). In the related Governance Network, the collapse of key actors may have profound and negative effects on the overall stability of the network.

It could be argued that the main limitation of the SNA in the context of UNISECO was that the method enabled the situation to be identified and presented for a given point in time, while the transition pathways experienced in each Case Study are, by definition, iterative and dynamic. However, the overall objective of the task was to create an exhaustive picture of the different types of networks that are currently involved in each agro-ecological dilemma, and not to provide evidence of the transition pathways.

In the next steps of the project, the different NET-MAPs could be used as a form of boundary object (Hauck *et al.*, 2015), thus as tools to stimulate additional discussion between actors with different perspectives. In particular, such networks should be considered as a starting point upon which to design and implement the following tasks required for the UNISECO project:

i) the participatory analysis for downscaling market and policy incentives (Task 5.3);
ii) the co-construction of innovative strategies (Task 3.3).

For these activities the NET.MAPs can be used to facilitate the exchange of experiences, and promotion of the integration of different forms of knowledge.

In greater detail, the results achieved from Task 5.2 should facilitate the co-construction of policy and marketing incentives that could stimulate (or further develop) agro-ecological transition at a Case Study level, by helping to address the following questions:

- Who are the key actors in a position to design and implement effective policy and market incentives?
- Who are the actors in a position to serve as mediators amongst different interests?
- How could the decision-making process be improved?

The NET-MAPs could also be relevant for the co-construction of strategies, by helping with the analysis of the drivers and barriers which enhance or hinder the implementation of agro-ecological approaches. They could also help with taking into account the complexity of interactions and processes between actors within the Case studies examined. Key questions that Task 5.2 will help to address are:

- Which network actors could work towards the identified strategy?
- Which network links should be strengthened to improve the design and implementation of the innovative strategies identified?
- How can missing actors could be empowered or link with other actors to take part in the strategies?

Overall, the analysis of multi-stakeholder governance networks reported in this deliverable reflects the transdisciplinary and action-oriented research approach used in UNISECO. Subsequent analysis will

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complement this task, enabling and encouraging the involvement of key actors in different SES, as well as reviewing trends and drivers hindering or fostering successful use of agro-ecological approaches in AEFS.

7. ACKNOWLEDGEMENTS

This report is compiled for the H2020 UNISECO project (Grant Agreement No. 773901). We would like to thank members of the Case Study MAPs in the partner countries for participating in the interviews and workshops and for their valuable input to the Social Network Analysis reported in this Deliverable.

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