12th European IFSA Symposium

Programme and Book of Abstracts

Social and technological transformation of farming systems: Diverging and converging pathways

12th – 15th July 2016 at Harper Adams University, UK

IFSA INTERNATIONAL FARMING SYSTEMS ASSOCIATION EUROPE GROUP

Andrew Wilcox & Samantha Vinall (Eds)

Harper Adams University

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Diverging and converging pathways

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Cover photograph

The cover photograph has been kindly supplied by Jake Freestone, farm manager of Overbury Farms. Overbury Farms is a 1570 ha farm on the Gloucestershire Worcestershire border. 950 ha are allocated to combinable crops and 110 ha let out annually for vegetables, with grass and woodland occupying the remaining area. The farm is a LEAF (Linking Environment and Farming) Demonstration Farm and the arable area has been converted to a zero tillage system. A sheep flock of 850Ha ewes, (lambs in April) grazes the permanent pasture and cover crops during the winter.

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Theme 5: Enabling governance, policy and institutions

About the 12th European IFSA Symposium

Social and technological transformation of farming systems: Diverging and converging pathways

Understanding farming as systems recognises the interconnections and dependencies among its many human and non-human dimensions. As changes in farming systems take place at all levels (*eg* individual to farm, local to global *etc*), understanding the nature of these interconnections and dependencies can be challenging. IFSA's 2016 symposium focuses on particular kinds of change, social and technological transformation It considers not only what is changing in terms of these dimensions and their contexts, but also how they relate to each other and how purposeful social and technological transformation of farming systems in different parts of the world are realized and how they could be brought about in the future.

The symposium focuses on particular kinds of change, social and technological transformation. The focus is not only what is changing in terms of these dimensions and their contexts, but how they relate to each other and how purposeful social and technological transformation of farming systems in different parts of the world are realized and how they could be brought about in the future. The concept of 'transformation' rather than just change is at the core of several different 'applied' systems traditions so is a particularly appropriate focus for IFSA. It is relevant to learning, methodology, sustainability, innovation, institutions and governance which will all feature in the themes of the symposium. The focus on the social and technological is, however, not exclusive. Interconnections and dependencies with other dimensions of change (e.g. environmental, economic or political) are fully acknowledged.

The relationship between social and technological dimensions of farming systems is particularly relevant to our current times with different communities responding to these dimensions in a range of ways – on diverging and converging pathways in relation to culture, values and purpose, capital intensity and to scales and nature of operation. As we proceed through 2016, farming in Europe and indeed across the world faces many issues including climate change, food security, food quality and safety, water and soil security, waste management, energy, conservation of biodiversity, resilience of communities, multi-functionality, farm restructuring, competition and innovation. The situation in Europe is more complex following the likely exit of the UK from the EU.

In order to address such questions and deepen our understanding of social and technological transformation, we have welcomed a diversity of perspectives on farming systems and different narratives of pathways. We have strived to attract researchers and practitioners from both natural and social science backgrounds who are new to systems thinking and who may be able to contribute constructively to the debate on how we can design and deliver more sustainable farming and livelihood systems for the future.

Using social media at the IFSA 2016 Symposium

If you are a Twitter user, please use the hashtag **#IFSA2016** in your tweets. The media team at Harper Adams will try to ensure your tweets reach the widest sudience.

Programme

Tuesday 12th July

12.00PM	Symposium Registration Opens
4.00PM	Interactive Opening Activity with Professor Nadarajah Sriskandarajah (upstairs in Queen Mother Hall)
6.00PM	**Close**

Wednesday 13th July

9.00AM	Opening Plenary Session 1 (Weston Lecture Theatre)
9.45AM	Opening Plenary Session 2 (Weston Lecture Theatre)
10.30AM	Coffee
11.00AM	Workshop Sessions 1
12.30PM	Lunch
1.30PM	Workshop Sessions 2
3.00PM	Coffee Break
3.30PM	Workshop Session 3
5.00PM	IFSA Board Meeting (Weston Lecture Theatre)
6.00PM	Close

Thursday 14th July

9.00AM – 5.00PM	Field Trips Meet outside Queen Mother Hall at 9.15AM
7.30PM	Drinks in Regional Food Academy Conference Space and Symposium Dinner (for delegates who chosen this option)

Friday 15th July

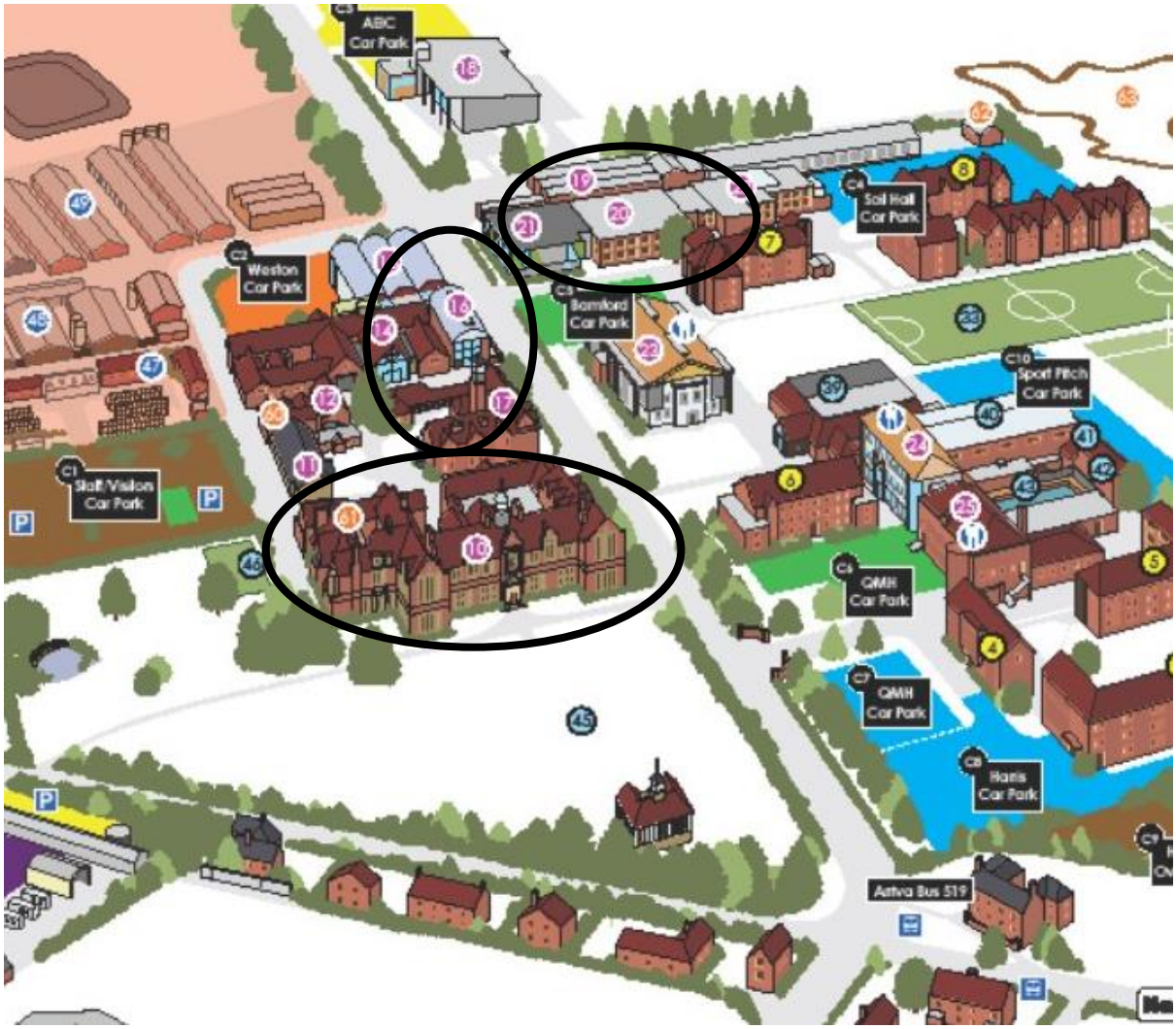
9.00AM	Workshop Sessions 4
10.30AM	Coffee
11.00AM	Workshop Sessions 5
12.30PM	Lunch
1.30PM	Closing Plenary Session 3 and review of Symposium (Weston Lecture Theatre)
3.00PM	Close

Conference Venue

The 12th European IFSA Symposium is held at Harper Adams University in the beautiful Shropshire Countryside. The University is the premier destination for agriculture and the land based industries in the UK. The University is located at the centre of a 343 hectare mixed farm comprising areas of arable, grassland, woodland, conservation and experimental areas. The farm has dairy, pig and poultry operations that are used for educational purposes but run on a commercial basis. The Symposium will be delivered mainly in the following areas:

- **Main Building**
- **Weston Building** (Registration Desk)
- **Postgraduate Building**
- **Teaching Block**

Coffee breaks will be held in the **Regional Food Academy Foyer** and meals (including the Symposium Dinner) in the **Dining Hall**. The Opening Activity will be held upstairs in **Queen Mother Hall** above the Dining Hall. You will be provided with a large scale map in your conference pack, but the diagram below shows the general location of the main Symposium areas.



Overview of workshop locations during the IFSA Symposium

Tuesday 12th July			Interactive Opening Activity 4.00PM Queen Mother Hall													
	Workshop Session	Workshop Time	WG1	WG2	WF1	WF2	RFA SR1	PC003	PC002	TF3	TF4	TF6	TG5	M11 (Board room)	M21 (Temperton Room)	M31	Weston Lecture Theatre
Wednesday 13th July	1	11.00 -12.30PM	1.1	5.9	1.2	2.2	3.3	4.1	1.5	1.3	1.4	2.3	5.4	5.8	5.7		
	2	1.30-3.00PM	1.1	5.9	1.2	2.2	3.3	4.1	1.5	1.3	5.1	2.3	5.4	5.3	5.7	1.7	
	3	3.00- 4.30PM	1.1	5.9	1.2	2.2	5.5	2.6	1.5	1.9	5.1	5.2	5.4	5.3	5.7	1.7	
		5.00 - 6.00PM															IFSA Board
Thursday 14th July			FIELD TRIPS														
Friday 15th July	4	9.00- 10.30AM	1.1	5.6	3.1	2.2	1.6	4.3	2.5	1.10	3.4	2.4					
	5	11.00-12.30PM	1.1 & 1.7 & 1.6	5.6	3.1	2.2	1.8	4.3	2.5	1.10	2.6	2.4					

Room Locations
WG = Weston Building
RFA SR = Regional Food Academy, Seminar Room
PC = Postgraduate Centre
TF/TG = Teaching Block
M = Main Building

Abstracts

Opening Plenary 1

A systems approach to improve potato varieties for organic farming systems

Edith T. Lammerts van Bueren[1,2], Ronald Hutten[2] & Christel Engelen[2]
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[2] Wageningen UR Plant Breeding, Wageningen University, Droevendaalsesteeg1, 6708 PB Wageningen, The Netherlands (edith.lammertsvanbueren@wur.nl)

Potato late blight (*Phytophthora infestans*) is one of the largest problems in organic potato production due to a lack of late blight resistant varieties and of appropriate fungicides. As breeding varieties for the relatively small organic sector is economically a challenge for commercial breeding companies, a special (classical) breeding program ('Bioimpuls') was designed in a participatory manner according to the traditional way of potato breeding in the Netherlands (Almekinders et al., 2014). The team consists of breeding researchers from Wageningen University and Louis Bolk Institute, and six commercial breeding companies. By setting up yearly breeding courses over 10 farmer breeders are now linked to this programme and are actively involved in the yearly selection. To allow the new varieties to be adapted to organic farming systems, several variety characteristics need to be improved. These include, in addition to late blight resistance also resistance to other diseases such as Rhizoctonia, Alternaria, viruses and scab, as well as nitrogen use efficiency, good storability without chemical sprouting inhibitors, good flavour, and last but not least: good market performance, e.g. appropriate flesh colour and a smooth skin. The focus is not merely on varieties that are adapted to low-input and organic growing conditions, but also on variety characteristics that allow an resilient farming system to function as a whole. This includes long term durability of resistance and measures to avoid breakdown of the new resistances by combining genes from different wild potato relatives and by selecting for clones that are not too late maturing to reduce the time of exposure to late blight infestation. The results will lead to a diversity of varieties as not only the general requirements are taken into account but also the individual selection criteria of each participating farmer due to differences in soil type, rotation, specific disease pressure, nutrient requirements, etc. Active commitment of other chain actors such as wholesalers and retailers is essential which was developed during an additional EU project COFREE enhancing market acceptance of the current eight late blight resistant varieties.
By embedding this breeding programme within the conventional breeding sector with commitment of the organic farmers and other chain actors, this systems approach does not only aim at ecological sustainability based on the values of organic agriculture but also on socio-economic continuity after the project ends.

Reference

Almekinders, C.J.M., L. Mertens, J.P. van Loon, E.T. Lammerts van Bueren, 2014. Potato breeding in the Netherlands: a successful participatory model with collaboration between farmers and commercial breeders. Food Security 6: 515-524.

Acknowledgement

This breeding programme Bioimpuls (2009-2019) is financially supported by the Dutch Ministry of Economic Affairs under the Green Breeding Programme, see www.louisbolk.nl/bioimpuls.

Biography of Edith T. Lammerts van Bueren

Dr. Edith T. Lammerts van Bueren (1952) was trained at Wageningen University in agronomy and has more than 25 years of experience in organic research and management. After being involved in a broad field of organic agriculture for many years, she specialised and pioneered in plant breeding and genetic resources for organic, low-input agriculture and has put this subject to the European agenda. She holds a chair at Wageningen University in the Netherlands as professor Organic Plant Breeding since March 2005. And she is also senior researcher Organic Plant Breeding at the Louis Bolk Institute in the Netherlands, a research institute specialised in organic agriculture, health care and nutrition. Edith was co-founder and president of the European Consortium for Organic Plant Breeding (ECO-PB) for 10 years, and is now chair of the Section Organic and Low-input Agriculture of EUCARPIA (European Association for Research for Plant Breeding). She aims at building bridges between existing expertise among both farmer breeders and professional breeders, and incorporating efforts of other stakeholders towards chain-based or community-based breeding models. She is also active in a broader field of sustainability and chairs a Dutch scientific interdisciplinary think-tank Council for Integral Sustainable Agriculture and Nutrition, which published their first report in 2012, and successfully elaborated on two cases studies (2013, 2015), see www.ridlv.nl.

Opening Plenary 2

Globalization, China and the New Zealand Dairy Assemblage

Michael Woods, Aberystwyth University, UK (zzp@aber.ac.uk)

This paper examines how the globalization of agriculture is reproduced through small-scale processes and practices of assembling and re-assembling not only transnational flows of commodities, capital, labour and material inputs, but also the physical and organizational structure of individual farms, and how these changes impact on the wider rural environment and rural communities. The case study focuses on the recent evolution of the dairy industry in New Zealand in response to shifting global markets, particularly the growth in demand for milk powder from China. Since deregulation in 1984, New Zealand agriculture has been particularly exposed to global economic trends and competition, with adjustment driving re-structuring of the industry including the expansion of the dairy sector. By adopting an 'assemblage' approach that emphasizes relationality, contingency and the combination of human and non-human actants and components, the paper analyses these developments at three levels. Firstly, it traces how the growth of New Zealand dairy trade to China was facilitated by the assembling of diverse technological, financial, transport and representational components, including the coding of New Zealand dairy produce as 'pure' and 'untainted'. Secondly, it examines how the rise in value of dairy products stimulated conversion of sheep and beef farms and forestry land to dairying, with conversions involving the re-assembling of farm systems, including the incorporation of components sourced internationally, such as cattle feed from Australia, hybrid maize seed developed in the US, and irrigation systems manufactured in China. Thirdly, as farms are embedded in rural environments and communities, the paper explores the wider consequential effects of dairy conversions, from watercourse pollution and changes in the appearance of the landscape, to in-migration by Filipino farmworkers and the wear of increased tanker traffic on rural roads. As such, the paper argues that globalization as experienced in farming communities is not a top-down imposition, but is the outcome of multiple, inter-connected and inter-dependent actions at diverse scales.

Biography of Michael Woods

Michael Woods is Professor of Human Geography at Aberystwyth University in Wales and has research interests that primarily focus on issues of globalization and rural change, rural politics and protest, and community governance and participation. He is currently leading a European Research Council project, GLOBAL-RURAL, which is investigating the restructuring of rural economies and communities by globalization, and is also Co-Director of the ESRC WISERD/Civil Society Research Centre and a former Co-Director of the Wales Rural Observatory. Michael is Editor of the Journal of Rural Studies and author of a number of books, including the textbooks Rural (Routledge) and Rural Geography (Sage).

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.1: **Generating spaces for innovation in agricultural and rural development**

Convenors: **Alex Koutsouris**, Agricultural University of Athens, Greece. (koutsouris@aua.gr).
Andrea Knierim, University of Hohenheim, Germany (andrea.knierim@uni-hohenheim.de).
Eelke Wielinga, Link Consult, The Netherlands. (eelke.wielinga@gmail.com).

Stimulating Innovations: Building Bridges and Generating Spaces

Eelke Wielinga[1], Alex Koutsouris[2] and Andrea Knierim[3]
[1]LINK Consult / ZLTO, The Netherlands, [2]Agricultural University of Athens, Greece, [3]University of Hohenheim and ZALF Müncheberg, Germany

This paper aims to summarise the main features of the AgriSpin project. The project is being financed by the *Horizon 2020* research program of the European Commission aiming at contributing to system-oriented innovation research in agriculture and as complementary to the policy instrument EIP AGRI. The idea behind EIP AGRI is that innovation emerges from interaction between stakeholders. Following this idea, the focus of attention shifts from diffusion of innovations to ways for creating space in which interaction might lead to innovation as a co-creative process. The AgriSpin project ("Space for Innovations in Agriculture") comprises 15 organisations in 12 EU countries cooperating for a period of 2½ years (March 2015 – October 2017) to address questions pertaining advisory work in relation to the stimulation of innovations at farm level. This paper aims to describe the main features of the project focusing on its conceptual background and methodological challenges while also pointing to some remarkable results (pearls and puzzles) that can be observed so far.

How to implement effective and efficient agricultural innovation support systems? Some insights from a European cross – country analysis.

Elena Favilli[1], Leo Dvortsin[2] and Gianluca Brunori[1]
[1]University of Pisa, [2]Wageningen University

It is acknowledged that innovations in agriculture and rural development need to be adequately fostered. Within a system approach applied to this matter, the role of people and organizations able to catalyse innovation through bringing together of actors and facilitating their interaction is growing in relevance. In such a model the intermediaries are assumed to play a key role in developing social impact and sustainability outcomes for regional rural development.
In this perspective, the European Innovation Partnership for agricultural productivity and sustainability (EIP-AGRI), which can be perceived as a platform based on interaction among farmers, researchers, and advisors/extensionists, represents a useful tool for a better understanding of applied innovation processes. Grounded in the activities performed within the EU Project Agrispin, in this paper we attempt to contribute to the identification of effective and efficient approaches for the implementation of the EIP-AGRI strategy.
Specifically, we present some preliminary findings on the functioning of EIP-AGRI system and

Operational Groups across five European regions and countries (Italy, Poland, Germany, The Netherlands, and Belgium), by comparing different implementation modalities of the EIP strategies. With this analysis, we aim to portray the practical implications for agricultural innovation support systems. In addition, we interpret the role and the actions undertaken by public authorities in supporting such innovation systems in their regional contexts. Finally, we try to explain the enabling dynamics behind institutional uptake of these innovations into the local public support systems, by addressing the issue of "institutional change" at both regional and local levels.

Agricultural networks across EU: What are the key features to enhance farmers' ability to learn and to innovate in cooperation with other actors?

Livia Madureira[1], Andrea Knierim[2], Dora Ferreira[1], Katrin Prager[3], Kinga Boenning[4], Monica Caggiano[5]

[1]University of Trás-os-Montes e Alto Douro (UTAD), CETRAD (Centre for Transdisciplinary Development Studies), Quinta de Prados, 5000 801, Vila Real Portugal, [2]Hohenheim University, Institute of Social Sciences in Agriculture, Stuttgart, Germany, [3] Social, Economic and Geographical Sciences, The James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, Scotland UK, [4] Leibniz-Centre for Agricultural Landscape Research, Müncheberg, Germany, [5] INRA SAD-APT, 16 rue Claude Bernard, 75231 Paris Cedex 05, France

Multi-actors networks are increasingly used by farmers to link between them and to be interactively connected with other partners, such as advisory organizations, local governments, universities, and non-farm organizations. Given the importance assigned to the agricultural innovation by EU resorting to the networking between the research chain actors and the farmers, a strong focus on enhancing the creation of learning and innovation networks is expected. In this context is relevant to have information about the features of such networks enhance farmers' ability to learn and to innovate in cooperation with other actors. The main goal of the paper is to contribute to the understanding of which are the features of agricultural or rural networks showing determinant to enhance the farmers' ability to learn and to innovate in cooperation with other actors, namely by identifying the influencing factors encouraging the farmers' enrolment and the influence of network stability. The additional goal of the paper is to provide insights on the way these networks link to R&D infrastructures and advisory services. Five case studies were conducted in Italy, Germany, Portugal, and UK comprising heterogeneous networks. The results highlight aspects that show decisive for the networks ability to provide effective learning and innovation platforms, including bottom-up functioning, informality, leadership and power balance, along with the participation of facilitators when networks are large and heterogeneous. These networks focus on innovation exploitation and depend on the existence of a support subsystem, namely a functioning R&D and advisory services infrastructure. They can fill in gaps in this infrastructure, but they cannot replace it.

New Knowledge Networks of Small-Scale Farmers in Europe's Periphery

Lee-Ann Sutherland[1], Lívia Madureira[2], Violeta Dirimanova[3], Malgorzata Bogusz[4], Jozef Kania[4], Krystyna Vinohradnik[4], Rachel Creaney[1], Dominic Duckett[1], Tim Koehnen[2], Andrea Knierim[5]

[1]James Hutton Institute, UK, [2]Centre for Transdisciplinary Development Studies (CETRAD), Portugal, [3]Agricultural University of Plovdiv, Bulgaria, [4]University of Agriculture in Krakow, Poland, [5]University of Hohenheim, Stuttgart, Germany

In this paper we assess the integration of new entrants to small-scale farming into agricultural knowledge and innovation systems (AKIS), in four study sites located on Europe's periphery (Bulgaria, Poland, Portugal, and the United Kingdom). Utilising qualitative case studies undertaken in 2013, we assessed the knowledge acquired to inform three new activities being undertaken by study participants: agricultural production; subsidy access and regulatory compliance; and farm diversification (specifically agritourism). Findings were assessed in relation to network structure, demonstrating clear patterns in new knowledge access: formal 'agricultural advisors' identified in the case studies were sought primarily for codified managerial knowledge which was delivered through centralised networks. In contrast, production and diversification knowledge were exchanged through 'distributed' and 'decentralised' networks, where a range of actors were involved across varying geographical distances. Findings thus suggest that state-funded services for small-scale farmers are largely embedded in traditional, linear models of knowledge transfer, and confirm earlier research that small-scale farmers are under-serviced by formal advisory services. However, new entrants employ more flexible, multi-actor approaches to production and diversification, much of which was 'free' in terms of financial cost, but not necessarily freely available to those without substantive social capital lodged in communities of place and practice. In all four cases, we found that small-scale farmers utilise formal advisory services primarily for accessing subsidies (e.g. completing application forms), rather than acquiring production knowledge. The authors argue that by utilising the limited state funding allocated to advisory services for small-scale farmers primarily to enable these farmers to access subsidies, important opportunities for the 'generation of space for innovation' can be lost.

Stimulating innovation opportunities through shared and unique connections of intermediaries within advisory networks

Dr Barbara King and Dr Ruth Nettle
University of Melbourne

Agricultural advisers are key intermediaries embedded within complex knowledge networks comprised of farmers and a range of private, industry and government stakeholders. Privatization of extension increases opportunities for market based extension services while changing the role of government and creating new challenges for knowledge sharing within networks. While privatization of extension has received considerable attention with respect to implications for public and private good, less consideration has been given to structural and relational implications for knowledge sharing. This study therefore considers the question 'how is knowledge sharing enabled in privatized extension networks?' To examine this question an empirically based case study was undertaken involving five industry extension advisers, referred to as Regional Extension Coordinators (RECs). This team was set up two years ago by Australia's dairy industry peak body, Dairy Australia to fill a gap in extension coordination and services left by the withdrawal of government extension services. Social network analysis in combination with qualitative data was used to identify the knowledge sharing relationships of RECs within their team as well as each REC's individual extension network. Findings show that the composition of each Regional Extension Coordinator's (REC's) network reflects differences in their professional backgrounds, for example whether their previous roles were in government or agribusiness. Knowledge sharing opportunities for the REC team include creating opportunities to access each other's unique contacts, identifying team strategies for

working efficiently with contacts they have in common, and developing approaches for working more effectively with network contacts considered 'not very enabling'.

Variable Collaborative Learning Spaces in the Quest for Agricultural Sustainability in New Zealand

McEntee, M
School of Environment, University of Auckland, New Zealand.

Participatory research is advocated for fostering multi-stakeholder engagement and learning necessary for advancing sustainability. This work examines how participatory projects develop collaborative learning to advance agricultural sustainability. It presents findings from empirical evidence from six micro-level horticultural innovation projects in New Zealand where farmers and scientists engaged in public / private funded partnerships. Analysis revealed institutions, partner relationships and learning were critical and highly inter-related dynamics of participatory research projects. This paper focuses on the creation of learning spaces in these projects that ideally should support and sustain change to more sustainable practices. The research revealed a 'collaborative learning space' influenced by the strength of partner relationships and institutions that shape how actors engage in participatory research. This paper visualises the variability of the collaborative learning space among the six projects and reveals the importance of this space where innovations can be co-developed and learning is emergent, adaptive and dynamic.

How agroecological farmers develop their own practices:a grid to describe the objects and mechanisms of learning

Cristofari, H., Girard, N., Magda, D.
Institut National de la Recherche Agronomique (INRA)

The agroecological transition -defined here as a transition toward practices based on the management of ecological processes- requires innovations involving a wide range of stakeholders, from farmers to scientists or intermediaries. An extensive literature has shown that agroecological farmers' practices cannot be exclusively based on the application and adaptation of general recipes to the specific context of their farms: for intermediaries, supporting farmers thus calls for opening innovation spaces in which they can develop their own practices and generate innovative agroecological knowledge rooted in their peculiar agroecosystem. As a consequence, we argue that it is important to better understand how this knowledge is developed. However, the ways in which farmers learn remain poorly investigated at the individual level. The major role of experience in learning leads us to build on Kolb's pragmatist theory and to consider the individual learning process as a continuous interplay between a farmer's experience and his or her capacity for action. The purpose of this paper is to propose an analytical grid to describe the mechanisms connecting the farmer's experience and his pragmatic judgements. To do so, we focused on the case of conservation agriculture. We conducted five semi-structured interviews with experienced farmers and qualitatively analysed them. The resulting grid exposes an array of learning mechanisms as well as the objects they may be linked with. This analytical grid may, in the future, be applied to a wider sample of farmers, as a means to better grasp the possible diversity of their learning processes. A deeper understanding of these processes would then help intermediaries to

identify which types of support are the most adequate for farmers engaged in the agroecological transition.

Farming System Transformation as Transition to Sustainability: a Greek quality wines case study

George Vlahos, Pavlos Karanikolas and Alex Koutsouris
Agricultural University of Athens, Department of Agricultural Economics and Rural Development

This study aims at analyzing the gradual transformation of a low input and bulk wine producing system into a quality system. This transformation is examined in Santorini Island in Greece during the last three decades, in a highly contested natural landscape. The conceptual framework draws from the 'transition to sustainability' approach, in particular the theoretical apparatus of the multi-level perspective (MLP). Spaces for innovations as well as threats for this transformation have been created by a series of 'socio-technical landscape' pressures, along with processes internal to the 'niche', the links between the niche and the 'regime', as well as multi-regime interactions. Public intervention in the form of both regulatory and incentive provision policy measures had a considerable impact on creating space for these reconfigurations and innovative forms of organization. A series of conflicts have been identified, as well as a polarization in the power game. Despite significant efforts for co-ordination among local stakeholders, there's a need for more permanent forms of co-operation such as an innovation platform. The interests vested are important hence the necessity of an institution acting as a mediator seems to be apparent.

Alternative medicine in dairy breeding: the key-role of atypical veterinarians

Hellec F.[1], Manoli C.[2], Joly N.[3]
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[2]Ecole Supérieure d'Agriculture d'Angers, [3]AgroSup Dijon

There is a scientific debate on impacts of private stakeholders increase in agricultural extension services. Some social scientists consider that concurrence goes against investment in new techniques. However, in the past many agricultural innovations have been promoted by private stakeholders, for example in organic farming and conservation agriculture. At present time, European Union encourages farming sector to reduce antibiotic use, in order to avoid antibiotic resistances in human medicines. In consequence, farmers show great interest for alternative medicine, like those promoted by atypical veterinarians: homeopathy, aromatherapy, plant and manual medicines.

Our communication focuses on a collective of homeopath veterinarians, which is called “GIE Zone verte” (ZV) and which is dedicated to farmers’ trainings and advisory services, mainly for organic breeders. Our analysis aims to understand why and how they are committed in diffusion of alternative approaches in animal health management. Our survey is made of (i) interviews with these professionals and also with dairy farmers, technicians and trainers, and (ii) observations made during trainings on animal health and meetings of farmers’ groups. We show that members of ZV are part of a professional segment of atypical vets, who defends another vision of vet medicine. Farmer autonomy and animal health equilibrium are the key concepts of their trainings. But they keep an expertise position with respect to farmers. In conclusion, we discuss their interaction with trainings organizers and their role in breeding innovation processes.

Social and technical influences that enable and constrain adoption of genetic improvement by commercial lamb producers.

Erica Schelfhorst[1], Ruth Nettle[1], Barbara King[1] and Roger Wilkinson[2]
[1]The University of Melbourne, Victoria, [2]Department Economic Development, Jobs, Transport and Resources, Warrnambool, Victoria

Productivity is important for improving the long term profitability and competitiveness of commercial lamb producers and the Australian lamb industry. Productivity can be achieved in part through improved genetics and as such it is considered a key profit driver for sheep producers. Yet improved genetics, such as breeding value technologies are still not completely accepted or adopted and the uptake of this technology is seen to be slower compared to other animal industries. The value of genetic improvement to productivity and profit has been repeatedly proven and demonstrated in scientific studies and yet the question that is still not well understood or investigated is why some commercial producers do not see and acknowledge the potential benefits. With genetic technology rapidly expanding, becoming more sophisticated and possibly more complex, there is now a greater need to recognize how producers make sense of breeding values and how social influences impact upon behaviour and beliefs or the meaning given to actions. Drawing on qualitative social research methodology and an agricultural innovation systems framework this study will explore the organisational roles and interactions of supply chain actors to address the following question ‘How do social and technical arrangements within the Victorian lamb industry support or hinder adoption of genetic improvement by commercial lamb producers? Data collection and preliminary analysis to inform the research started in 2015. A number of focus groups with commercial lamb producers and semi structured interviews with industry representatives form the basis of early learnings around actor roles, beliefs, confidence, knowledge exchange and interactions.

Development of an assessment framework for researcher-farmer knowledge exchange: the case of DAIRYMAN

Lies Debruyne[1], Laure Triste[1], Fleur Marchand[1,2], Ludwig Lauwers[1,3]
[1]Institute for Agricultural and Fisheries Research (ILVO), Social Sciences Unit, [2]University of Antwerp, Ecosystem Management Research Group and IMDO, [3]Ghent University, Department of Agricultural Economics

Knowledge is being recognized as a crucial resource in the search for more sustainable farming practices. We present a literature review, discussing i) the types of knowledge at stake, ii) by who and how it can be created or acquired optimally, and the different associated learning processes and iii) on the role of networks and communities in supporting processes of knowledge exchange and co-creation. Taking indications from literature, we propose an assessment framework to evaluate the potential of an extensive network to provide farmers with support to tackle sustainability challenges. The international network consisted of 10 interconnected, smaller regional networks, and was created during the European Interreg IV project 'DAIRYMAN' (2009-2013). Our framework is aimed at assessing individual learning in a social context, combining elements from an individual-centric framework developed by Lankester (2013) with the concept of value-creation, designed for networks and communities (Wenger et al., 2011). Follow-up research will use the developed framework to answer two main research questions; i.e. i) Does the DAIRYMAN network support knowledge exchange and what, how and why have participants learned? And ii) What are the differences in regional networks, and has this influenced participants' learning outcomes?

University research enters practice – and is enhanced by farmers. A Precision Farming case study

Kerstin Huelemeyer
Institute for Rural Development Research at the Goethe University Frankfurt (IfLS)

This paper describes the case of a Precision Farming technology, the Yara N-Sensor. This more than 15 years old successful university research based innovation has since been supplemented by two modules which have been co-developed by farmers. Today, the optical crop sensor is used for site-specific nitrogen, growth regulator and fungicide application deriving optimum site-specific application rates which are sent to the spreader or sprayer. The most important impacts of the N-Sensor are efficient use of inputs, higher yields and a better harvesting performance.
We trace the innovation's impact pathway from the initial research proposal to the current adoption on estimated 700,000 ha of agricultural land in Germany. Based on a dissertation project running from 1994 to 1996 at the University of Kiel, the innovation was brought into practice by Yara, a mineral fertilizer producer, in 1999. It has since been constantly enhanced, not only by Yara but also by a German SME named AgriCon. The latter company is responsible for sales and marketing in Germany and became a co-developer of the sensor through the development of the two additional modules together with farmers.
For the case of the YARA N-sensor, we detect enabling factors and barriers for innovation. Based on these results we draw conclusions on what we can learn from the presented case on how to foster the innovation diffusion and related knowledge co-production and learning processes. Closeness and proximity to farmers seems a key factor in this respect.

Building social capital and promoting participatory development of agricultural innovations through farmer field schools: The Greek experience

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More than 25 years after the first implementation of Farmer Field Schools (FFS), there is a rich corpus of evidence that participation in FFS improves farmers' knowledge, skills, and competencies. On the other hand, several studies converge to show that FFS, by strengthening group action, have the potential to build-up social capital among participants and, thereafter, within local communities. However, it is not yet clear if this social capital is reflected in the levels of knowledge gained by FFS participants and to what extent it promotes farmers' participatory engagement in the process of innovation development. To answer these questions we used between and within-subjects approaches. Data were drawn from facilitators and cotton farmers who participated in an FFS project aimed at the development of competencies in three domains: integrated crop management, farm management, and occupational safety. In a first step we developed three measures to assess the levels of social capital among farmers, the degree to which each participant contributed to the co-production of innovations within the framework of the project, and the knowledge gained by farmers. Regression analyses confirmed that the levels of social capital – and especially bonding social capital – do indeed predict both the co-production of innovations by farmers, and the levels of knowledge they gain through their participation in FFS. These findings indicate that cultivating social capital among FFS participants is a key element in facilitating the construction of knowledge and the co-evolution of agricultural innovations by farmers, two of the core foci of FFS approach.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.2: **Monitoring and Evaluation for Learning and Innovation**

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Applying the Participatory Impact Pathway Analysis (PIPA) approach to enhance co-innovation for sustainability within livestock family farming in Uruguay

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Participatory approaches are needed to ensure learning processes and to incorporate lessons learned during the implementation of a project. This is particularly important when the aim is to improve farm sustainability considering changes in knowledge and skills, natural resources management and networking. This paper describes the Participatory Impact Pathways Analysis (PIPA) implemented within the participatory action research project “Co-innovating for the sustainable development of livestock family-farming systems in Rocha, Uruguay”, which involved stakeholders for planning, monitoring and evaluating of the project’s progress. Six workshops were implemented during 2012 - 2015 to enhance the project’s actions. Participatory methods were used to adapt PIPA to the Uruguayan culture. During 2013 an interinstitutional network was established, a shared vision of expected project results was defined, as well as impact pathways, goals and activities to achieve them. During the 2014-2015 workshops, reflections and suggestions led in turn to new or modified activities. This process contributed to confidence and commitment building, improving the quality of the established relationships and strengthening networking to enhance the dissemination of the project findings. As a result of the learning process, and inspired in the project’s methodological and technological results, one stakeholder organization established a project for another region. The last workshop focused on a participatory evaluation of the whole project, demonstrating that a successful innovation process took place. This Uruguayan case showed that within the co-innovation framework, the PIPA approach nurtured the creation of a common space for social learning and innovation, providing a useful instrument for rural development.

What is capacity to innovate and how can it be assessed? A review of the literature

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'Capacity to innovate' is an emerging concept, especially in agriculture and rural development. There is no universally agreed definition for this concept, but many authors agree that it refers generally to the ability of actors to continuously identify constraints and opportunities, and to mobilize capabilities and resources in response – i.e. to produce and sustain innovation processes in a dynamic systems environment. Increasingly, capacity to innovate (C2I) is recognized as playing a critical role in successfully responding to a changing external environment. Facilitating and building this capacity is therefore crucial for adaptable farming systems and for improving the resilience and livelihoods of poor farmers and other rural actors. This paper summarizes the findings of a targeted literature review aiming to unpack the concept of C2I, exploring its meaning across all research sectors and ways to assess it in agricultural communities.
We propose that the various dimensions of C2I identified through the literature review can be a starting point for developing an assessment framework to measure changes in C2I. Specifically, we identify four core capacities that make up C2I: (1) to envision and create new ways of doing things; (2) to connect with others to access and understand new information and resources; (3) to experiment, test, assess, and adapt; and (4) to work with others to achieve action and change. We review previously described indicators to measure these concepts, and accordingly propose an initial set of metrics for use in agricultural communities. We conclude that the C2I concept puts a spotlight on process-driven approaches to innovation that have previously been undervalued.

Evaluating for learning and accountability in system innovation: Incorporating reflexivity in a logical framework

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Approaches to accelerate innovation have become more integrated and systemic over time, such as Agricultural Innovation Systems and co-innovation (Brunori *et al.* 2008; Knickel *et al.* 2009; Fischer *et al.* 2012). Primary Innovation is a New Zealand co-innovation program in which innovation is conceived as being 'co-produced' by stakeholders who contribute their unique knowledge to solving a problem or realising an opportunity. In co-innovation, cyclical processes of planning, doing, observing and reflecting enable innovation to emerge from interactive learning among stakeholders (Botha *et al.* 2014). The value of applying logic models, logical frameworks, programme theories or theories of change and concurrently evaluating the effects of co-innovation practices (particularly reflexive processes) in order to understand the extent of learning in and impact from systemic projects have been questioned and debated (Klerkx *et al.* 2012; Regeer *et al.* 2016).

In this paper we argue that when flexibly applied and adapted to capture dynamics typical in systems innovation projects, the Log Frame Approach (LFA) (Gaspar 1999; AusAid 2005; Kaplan 2015) and logical frameworks (Kaplan 2015) have considerable utility to support evaluation for both learning and accountability, and for identifying and addressing institutional logics, which leads to system innovation. We demonstrate this for the case of Primary Innovation, and compare our experiences with the limitations and solutions suggested by Regeer et al. (2016) when applying logic models, logical frameworks, programme theories or theories of change as part of an `adapted accountability framework'.

Outcome Evidencing: A Rapid and Complexity-Aware Evaluation Method

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This paper describes the development and use of a rapid evaluation approach to meet program accountability and learning requirements in an on-going research for development program operating in five developing countries. The method identifies clusters of outcomes to which the program has contributed, within program areas of change. In a workshop, change agents describe the causal connections within outcome clusters to identify outcome trajectories for subsequent verification. Comparing verified outcome trajectories with existing program theory allows the program to question its underlying causal premises and adapt accordingly. The method can be used for one-off evaluations that seek to understand whether, how and why program interventions are working. Repeated cycles of Outcome Evidencing can build a case for program contribution over time that can be evaluated as part of any future impact assessment of the program or parts of it.

Small-scale farmers' perspectives on what enhances capacity to innovate

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Agricultural research and development (ARD) agencies are now more aware of the importance of enhancing capacity of small-scale farmers to innovate and to become better able to adapt to new conditions, problems and opportunities. Challenges for these agencies include: i) monitoring and evaluating changes in capacity to innovate (C2I) at individual and community level as a result of their interventions; and ii) using the monitoring and evaluation (M&E) process as a means for all stakeholders in ARD to learn about what favours and constrains local innovation. Usually, the intervening ARD actors develop the M&E approaches, criteria and indicators to use. In order to better understand the factors that influence C2I from the perspective of small-scale farmers, a mini-study was carried out among 12 such farmers who showcased their innovations at the West African Farmer Innovation Fair in May 2015. The study explored what they saw as the main factors that strengthened local C2I. Semi-structured interviews revealed that many factors identified by the farmers were similar to those identified by intervening agencies, but other factors were mentioned only by farmers, e.g. the role of

supportive family members, neighbours and others in their social networks in the innovation processes. Although very limited in scope, this mini-study indicated that there is more to C2I than intervening ARD agencies may expect. This paper calls for attention to this essential yet neglected aspect – the perspectives of small-scale farmers – in evaluating programmes that seek to build C2I as part of their theory of change.

Monitoring & Evaluation for Research for Development - Building a Results-based Management System for Climate Smart Agriculture

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Making farming systems more climate smart requires taking different disciplines, sectors and scales into account, at the same time as facilitating farming system innovation within the context of climate change. Here we present a research-for-development program's case of the evolution from a logframe approach to an outcome and results-based management oriented Monitoring, Evaluation and Learning (MEL) system. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is designing an impact pathway-based MEL system that combines classic indicators of research quality with innovative process and outcome indicators of developmental change. CCAFS has developed a methodology for evaluating with stakeholders factors that enable or inhibit progress towards behavioral outcomes in study sites and regions. Impact pathways represent the program's best understanding of how engagement can bridge the gap between research outputs and outcomes in development. Strategies for enabling change include a strong emphasis on partnerships, social learning, gender and social inclusion, capacity building, communication, and MEL that focuses on progress towards outcomes. The importance is highlighted of working with next-users in the development of impact pathways and consistent engagement with partners and users of research outputs throughout the life of the program. Theory of change can be used to balance the drive to generate new knowledge in agricultural research with the priorities and urgency of the users and beneficiaries of research results. Research alone may not lead to impact, but it can generate knowledge that can be put into practice to generate development outcomes.

Reflexivity in and through evaluation: shedding light on its meaning for system innovation initiatives

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Complex problems need a freeing-up of formal and informal rules and relations that guide problematic standard actions and routine practices. This could take place in an interactive learning process. Several evaluation approaches have emerged to actively support system innovation from a reflexive perspective. The current conceptualisations of reflexivity however, provide insufficient clarity and hence no guidelines for such evaluations. In our paper, we first make a case regarding the need for reflexive evaluation approaches and their key features, based on an earlier paper. We then present a framework to operationalise and investigate reflexivity and its relation with learning empirically, with the purpose of informing reflexive evaluation approaches addressing complex problems. The potential value of this framework is illustrated with a case of a sustainability initiative in the Dutch greenhouse sector, which we

supported with Reflexive Monitoring in Action. With an ex-post, secondary analysis of all the data collected, the changes in reflexivity as well as the associated outcomes of learning were traced from a temporal perspective. We conclude that learning among the actors in a system innovation process may indeed contribute to reflexivity. However, the relation between the two is weak; reflexivity is clearly also the outcome of the interactions between initiative and context. This has implications for reflexive evaluation approaches.

Welfare Impacts of Agricultural Innovations. A Theory-based Impact Assessment of Biochar as a Soil Amendment and Improved Wastewater Irrigation in West African Cities

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This paper proposes a methodology for systematically assessing the welfare effects of agricultural innovations, exemplified by biochar as a soil amendment and improved wastewater irrigation in the West African cities of Tamale (Ghana) and Ouagadougou (Burkina Faso). Intensive cultivation of vegetables on small urban open-space plots has resulted in declining soil fertility and yields. Insufficient irrigation and nutrients have promoted the use of wastewater irrigation amongst urban vegetable farmers, exposing urban producers and consumers to health-related risks. Productivity-enhancing innovations may simultaneously improve the livelihoods of urban farm households as well as, through reduced market prices, increase the food security of consumers. Additionally, improved irrigation technology to reduce pathogen loads on vegetables may enhance food safety but increase production costs. In order to evaluate economic impacts of such technology enhancements ex ante, a household production function for urban vegetable farmers that integrates soil fertility indicators is developed, alongside an aggregate supply and demand model for urban vegetable markets. This will allow the dynamic estimation of income effects for urban farmers due to production changes with resulting price changes at the market level. To scrutinize further assumptions pertaining to both consumers‘ and producers‘ perceptions on the costs of illness, studies on the opportunity cost of wastewater-related illnesses of producers and consumers‘ willingness to pay for safe, certified food are being conducted. The combination and integration of a farm-level assessment of productivity changes, analysis of market-level changes and contingent valuation studies on consumers’ preferences allows for a holistic and systemic assessment of the sustainability of agricultural innovations.

Adaptive management intentions with a reality of evaluation: Getting science back into policy

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Adaptive management was initially proposed to address system uncertainty in natural resource management. In theory, adaptive management integrates scientific experimentation in policy planning and implementation to discover and gather knowledge from across a system’s stakeholders. It systematically tests hypothesis with the results redirecting or improving policy, applying a paradigm of scientific problem solving.

This paper uses a case of water management in Australia's Murray-Darling Basin. Water reform has been contentious as government attempts to reconcile historical over allocation of water to irrigation with the use of water to protect and restore wetlands of international biodiversity significance. In areas scientific knowledge of the system is either imperfect, incomplete or system responses are unpredictable. In this case there are legislative requirements for both adaptive management and evaluation. Evaluation looks to achievement of policy objectives, as determined through monitoring of system response and value judgements, in a structured framework of action, outputs, outcomes and objectives.
The intentions for adaptive management are compared to the reality, as determined through legislation, public speeches, government reports and semi-structured interviews with government policy makers and implementers. The findings demonstrate contradiction between intent and reality, with adaptive management subsumed by evaluation. The loss of adaptive management as a distinct concept is seen as a loss of science and discovery from the policy process. Despite intentions for adaptive management, the dominance of evaluation is discussed as limiting innovation, a 'muddling through' process of improvement and meeting political and accountability needs.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.3 **Using a co-innovation approach to improve innovation and learning**

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A co-innovation approach in family-farming livestock systems in Rocha - Uruguay: A three-year learning process

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There are opportunities to improve livestock family farms (LFF) sustainability in Uruguay by changing management practices and incorporating technologies, using the co-innovation approach. To harness these opportunities, between 2012 and 2015 a research project was implemented in Eastern Uruguay, where three simultaneous processes occurred at three levels: farm, region and research team. At farm level, the work was carried out in seven LFF as case studies. Through monthly visits to the farms by a field agronomist the process followed three phases using the Evaluation of Natural Resource Management Systems Incorporating Sustainability Indicators (MESMIS) framework: (i) characterization and diagnosis, (ii) re-design, (iii) implementation, monitoring and evaluation. As a result, farmer knowledge and skills for farm management improved and the farms increased their meat production and net income (23 and 56% on average, respectively) while preserving natural resources. At regional level, a participatory approach to planning, monitoring and evaluating the project´s progress with regional stakeholders was adapted from a Participatory Analysis of Impact Pathways (PIPA) method. An interinstitutional network was consolidated, which developed a common vision and expected project outcomes and designed a communication plan to disseminate the results. At team level, a Participatory Action Research (PAR) approach was carried out. A transdisciplinary team was consolidated through cyclic processes of research, reflection and action. Consensus on the objectives and methods allowed combining knowledge to solve practice-oriented problems. The three-year process demonstrated effectiveness in improving LFF sustainability, opening a learning space with stakeholders and contributing with a novel model of rural development: co-innovation.

Evaluating a space for co-innovation: The practical application of nine principles for co-innovation in five innovation projects

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Primary Innovation is a five year collaborative initiative demonstrating and evaluating co-innovation, a systemic approach to innovation addressing complex problems, in five 'innovation projects' (active case studies) in different agricultural industries. In defining the elements of co-innovation, Primary Innovation has emphasised nine principles (based on those from Nederlof et al., 2011) which guide activity in the innovation projects. To understand how useful the nine principles were in guiding practice, and their influence on co-innovation, innovation project participants assessed and reflected on: how the principles were applied in practice; issues that arose; how each influenced the project; and how important each principle was perceived as being in influencing project outcomes. Data were captured and summarised in an on-line survey. While each principle added an important element to each innovation project, different contexts and barriers to implementation required them to be applied in different ways and to different degrees. The nine principles should be understood in each individual project's context because their appropriateness and usefulness were affected by the type of problem being addressed and the stage of the project. It was also evident that they need to be built into the process from the start.

Hitting the bull's-eye: The role of a reflexive monitor in New Zealand agricultural innovation systems

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Reflexive monitors (RMs) are vital to the success of co-innovation approaches in Agricultural Innovation System (AIS) projects. While the practices utilised by RMs have been examined in various contexts, links between their roles and the theoretical frameworks they straddle is limited. This paper will address this gap in terms of explaining the case-specific behaviours that have been utilised in seven different New Zealand (NZ) AIS projects. More importantly, however, it will place the role of the RM in a framework that incorporates AIS, Actor Network Theory (ANT), and broader Agricultural Transition Theory (ATT). Qualitative data from interviews with six RMs will be used to argue that RMs are a key component in the co-innovation process and are required to play diverse roles depending on project circumstances to enhance system innovation – for example devil's advocate, project supporter, consensus seeker, conflict mediator, critical enquirer or encourager. The findings have implications for how RMs should be chosen, the characteristics that make a good RM, and how they report on the practice of monitoring a project reflexively.

Multi-scale modelling as a tool for sharing the perspectives of researchers, practitioners and farmers on beneficial management practices to be adopted in an intensive agricultural watershed

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Canadian agricultural production systems are facing issues related to maintaining high crop yields and profitability while adopting beneficial management practices (BMPs) that mitigate their impact on the health of the environment. Since 2014, Agriculture and Agri-Food Canada (AAFC) has been collaborating on the development of an open innovation platform, namely the “L'Acadie-Lab” living laboratory, initiated by an interactive community of farmers, practitioners and researchers to increase the adoption of BMPs in the L'Acadie River watershed, in southern Quebec' Canada. So far, workshops were held featuring farmers, practitioners, scientists and other stakeholders. These workshops have revealed a disconnect between farmers’ expectations and research organisations' ability to provide a consistent array of practices and knowledge. To get new knowledge and technology adopted, consistent choices between various practices that interact on a range of spatial and temporal scales have to be proposed to the users and the economic and ecosystem benefits have to be demonstrated. In response to these issues, the authors propose the development and use of a participatory modelling approach as a tool for sharing the perspectives of researchers, practitioners and farmers on innovative practices to be adopted. The approach links the knowledge of researchers and certain modelling tools at the plot level or the farm level with ecosystem services simulation models at the landscape level to produce quantitative or semi-quantitative results. Farmers and advisors will play a special role in defining the scenarios to be simulated to ensure that their situations and concerns are reflected and to increase the commitment to innovation.

Just-in-case to justified irrigation: Applying co-innovation principles to irrigation water management

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A pilot study, using a co-innovation approach in identifying the opportunities to improved irrigation management, is underway in five farms in an irrigation scheme in New Zealand. Through a process of co-learning, a group of on-farm and off-farm stakeholders defined the problem of on-farm water use efficiency and developed solutions to enhance farmers’ ability, desire, and capacity to adopt improved irrigation practices. To enable informed decision-making, participants were supplied with current soil water demand (measured on farm) and 2 to 15 day rainfall forecasts as a daily email update. We conducted several one-on-one formal/informal meetings and annual workshops with stakeholders to evaluate the farmers’ ability in integrating the updates into their current irrigation practices. Some of the key learnings are: 1. on-farm irrigation decisions are influenced by on-farm and off-farm

hydrological, climatic, infrastructural, and regulatory factors, thus we need to develop a wider view to irrigation management; 2. for successful uptake, it is important to understand the external stimulants that, directly and indirectly, conflict or align with proposed practice changes; 3. introduction of stakeholders with conflicting perspectives needs to be carefully managed; 4. with co-learning, project objectives continuously evolve in response to ongoing monitoring, review and reflection on the processes, thus it is important to build flexibility into the implementation pathway; 5. when scaling out from five farms to the wider irrigation scheme, opportunities such as collective learning and reflection at end-user focused workshops may become more challenging owing to stakeholder size, thus other co-learning opportunities need to be identified.

Triggering system innovation in agricultural innovation systems: Initial insights from a Community for Change in New Zealand

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The ability of actors to co-innovate is influenced by how Agricultural Innovation Systems (AIS) are structured, with systemic problems related to the absence or weakness of structural elements. To create structural change, the causes of interconnected systemic problems need to be dealt with by addressing underpinning institutional logics; so called system innovation. This requires active engagement with potential change agents, with potentially conflicting perspectives about the underpinning institutional logics. This paper describes a process for stimulating this engagement to develop a shared understanding of systemic problems, challenge prevalent institutional logics, and identify individual and collective actions that change agents might undertake to stimulate system innovation. To achieve this the process included (i) multiple actors from the AIS, (ii) steps to prompt reflexivity to challenge underlying institutional logics, (iii) an iterative process of practical experimentation to challenge current practices, and (iv) actions to encourage generative collaboration. Problem structuring was used to support potential change agents to develop a shared understanding of three systemic problems and understand the role that inter-relationships, perspectives and boundaries play in reinforcing or destabilising current practices and institutional logics. There is early evidence that involving multiple actors from the AIS in challenging underlying institutional logics and encouraging generative collaboration is stimulating project-level actions and recognition of wider AIS barriers and opportunities. This confirms the benefits of collective system analyses for identifying and addressing structural changes, and extends this to potential for system innovation of the AIS. A challenge still to be addressed is how to simultaneously resolve innovation project-level actions with AIS-level actions.

Navigating the unknown - practice-led collaborative research for the improvement of animal welfare.

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There is a growing policy interest in agricultural innovation generated through practice-led collaborative learning processes. While there is a considerable body of work on how local innovation is generated and facilitated in the field of natural resource management, far less has been done in the area of farm animal welfare.
Using the egg-laying-hen sector as a case study, the EU-funded Hennovation project is testing mechanisms to facilitate practice-led innovation in sustainable animal welfare through development of 'innovation networks'. Up to 12 innovation networks, involving producers and laying-hen processors, have been mobilized at local, national and European level. These are supported by a variety of actors and moderated by external facilitators.
This paper presents a framework for the management and facilitation of practice-led collaborative innovation processes in sustainable animal welfare. This framework has been developed and is tested through action research and a Delphi- style consultation process and includes key steps and guiding questions allowing the facilitators to assess and monitor their intervention in innovation processes. Practice-led innovation processes are network specific and evolve as the actors within the network come together to share common problems, experiment with possible solutions and learn. The end-results of these processes, in terms of outputs, are often unclear at the outset and thus planning for them raises specific methodological challenges.
In focussing on collaborative approaches to innovation, this project contributes to the integration of science and practice leading to solutions designed to deliver lasting change in animal welfare practices.

Addressing complex challenges using a co-innovation approach: lessons from five case studies in the New Zealand primary sector

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Co-innovation can be effective for complex challenges – involving complex interactions among multiple stakeholders, viewpoints, perceptions, practices and interests across programmes, sectors and national systems. However, there is limited systematic research on how co-innovation works in different projects. Approaches to challenges in the primary sector have tended to be linear, where tools and outputs are developed by a few, mostly scientists/researchers, and then extended to stakeholders. A co-innovation approach first deciphers and delineates the biophysical, societal, regulatory, policy, economic and environmental drivers, constraints and controls influencing these challenges at multiple levels.

Secondly, stakeholder interactions and perspectives can inform and change the focus, as well as help in co-developing solutions to deliver agreed outcomes. Here we analyse the results of applying a co-innovation approach to five research projects in the New Zealand primary sector. The projects varied in depth and breadth of stakeholder engagement, availability of ready-made solutions, and prevalence of interests and conflicts. The projects show how and why co-innovation approaches in some cases contributed to a shared understanding of complex problems. Our results confirm the context-specificity of co-innovation practices.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.4 **From farmer to "eco-preneur" in multifunctional agricultural knowledge and sustainable regional development: Participatory curricula development and implementation of educational measures**

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PerfEA: Ongoing counselling towards strategic planning processes to implement the agro-ecological transition

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Since 2012 the French Ministry of Agriculture has launched an ambitious program called "Agro-Ecological Project for France". This program aims to facilitate and support the agro-ecological farming systems transition. For supporting the agro-ecological transition, on the one hand, school farms in the French educational system have to propose an agro-ecological strategy. On the other hand, teachers have to use didactic processes that helps learners to understand and manage agro-ecological systems. For one year, six farms within agricultural high schools have implemented a strategic accompaniment method called PerfEA[1] for helping them to build and manage a sustainable project for the school farm. On each farm, a group comprising teachers, school director, farm manager and farm technicians, has implemented the PerfEA methodology with the support of a facilitator. At the end of the exercise, the participating school farms have defined the values of the organization (e.g. *innovation, sustainability, transmit and share knowledge*), its missions (e.g. "*Farm is a support of learning process and technical demonstration for students and local farmers"*), and its vision of farm development (e.g. "*Being an organic farm open to territory and his actors").* A balanced scorecard, composed with some strategic indicators (e.g."*Protein autonomy", "Number of projects involving farm workers, students and teachers"*), was constructed in order to assess and to pilot the performance of the school farm. Thinking and designing the strategy and its management tools have to be seen as a learning process. This article discusses how the ongoing counselling methodology as offered by PerfEA, to implement management strategy and its tools are learning supports which facilitate the agro-ecological transition. These learning are individual and organizational. According to loop-learning theories, they address to different extents: improvement of practice, revisiting assumption or reconsider underlying values and beliefs.

[1] PerfEA means Global performance of the farm

Farmer mentoring in Norway– How do different mentoring approaches improve entrepreneurial skills?

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Running a small business such as a farm can be a complicated and challenging task, and there is a growing body of evidence on entrepreneurial competences needed to run and develop a farm. Mentoring can support entrepreneurial competences, but how this influences entrepreneurial learning has been explored only to a limited extent. Therefore, two farmer-mentoring programs aimed at supporting farmers' learning and development were studied to identify how the concept of mentoring is incorporated, what kinds of learning are stimulated, and what effects on entrepreneurial learning are found. An analytical model was elaborated based on the functions of mentoring—psychosocial and career-related – complemented with the concept of entrepreneurial mentoring and entrepreneurial skills, to identify outcomes on entrepreneurial learning related to entrepreneurial identity, recognition and acting upon opportunities and growth of the business. Findings indicate that the matching process and the qualities of the mentors differ between the two programs, and they do not fully incorporate the concept of mentoring because they have little focus on helping the mentees to explore options and ideas that they can use to solve their own business issues. In both programs, the production-oriented knowledge and experience are important. In only one of the programs, there is development of entrepreneurial identity.

From Action Research to Action Learning – Ecosystem services assessment as a learning platform for students, local land users and researchers

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The Spring School in Landscape and Territory Agronomy has been organized by an international team of teachers since 2007. The target of landscape agronomy is to address the spatially explicit interactions between farming practices and natural resources at territorial level. It requires an action research approach that we have conducted on different topics all applied to the same region in Pisa (Italy).The case-study based Spring School is a good platform for action learning. So far, we focused on environmental and water management (2007, 2009), peri-urban agriculture (2013) and the ecosystem services provided by agricultural and semi-natural habitat management (2015). These case studies enabled to elicit the relationship between stakes that are often treated separately. The course was designed for PhD students of various disciplinary backgrounds but all interested in action research related to agricultural land management. In this learning platform, local stakeholders are involved through round table discussions, interviews and the territory game, a participatory territorial foresight. Students can experience the effectiveness of action research by interacting with local stakeholders and they become aware of the complexity of information gathering and analysis in a real situation. Through the interactions with the students, local stakeholders have the opportunity to widen their view on stakes they are concerned with in their every-day life. Compared to pure action research, our learning platform creates a

collaborative environment facilitating interactions between stakeholders and therefore it creates a learning device for them as well. In this specific case, the action research methods proposed to the students and used in their interactions with the stakeholders allowed the group to prepare spatially explicit maps indicating where various ecosystem services are produced and where their benefits are delivered according to the stakeholders. These maps were eye-openers for the stakeholders but also for the researchers involved, because it allowed them to bridge the gap towards transdisciplinary approaches to address land management in an agricultural context. Moreover, it highlighted that the main challenge regards land use management and its coordination at territorial level, regardless of the specific ecosystem services stakeholders expect to receive or think they deliver through their activities. In particular, the participatory territorial foresight resulted in innovative land management proposals capable to overcome more traditional and sectorial perspectives.

Participation in Extension Program Planning for an Improvement of Smallholders' Livelihoods in the MENA region

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Farming systems all over the MENA (Middle East and North Africa) region are formed by “resource-poor” smallholdings. These are often subsistence-oriented family farms with limited land availability, few capital (including animals), and limited access to inputs. Farmers usually are not well-educated or even illiterate.

Despite their importance for the region and an urgent need for system development, these farmers are often neglected - particularly by extension. Even if extension programs exist, they all too often do neither cover the knowledge demand of smallholders nor do they fit to their learning abilities. In other words: extension curricula are inappropriately designed with respect to training content and methodology. Reasons might lie in a centralization of planning processes, and a lack of communication between extension staff, program planners, and their target groups. However, we assume that there is a crucial need to increase smallholder farmers' participation in agricultural extension program planning.

This paper aims at developing some general strategies to improve participation in extension programmes considering the specific circumstances and resources-availability in the region. Part of this is an analytical framework of the possible effects of participation in extension on livelihood of smallholder farmers. The latter might be useful for valuation of specific cases, and thus for integration of situational analysis into regular programming. Insofar the paper serves two purposes. It provides the basis for an empirical analysis and in the long for institutionalisation of participatory curricula development in the extension systems.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.5 **Pathways towards sustainability in the agricultural knowledge and innovation system: The role of farmers' experiments and innovations**

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Experiments in animal farming practice: the case of decreasing the use of antimicrobials in livestock (France)

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Many farmers are engaged in activities that can be considered as experiments, but until recently few of their practices were studied. This paper offers a first characterization of experiments by dairy, pig and poultry farmers working in organic, labelled or conventional systems. Data (40 interviews) were collected during an interdisciplinary research project on antibiotic use in livestock farming in France. First, we discuss the literature. In line with D.A. Schön's "reflective practitioner model", we agree that farmers mainly carry out informal experiments. Second, we provide an overview of the experimental process (type of farmer's experiment (FE), period, topics, targets and length) and the outcomes (efficiency, transfer, possible impact on antimicrobials use, renewal), drawing on farmers' subjective valuation and qualitative interview data. We find that farmers carry out multiple tests, mainly with alternative medicines. There is a clear tendency of transferring positive tests for a given pathology to one another. Third, we present seven portraits of farmers to shed light on complementary dimensions of experiments: the appeal of novelty, the role of vets and technicians, and the role of farmers groups and training. Finally, we argue that much can be learned from ethnographic investigation in order to grasp what farmers are experiencing when they endeavour to solve animal health problems.

From Seed to Bread : Co-construction of a Cereal Seed Network in Wallonia

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After losing its artisan character after World War II, bread is now commoditized as the outcome of an increasingly globalised seed, cereal growing, milling and baking industry. Yet, alternative pathways are emerging to develop a more resilient and locally-adapted cereal system. Our case study focuses on exploring the emergence of a cereal seed network in Wallonia, which gathers farmers, millers, bakers, households and researchers. In this paper we look into the creative process of co-construction of this network, after 3 years of participant observation. We explore how group objectives and personal motivations evolved along with internal and external events. The main objective of this network is to conserve and breed a diversity of cereal varieties adapted to local agroecological food systems. Our results show that (i) novelties are being produced and tested in farms; (ii) opening up a safe-learning space favours networking of these isolated novel actors; (iii) collaborative management of cultivated diversity entails opportunities and challenges. We discuss these results in the light of similar experiences of seed networks in Europe and outline questions raised by challenges faced in participatory research on seed. Our conclusions suggest that in order to improve the nutritional quality of bread and develop a more resilient cereal system, collective management of seed and participatory plant breeding programs should be fostered. This will need a reversal of agronomy research approaches and of priorities in food policy.

The role of Internet and social media in the diffusion of knowledge and innovation among farmers

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The impact of the use of information technology (IT) has been gaining relevance recently in the way it can facilitate communication in the agricultural sector. Farmers can share innovations and knowledge alongside solving problems through social media, or other uses of the Internet. Farmer-to-farmer knowledge sharing is an important source of information, but potential obstacles to effective communication can include distance and the amount of time farmers can invest in knowledge sharing activities. The Internet has therefore become an effective way to overcome those obstacles. The internet allows farmers to share their experiences, which traditionally would have been over a farm-gate, via YouTube, web forums and online groups. There are Twitter feeds that farmers can go to, ask questions, or share experiences. Whilst some conventional farmers are also using these tools, they have become a lifeline for farmers hoping to or currently farming more sustainably. These farmers are likely to be disparate throughout the UK, may no longer share with their neighbours, but instead rely on social media for advice and mentoring. Key annual farming events are broadcasted live via Twitter. Farmers and other participants are encouraged to share highlights of the conference sessions, their comments on the speakers and event itself, allowing others unable to attend to receive information from the event. Internet and social media have a growing role in the

diffusion of knowledge and innovation within the agricultural sector, allowing a greater number of farmers, researchers and practitioner to share information and experiment so as to facilitate innovative farming practices.

An agronomical framework for analyzing farmers' experiments

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Transition towards sustainable agro-food systems questions how farmers use and build new agroecological knowledge. First, as the efficiency of biological regulation processes highly depends on each specific farming situation, farmers cannot only apply technical packages built elsewhere. They have to adapt or even to create agroecological knowledge to fit their own situation. Second, farmers engaged in agroecology have to act with uncertainty, for example on dynamics of the systems or on long-term effects of a practice. Hence, the issue of farmers' experiments returns to the forefront, although its contribution to the farmers' learning process was observed long ago. We built an analytical framework derived from the agronomic experimental process to describe farmers' experiments and discuss the learning processes. The framework is used in a heuristic way to re-read the literature on farmers' experiments.
Experiments are described with 3 phases: (1) design (objectives, experimental design planned, modalities compared, location), (2) management (indicators to monitor the systems, way to collect them, reaction to unexpected events), and (3) conclusion (interpretation of data to assess the systems tested and build new knowledge). Results are two-fold. First, the framework enables to describe the diversity in farmers' experiments as described in the literature even if few articles are precise enough to fully complete the framework. Second, the framework is used to describe three experimenting situations coming from a case-study of producers located in the South of France. This communication should be regarded as a contribution to the debate on the relationships between learning and innovation processes, and on the possible synergies between scientific and empirical knowledge.

Better than best practices: Using farmer field trials to identify adaptive management options within complex agricultural systems

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Agricultural systems are widely recognized as being complex, dynamic, and diverse, and containing of many uncertain or unknown components and interactions. However, management recommendations are often derived from highly controlled experiments that reduce the complex working of the system to artificially simple relationships that are typically investigated in isolation under the assumption of "all else being equal." Such reductionist experiments are appropriate for investigating certain aspects of agricultural systems, but do not estimate the reliability or robustness of the effect of specific manipulations, which is what is implied by "best management practice" recommendations. These limitations are illustrated here through the preliminary results of an ongoing project in Senegal and The Gambia, where

a network of farmer field trials tests and largely rejects current recommendations for rain-fed crop production, while suggesting potentially more reliable alternatives. These results also demonstrate the research value of experiments that are embedded within a complex system, both as a stand-alone method and as a part of a more integrated approach to the study of complex agricultural systems. While this approach may lead to general recommendations, it can also identify a range of potentially adaptive practices, thereby encouraging multiple adaptive pathways, a result that makes this approach particularly valuable in diverse and understudied systems.

Farmer experiments, agro-environmental policies and practice change

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More sustainable farming practices need to be developed and adopted. Current agro-environmental policies struggle in efficiently promoting sustainable agriculture. On the other hand, many farmers experiment constantly in order to improve their practices, but the created knowledge is rarely acknowledged by formal agricultural research or extension, nor is it systematically collected to provide general lessons. Farmer experiments can be seen as a part of the creation of farmers' local knowledge as opposed to more scientific and bureaucratic knowledge that forms the basis of policy formulation. This paper explores the role of farmer experiments in the building of their expertise and the relationships between experiments, agro-environmental policies and changing farming practices. Findings from thematic interviews of 31 Finnish farmers are provided. Farmer experiments were identified important in translating innovative technologies and practices promoted by policies to the local circumstances. To encourage experimentation, policies need to leave sufficient room for local adaptation while encouraging practice change. If collected in a systematic manner, farmer experiments could be an important source for improving the policies as well as facilitating the spreading of environmentally friendly practices.

Sparking small scale dairy farmers' enthusiasm within a transdisciplinary project in Kenya

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Small-scale dairy farming systems in Kenya are low-external input systems and therefore show a high context dependency. As most small-scale farmers have low capital endowment and have poor access to new information, they do often not see chances to improve their situation on their own. Fostering change in such systems requires methodologies that give farmers voice in the research process and that integrate and expand farmers' knowledge and capacities, leading to improved action. As part of a transdisciplinary research project, two small-scale dairy farmer groups in Nakuru-County Kenya engaged in a collaborative learning process. This article seeks to analyse the processes that contribute to successful facilitation of farmers' experimentation and innovation. We want to understand how enthusiasm was triggered, maintained, or suppressed. Enthusiasm is defined as a desire to engage with practices that draw on the energy, imagination and ideas of an individual or group (Russell and Ison 2000). We found that enthusiasm played a role throughout the four collaborative

learning phases, i.e. establishing the collaboration, dialogue, discovery and application. Democratized research relationships sparked enthusiasm during the steps of establishing the cooperation and dialogue, while a sense of progress and success maintained it during the steps of discovery and application of new knowledge. The article concludes by stressing the importance of new forms of research, such as transdisciplinary research, that include local actors, i.e. those that can change the system by changing their actions, as partners in a knowledge creating dialogue.

Integration of knowledge for sustainable agriculture: why local farmer knowledge matters

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Previous research has revealed that transition to sustainable agriculture requires a new knowledge base – new content and forms of knowledge and learning. In this paper, we explore farmers' knowledge and learning practices with a focus on the role of informal knowledge and learning in strengthening agricultural sustainability and resilience. It is based on 11 case studies from the international RETHINK research programme, which discover diverse pathways of farm modernisation and related knowledge and learning processes. We outline the diversity of knowledge sources and learning forms that farmers use and the particular role of local farmer knowledge. We argue that the potential of farmer knowledge is not being optimally used, and we identify several ways in which different kinds of knowledge can be integrated: by the individual farmer by synthesising knowledge from different sources, through farmer networking – whether or not facilitated by formal agricultural knowledge institutions, through collaboration between farmers and researchers as knowledge co-generators, and through multi-actor knowledge networks that bring together participants from various fields. We conclude that the dynamic contexts, complexity and the local specificity of the current challenges facing agriculture and the many roles it is being asked to fulfil require more inclusive, flexible modes of the generation, integration and sharing of knowledge. All stakeholders and all kinds of knowledge need be brought together on equal base in innovation processes. For these purposes, policy frameworks and initiatives that promote an interactive multi-actor approach to agricultural development, can play a considerable role.

How "fundamental knowledge" supports the cropping-system re-design by farmers?

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Re-designing cropping systems to move towards agroecology leads farmers to implement practices which involve biological processes, sometimes qualified as "knowledge-intensive", as they involve the renewal of agronomic principles and numerous interactions between the systems' components and their regulations. Agronomists have developed an abundance of

models, which encapsulate partial knowledge on systems' functioning, but these appear to be seldom used by farmers. By contrast, several studies recognize the value of exchanging specific and fundamental knowledge with farmers in relation to technical change processes. This paper discusses how fundamental and generic knowledge acquires an agronomic sense and is reinvested in the action of farmers through their technical changes. We performed an inductive case study of step-by-step cropping system re-design situations. We combined individual interviews with farmers re-designing their cropping-system, and facilitated farmers meeting about a shared technical problem. From full transcripts, we identified each new element of knowledge and its reformulation, its relation to action mentioned by farmers. The focus of our analysis concerns the knowledge which made possible to develop action strategies when farmers were facing hindrances in continuing their technical changes. Our findings concern the specific fundamental knowledge actually mobilized, and the processes of its linkage with action through contextualization. We conclude by suggesting that farmers alternate between systematic and systemic thinking about the biological processes at play in their own situation. This has practical implications for agronomists wishing to support such re-design processes, and provides an insight on how farmers' experiments might be combined to fundamental scientific knowledge on agroecosystems components to enhance cropping system redesign.

Farmers' experiments and innovations: A debate on the role of creativity for fostering an innovative environment in farming systems

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Innovation has become *the* promising concept to overcome problems and enhance agricultural performance in agricultural research and policies. In the past, innovation was mainly seen as being developed by science or enterprises, and only recently the focus has shifted from a linear to a systemic perception, acknowledging that innovation is a dynamic process that implies the participation of a diversity of stakeholders. Consequently the role of multiple stakeholders, including farmers, in the innovation process receives more attention. Farmers' experimentation is the process by which farmers informally conduct trials or tests that can result in innovations suitable for their specific conditions. Although the role of farmers experiments in the innovative process is increasingly acknowledged, literature on the creative process that leads to farmers' experiments and innovations is missing in farming systems research. The aim of our contribution is discussing this missing link, focusing on how motivations, learning processes and specificities of the workplace farm may influence the creativity of farmers.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.6 **Merits and limits of innovation platforms to promote sustainable intensification in farming systems**

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Agricultural innovation platform dynamics: a conceptual framework to analyze knowledge production

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Innovation platforms (IPs) appear to be one of the most appropriate tools to operationalize research for development. Increasingly, agricultural research initiatives for development set up innovation platforms to facilitate the management and support of innovation processes. Yet, the mechanisms by which they operate are not well understood. This paper seeks to open the 'black-box' and proposes a framework to analyze processes that occur in innovation platforms from inception to maturity. Firstly, we use a New Institutional Economics (NIE) based analytical framework for the M&E of IP performance. Secondly, from a review of the literature, we identify three ways through which research could be done within IPs: 1) soft transfer, when research has readily available results that could help solve jointly identified problems; 2) co-creation, when researchers and IP members develop research objectives and protocols together; and 3) community-based research, when IP members set up experiments on their own. We propose that both frameworks should be used to improve the monitoring of IP dynamics.

Innovation platforms beyond projects and commodities: A case study of Lundazi, Zambia

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Innovation Platforms (IPs) are undoubtedly the most common manifestation of the growing popularity of Agricultural Innovation System (AIS) thinking in Agricultural Research for

Development (AR4D). Born out of the realization that constraints to agricultural development are not merely technical but often located beyond the farm level and of organizational and institutional nature, AR4D projects increasingly initiate such multi-stakeholder fora. IPs are a well-documented "phenomenon" (see, for example, Nederlof et al 2011; Nederlog en Pyburn 2012, Sanyang et al 2016, Dror et al 2016). They are conceptualized as a group of individuals or organizations, often interdependent, that come together to exchange knowledge and tackle problems (Nederlof et al 2011, Homann-Kee Tui et al 2013, ILRI 2012, Schut et al 2016). This case study documents and analyses the institutional development of one such multi-stakeholder fora in Lundazi, eastern Zambia. It describes how two different project-based initiatives were integrated in order to strengthen project activities and coordination within the district; a major function of IPs. This case study makes a case for linking IP initiatives to existing coordinating institutional structures, not merely for coordination – which is key to scaling-up – but also for improved agricultural sector governance and learning (Nederlof and Pyburn 2012, Mur and Wongtschowski, 2013, Pyburn and Woodhill, 2014).

Designing and implementation of innovation platforms in facilitating the local adaptation of Conservation Agriculture. Lessons from case studies in Burkina Faso

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Numerous interventions implement innovation platforms (IPs) to support agricultural innovation processes and stakeholder interactions within a value chain in west Africa. Yet in this context, little research has been undertaken on the design and implementation of IPs focussing on other issues than market access such as aiming to encourage the technical and organizational feasibility of complex cropping systems. Conservation Agriculture (CA) is such a case in which IPs may be useful, since its complex nature calls for technical, organizational, and institutional changes involving several stakeholders at both production system and village territory levels. This paper highlights the design and implementation processes of platforms established in three villages in Burkina Faso aiming to participatory assess the relevancy of CA for the west African context by developing CA technical references with local stakeholders and analysing how to renew rules of interaction between stakeholders within a territory. The design of the IPs was initiated by a multidisciplinary research team and based on three complementary steps: the diagnosis of existing forms of organization, the development of an IP model, and the validation by stakeholders of the IP model followed by the planning of activities. After three years of activities, we assessed the effects of IPs on farmers' perceptions, attitudes, practices and networking in relation to the initial objectives assigned to the IPs. The platforms enabled farmers in the three villages to actively participate in the specification of the cropping systems tested and to improve their perception of CA. They furthermore promoted networking in terms of exchange among farmers and the spread of CA principles in the communities. And they facilitated the development of new rules for crop

residue use. The platforms thus appear to be relevant mechanisms enabling complex innovations to be explored. However some modifications and improvements are necessary to ensure the sustainability of the platforms and the evolution of their objectives and activities beyond those of the project under which they were launched.

The merits and limitations of innovation platforms for promoting Conservation Agriculture in sub-Saharan Africa

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Despite many efforts, Conservation Agriculture (CA) has not been embraced on a large scale by African farmers. CA requires technological, organisational and institutional changes, as well as a strong capacity in problem solving from farmers and service providers to adapt CA practices to the local context. Such a broad set of changes is not suited to a top-down, linear approach of technology transfer.
Over the last decade, various CA initiatives have therefore adopted an innovation systems approach, using innovation platforms (IPs) as an instrument to promote CA. However, to date CA innovation platforms have tended to focus on CA as a solution, thus overtaking the attention to tackle underlying problems and constraints such as declining soil fertility, insecure property rights, conflicting demands on farm resources, or lack of inputs and services. Innovation platforms that have functioned well in terms of experimenting with different CA practices required a lot of time and effort to facilitate the platform activities. Drawing on experiences from different projects (primarily ABACO, but also from DONATA), we identified several lessons and strategic questions regarding the use of innovation platforms for CA.
Some of the issues to be considered when using IPs for sustainable agriculture are: identification of suitable themes for IPs; the influence of different starting points and structures that are used for the set-up of IPs; the use of external resources and facilitation in establishing and maintaining the IPs; opportunities and constraints to foster autonomous IPs; and relevant criteria for measuring success of IPs. The paper further discusses under which conditions, and to what extent, IPs are an improvement on conventional ways of developing and promoting agricultural technologies.

Theme 1: **Innovation, knowledge and learning processes**
Workshop 1.7 **Scaling up and scaling out transformative farming practices: Critical assessment of tools methods and skills**

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Upscaling of integrally sustainable animal production systems: The dynamic of anchoring processes

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This paper analyses the combination of a method to design new sustainable animal husbandry systems by the name of RIO with efforts to stimulate the uptake of these new designs in practice. Over the past 15 years, this approach has been applied in a variety of animal production sectors in the Netherlands, two of which will be analysed here, one for broilers (chickens for meat) and one for pigs. To analyse the uptake process we build on the concept of anchoring that describes how a novelty becomes newly connected, connected in a new way, or connected more firmly to a niche or a regime. In the literature, three forms of anchoring are distinguished, notably technological, network and institutional anchoring. In this paper we seek to develop this general conceptualisation further to understand the dynamics of anchoring processes. On the basis of the cases analysed we conclude that to make technological anchoring more robust, a process takes place that we have called the 'specification of technology'. Furthermore, we distinguish two patterns in institutional anchoring, one in which the technology adapts to existing institutions and one in which new institutions are adapted to fit the developing novelty. This latter process seems to be key in transition processes to develop 'integrally sustainable' solutions.

Practical Lessons for Successful Long-term Cropping Systems Experiments

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Many lessons in long-term cropping systems experiments are learned from practical experience. The senior author has conducted large-scale, long-term, multidisciplinary dryland and irrigated cropping systems experiments with numerous colleagues (mostly with the coauthors of this paper) at university and government research stations and in farmers' fields

in the United States and in developing countries for 30 years. Stakeholder input is critically important for designing these experiments. Several practical lessons learned through the years are outlined in this conference proceedings paper. While some of these lessons learned may be intrinsically obvious, results of many cropping systems experiments have not been published in scientific journals due to fatal flaws in experimental design, improper transitioning between phases of the experiment, and many other reasons. Ongoing active support by stakeholders is critical to maintain funding for long-term cropping systems studies. Problems and unexpected challenges will occur, but scientists can often parlay these into opportunities for discovery and testing of new hypotheses. Better understanding and advancement of stable, profitable, and sustainable cropping systems will be critical for feeding the world's projected 10 billion people by the mid 21st century.

Upscaling of more sustainable cropping systems: a framework to analyse and support intermediation processes

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The Ecophyto Plan 1 was devised to achieve a 50% decrease of pesticide use in France between 2008 and 2018. Based on available agronomic knowledge, collective expertise showed that reaching such a target at farm level implied in-depth redesigning of the current cropping systems. The DEPHY Network is one of the main policy instruments to support such a redesign process and to contribute to inviting more and more farmers to take up this challenge. To analyse the ways in which intermediation is organized in this network, we developed a framework which we also applied to two farmer-led networks that support farmers in redesigning their cropping systems and that seek to increase farmers' participation in such processes. Grounded in former studies on transition pathways at farm level and in participatory design processes in work system design projects or in open source communities, our framework distinguishes three levels (strategic, experiential and collaborative) to analyse the organization of intermediation. We apply it to the DEPHY Network and then point out the differences that we identify between the 3 networks analysed. Based on this, we make recommendations about the way each level should be addressed in order to support on-farm redesign processes in a large and inclusive network. We finally conclude by highlighting the limits of our framework and the need to test our recommendations.

Competing socio-technical transition pathways towards implementation of conservation policy aimed at enhancing hedgerow and grassland networks

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Rural landscapes containing hedgerow networks and permanent grassland have diminished in France and current legislation aims to conserve and restore such habitats and their wildlife.

Our multidisciplinary study aimed to identify how livestock farm viability could be reconciled with biodiversity conservation planning policy, in three regions with hedgerow networks. The implementation of the green network policy is legally imposed, though local parties must determine the methods for achieving it at local level. Therefore, the state puts local authorities in charge of organising spatial, ecological planning, from farm scale up to the scale of a small region, a process involving a diversity of local stakeholders. We consider this process as a test case for upscaling and outscaling. The results of sociological analysis of interviews show that local stakeholders tend to envisage three different possible pathways to attaining the policy's requirements: (i) ecological knowledge-driven network design which promotes minority forms of agriculture (niche innovation); (ii) protection of the dominant socio-technical regime, as it is considered to have produced the hedgerow networks and their biodiversity; (iii) Agro-ecological innovation and reconfiguration of the socio-technical regime in order to better integrate biodiversity. Results from ecology and animal science / agronomy approaches shed additional light on the pathways envisaged. It emerged from this work that (i) ecological results do not necessarily provide clear recommendations about the optimal approach for land planning; (ii) the diversity of farming situations is such that one cannot consider that the contribution of each farmer to ecological continuities will be equal; (iii) increasing natural elements within livestock farms may be possible but must be achieved without neglecting the up-scaling dimension of ecological networks.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.8 **Cooperation as a key issue for innovation and learning processes in sustainable land management**

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Cooperation management as a distinct function in innovation processes for alternative food production and consumption – potentials and limitations

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Cooperation is an important function in innovation processes for sustainable land management. Thus, cooperation management may determine – as one key element – the success or failure of such innovations processes. One goal of the transdisciplinary research project ginkoo is the development of a tool “cooperation management” that supports practitioners to plan and to improve their cooperation.
In this paper we develop the specificity of cooperation for sustainable land management conceptually. Against this background, we sketch a first prototype of this tool “cooperation management” that consists of three levels with a different degree of abstraction. The first level provides general questions for orientation about cooperation for sustainable land management. The second level displays key functions of cooperation in specific phases in a matrix. The third level will supply a set of instruments that supports the users in solving concrete problems of cooperation management addressing key functions of cooperation. Further, we present empirical findings of a pre-test of the prototype with practitioners in two case studies.

Experiences with knowledge integration methods in an inter- and transdisciplinary project of sustainable land use in North East Germany

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This paper draws on experiences of the inter- and transdisciplinary research project ELaN which has been carrying out various methods of knowledge integration throughout a five years research process. ELaN had the aim to develop innovative water and land use options in the North East of Germany.
During the initial phase of the project, a joint problem formulation has been developed in several iterative loops with the method of constellation analysis. Further along the process the results of the 14 sub projects were integrated in several synthesis products: an administrative manual with recommendations regarding the use of treated waste water, a decision support system for farmers that contains a variety of land use options depending on different groundwater levels, scenarios of land use options depending on different framework conditions and governance recommendations for sustainable water and land use options.

Additionally the main results of the project were summarised in 11 core statements. These synthesis products were discussed with the respective target groups to different extents.The paper provides in-depth empirical insights of applying a range of methods and whether they were more appropriate for integrating knowledge from different disciplines or to serve as boundary objects between science and practice. We analyse whether knowledge integration via the different synthesis products results in system, target or transformation knowledge. Furthermore we differentiate between consultative and participative transdisciplinarity referring to the intensity of exchange with practitioners and processes of mutual learning. Finally, we refer to restrictive and favorable structural factors for successful knowledge integration. The paper concludes that a systematic design and management of knowledge integration processes is crucial but that the nature of the problem at stake, as well as political or societal windows of opportunity are just as important for successful transdisciplinary research processes.

Collaboration for a more sustainable agriculture – when does it work?
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Finding and implementing innovative solutions to sustainability problems in agriculture makes collaboration among farmers and other stakeholders indispensable. There has already been much work on conditions influencing success or failure of joint action in different contexts. However, aside from not providing insights specifically for collaboration in the context of sustainable agriculture, much of this research has been based on the investigation of one or few case studies. Other works have investigated more specifically collaboration in the context of sustainable agriculture. Yet, there is a lack of research on collaboration for sustainable agriculture that integrates insights in both internal and external factors for success and that assesses these factors against explicit and comprehensive success criteria. To fill these gaps, this research provides first results of a case survey of case studies of local or regional collaborative interventions in EU-countries that attempt to improve the sustainability of agriculture. The aim of this case survey is to identify which conditions contribute or hamper general success of such interventions. Specifically, the first eight coded case studies were analysed to explore existence and type of causal relations between the (long-lasting) success of an intervention and factors related to group composition and social capital among involved actors on the one hand and factors of organisation and management of these interventions on the other hand. Apart from indicating a range of factors that potentially have an effect on the success of collaborative interventions for a more sustainable agriculture, for a selection of these factors mechanisms were identified through which this influence on success may occur.

Elaborating hypotheses on motivations for participation in cooperation initiatives for sustainable farming.
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Farmers can be motivated in different ways to participate in initiatives aiming stimulate farmers towards sustainable farming. The dynamic interaction between an initiative's design, farmer motivations to participate and their motivations to contribute to sustainable farming, makes

research on farmer motivations to participate in sustainable farming initiatives (SFI) very interesting for SFI organizers. To grasp this dynamic relation between motivations and an initiative's design, 9 hypotheses were developed, using Self-determination theory (SDT). Based on these hypotheses we constructed a methodology to test them in SFI cases.

Cooperation between farmers in feed production and use of manure

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The objective of the research project was to explain the benefits or advantages of cooperation in manure management and feed production from the point of view of the agricultural entrepreneur and also describe the (strategic) significance/relevance of these cooperation forms for the whole farm business. The role of risk in land management and various innovative approaches regarding mutual cooperation and the importance of trust and commitment was sought for. The theoretical background is based on the theory of strategic management on farms as well as resource based theory. Semi-structured interviews with eight farmers were carried out in the region northern Savo in eastern Finland in March-September 2015. The interview transcripts were categorized by conventional and directed content analysis. The cooperation between crop and animal husbandry farmers could be classified in various categories of looser and closer strategic cooperation. Benefits mentioned were partly clear economic benefits like reduction of costs, savings in labour time but also a range of benefits not explicitly economic like guaranteed deposition of produce. Access to organic nutrients as well as access to farm land for manure spreading, better crop yields, better crop rotation and land management were other direct benefits mentioned. Economic benefits could be divided between short-run (one year or less) and long-run (5-10 years) benefits. Farmers mentioned trust in one another and well working personal relationships as the particular condition for cooperation, which was also obvious by the lack of written contracts. Cooperation mainly was regarded as reducing risks even though in three cases cooperation also was seen as involving risks. Commitments varied from mutual cooperative arrangements to quite concrete short-run practical arrangements which can be categorized according to two axes: organizational bonds and managerial bonds. Themes which clearly emerged from the interviews were long-term goals, understanding of the operational environment as well as the competitive factors arising from resources of the farm.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.9 **Inclusive innovation**

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Title: "All relevant stakeholders": a literature review of stakeholder analysis to support inclusivity of innovation processes in farming and food systems

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Transdisciplinary research aims to be inclusive because it integrates the knowledge and perspectives of scientists and societal stakeholders in order to find solutions to complex real world problems, for example in food and farming systems. However, when designing transdisciplinary research, who should be included? In order to support inclusivity, the question of whom to work with must be addressed in a transparent manner. This literature review of stakeholder analysis traces the evolution of the concept including use of the terms, 'actors' and 'stakeholders'. We find that who defines a problem has bearing on who is considered relevant in relation to that problem. Considering heterogeneity within stakeholder categories requires further decisions on who is considered to be representative. Likewise, the presence of marginalized groups further complicates the issue because their inclusion hinges on the ability of those involved to recognize inter-connections that tend otherwise to be neglected. To overcome the limitations of using only the relevance systems of researchers to make these decisions, the participation of potential stakeholders is necessary for making decisions on involvement that reflect "on-the-ground" realities. In conclusion, we propose that researchers share the tasks of problem definition and stakeholder identification with potential stakeholders using participatory methods.

Unravelling inclusive business models for achieving food security in low income markets.

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Business actions to strengthen food value chains in developing countries can fulfil important roles in achieving future food security. But hardly anything is known about such initiatives going beyond pilot phase, or have been replicated or scaled up. The complexities of the food value chain, the inter-dependence of its different components, and the challenging contextual

conditions encountered in low income markets, present both a challenge and an opportunity for the private sector to develop successful business models. This article aims to answer the research question "What are the characteristics of the business models used by the private sector to contribute to food security for low income markets?" Five business intervention strategies on food security for low income markets are analysed on business model components, local embedding and innovation strategies and business eco system building strategies. Important findings are the added value of marketing and distribution strategies for successful business model development on food security, the use of coalition building to overcome institutional and cultural gaps, and the added value of intermediary organisations.

Learning about success and failure - A systems perspective on Food Security Innovation processes for small-scale farmers in Tanzania

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Food insecurity is still relevant for 16,8 mill. Tanzanians (FAO, 2015). Introduction of e.g. innovative techniques is a widely accepted approach to food insecurity (e.g. Alarcon, 2011). Causes of food insecurity are multi-level and multi-issue evolving e.g. from interplays of poverty, insufficient awareness, environmental degradation or price instabilities (Ashley, 2016).
We argue that to successfully implement and disseminate food security innovations, an adequate understanding of the context is needed. So far, innovation system approaches (used as analytical frameworks) have proven to be appropriate tools to study these multi-level and multi-issue problems in a holistic way (Hall, 2003).
In this context, we focus on food security innovations for small-scale farmers in two Tanzanian regions. Based on empirical research, the paper presents findings on:

1) food security innovation processes within the study area.
2) selected food security innovation examples from which we attempt to derive the initial conditions for successful dissemination.

Methodologically, an explorative mixed-methods approach was applied starting with a literature review and then fieldwork including semi-structured expert interviews at national and regional levels and farmer group discussions at the local level. Preliminary results from system analysis show that the ability of farmer groups to connect to other system-levels and actors would be a critical success factor, but knowledge flows occur when there are levels of trust on the horizontal level. For the local level, knowledge sharing systems are an important condition to enable dissemination processes.

Going beyond "Add women and stir" in inclusive innovation processes: Facilitating participatory activities with pineapple chain actors in Uganda

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Transdisciplinary investigation of agricultural value chains can encourage innovation by bringing people together for knowledge integration and learning. The quality and result of the process is however dependent on how the diverse chain actors are identified, characterised and involved. Gender-sensitive approaches to innovation processes must go beyond mere rhetoric. Rather, inclusive innovation can be fostered when the gendered needs of women are considered in order to enable active involvement. This paper attempts to go beyond this, and shows how an iterative process containing a gender-sensitive stakeholder analysis can lay the foundation for facilitating inclusive innovation processes.

This paper presents research that is part of a transdisciplinary project to reduce post-harvest losses and improve livelihood benefits among primary actors in pineapple value chains in two different regions in Uganda. We introduce an iterative process including (i) actor identification and characterisation, (ii) establishing selection criteria and participation targets, (iii) identification of challenges and constraints for inclusion and (iv) design and implementation of multi-stakeholder processes, as well as integrated feedback and reflection on each step. In order to obtain the information needed, a multi-methods approach was used, comprising of semi-structured interviews, participatory group activities, and participant observation with actor groups along the chain in addition to multi-stakeholder meetings.

This paper describes the gendered composition of the different actor categories. A variety of constraints and challenges for participation were identified particularly for women, e.g. time constraints, lack of resources and intra-household power relations. With feedback and reflection, it was possible to develop context-specific strategies to circumvent certain challenges. However, in order to achieve the desired inclusiveness, balancing the needs of different chain actors requires constant vigilance. This paper concludes with lessons learnt while applying this iterative process with pineapple chain actors in Uganda.

Theme 1: **Innovation, knowledge and learning processes**

Workshop 1.10 **Practical experiences and methodological concepts from the first years of EIP-Agri implementation**

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Administrative intimidation and payment reduction frustrate innovative farmers under the European Agricultural Fund for Rural Development

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The article discusses how to put in perspective what is perceived by some project grant applicants of operational group projects operating within the late Rural Development Programme 2 (RDP-2) project grant funding in 2013-2015, as administrative intimidation and discouragement of the Dutch national payment agency. We may learn from the conclusions in view of the operational groups under the upcoming EIP-Agri support aid and other RGP-3 grants.

In view of what EU taxpayers rightly may expect of the agency, the procedure for the aid applications of EU funds seems deviated from the purpose of the regulation. The image of a stimulating (though immature) regulation with a purpose-focused procedure, which resulted in remarkable effective and efficient knowledge exchange developments in the years 2007-2010, is gone. Instead the image has turned into an unreliable time and resources absorbing regulation, with such administrative burden, that potential project leaders are reluctant to encourage farmers to apply – even if they do not fear important payment reduction, like the former government organisations (fgo's): research institutes and extension agencies. The applied payment reductions led – of course, to additional societal unease. Moreover: the project successes in terms of knowledge exchange towards innovation are not celebrated anymore as they were in the early years of the RDP-2, because the focus has deviated towards the disadvantages and negative side effects.

Aside, the article reveals a reverse correlation between the projects that were allowed communication before the final decision about the payment and the applied payment reduction. Fgo's seem to suffer disproportionately less from the newly implemented communication policy of the payment agency. The fgo's are nonetheless, just as critical as other project leaders about how the payment agency handled the procedure. A reintroduction of the insights of the policy implementation notes of 2007 about communication could reinstall a satisfactory system from the perspective of the EU taxpayer , in particular, if complemented with a sound and longer-term coordination within the payment agency. It is recommended to reinstall such concept as a control system for the RDP-3 grant procedures. Besides, the procedure for administrative control should be improved substantially, and lined up with the EU precedent judgements.

Methodology, a useful tool to foster multi-actor innovation networks performance.

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We address in this paper opportunities of Q Methodology for empirical agricultural innovation studies. In the systems perspective on innovation, multi-actor innovation networks are seen as a key strategy to successful innovation. Given the several types of actors involved, the scientific and policy literature points at the need for 'innovation brokers' to build capacity for collective innovation and prevent innovation network failures. This paper aims at introducing Q Methodology as a fitting and promising tool to assist these systemic facilitators to probe more deeply into the mechanisms of social learning and collective cognition. Q Methodology is a mixed method that provides quantitative structure to individuals' opinions via factor analysis, based on a clear methodological structure and process. It has gained popularity in a range of 'messy' studies to analyze and typify the diversity of worldviews on complex and socially contested issues.Increasingly considered as a well-established method to address rural research questions, its use in agricultural innovation studies is still missing.
After providing a deal of practical information about the conduct of Q methodological research, we thus offer to reflect on the usefulness of Q Methodology in fostering multi-actor innovation network performance.

How to design and develop inclusive knowledge and innovation agricultural networks: Lessons from the case of the Portuguese Cluster of small fruits

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The idea underpinning EIP-AGRI of linking producers and users of knowledge and promoting their interaction around problem-solving is well grounded on the evidence provided by the 'innovation systems' and related literature. Evidence gaps that matter to the implementation of the EIP-AGRI activities comprise the lack of knowledge regarding the best-fitted network configuration for different farming systems and farming styles, and the nature and effectiveness of a facilitator function and role to bridge communication between researchers and farmers. This paper contributes to fill the evidence gap regarding the networks configuration best-fitted for different farming system and farming styles and provide insights on the facilitator relevance and its desirable profile, build on the evidence collected for a concrete network: the Portuguese Cluster of small fruits (CSF). The small fruit sector is a novel sector in Portugal that has attracted in the recent years a large number of new investors, in particular newly-established small-scale inexperienced producers. A social network analysis (SNA) approach has been used to depict the different actor´s positions and interactions in the network focusing on the knowledge flows involved in the creation and exchange of knowledge. The insights provided by the CSF analysis emphasises that agglomeration economies based networks, which are very important in some agricultural sectors (e.g. fruit, wine) and in countries or regions where small-scale farm is significant, can in fact be the ground for knowledge and innovation networks in the sense wanted by the EIP-AGRI, since inclusiveness and facilitation functions are accounted for properly.

First Experiences in Implementation and Evaluation of the EIP Approach in two Federal States of Germany

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The implementation of the EIP-AGRI differs between the several federal states of Germany. The paper provides an overview of the current state of implementation of the EIP approach in Germany. The authors are involved in the implementation of the EIP-AGRI in two federal states in different ways: In Hesse the Institute for Rural Development Research (IfLS) is commissioned as the 'innovation support service' and in Baden-Württemberg as the evaluator of the EIP-AGRI approach. The paper presents the state of the implementation of the EIP-AGRI-Approach in Germany and compares the requirements and regulations of EIP-AGRI funding in the context of the two federal states' Rural Development Programme of Hesse and Baden-Württemberg. The third part of the paper focuses on the assessment concept for the evaluation of the EIP-AGRI in Baden-Württemberg.

Methodologies for evaluation of sustainable agricultural public policies within the European context. A review.

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In Europe, many governments have already defined and implemented public policies for sustainable agricultures, at several scales and in different territories. Nowadays, decision-makers count on pre-defined and already tested evaluation methodologies for the policies they design. But indicators that are brought on the table for the evaluation tasks are mainly focused on one aspect of the sustainability. Many of those methodologies are mainly defined for a single objective, that usually is the environmental one. Thus, not all the tackled points are assessed, such as participation or socioeconomic issues.When it comes to define public policies and their evaluation systems from a holistic or multidisciplinary perspective, several main goals are to be tackled. Indeed, from an agroecological approach, policies must be engaged in environmental issues as well as on social and economical matters. Moreover, there is not yet a specific evaluation set for systemic public policies for sustainable agricultures.
This article aims at identifying the current evaluation methodologies for public policies related to sustainable agricultures in Europe. Based on the review of several authors' publications, it presents an analysis of the existing and proposed methodologies so to highlight their potential and deficiencies for their translation into public policies defined from a multidimensional approach. This analysis, together with a reflexion on the nature of the indicators to be integrated on such methodologies will include participation, ex-ante or ex-post evaluations approach as well as whether the multidisciplinary sustainability evaluation are included. It pretends to propose a basis for defining evaluation methodologies well adapted to public policies related to sustainable agricultures that tackled simultaneously its three dimensions: social, economical and environmental.

Theme 2: **Methodology and frameworks of farming systems transformation**

Workshop 2.2 **Sustainability Assessments at Farm Level for catalysing practical change**

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Lessons learned from a qualitative sustainability assessment method "Farm Talks".
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This paper presents a qualitative peer review "Farm Talks" method which stimulates farmers' learning beyond existing quantitative sustainability assessment tools. Farm Talks were started in 2008 by the biodynamic farming association and the Demeter organization in the Netherlands as a qualitative alternative to support learning and awareness on sustainability and biodynamic principles. In each Farm Talk, a farm is visited by a small group of colleagues and a facilitator to discuss farming practices and to explore how the farm could develop its sustainability performance. The Farm Talks method presents a novel approach to sustainability assessments in agriculture and enables farmers to define what they consider important for sustainable and biodynamic farming. The development of the method went through several phases of readjustments based on feedback from farmers and facilitators, and experiences from practice. The initial combination of learning and performance functions in Farm Talks caused tensions. Given the focus on individual farm development, the method continued as a learning and process-oriented method. A precondition for such an approach is the willingness of farmers to participate and actively engage. The method enables farmers to define actions for improvement based on their intrinsic motivation.

Animal pain assessment as an innovative and sustainable way of animal breeding in farm

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Sustainable assessment seems to be quite complex to do because there are different ideas of what exactly should be 'sustained' in terms of degraded natural resources (soil and water insecurity) and/or socioeconomic challenges (economic growth, threatened rural livelihoods, social injustice). Even if sustainable development lacks clarity, it supports the common wish of welfare and wellbeing for all, now and in the future. As the development of assessment methods towards sustainability often aim to design more productive, sustainable production

systems that are less harmful to the environment, we propose in our contribution to focus on social sustainability such as animal welfare which directly interfere on wellbeing of humans and animals but also on the efficiency of farm production.
In fact, animal welfare is here assess through animal pain indicators which mix animal welfare concerns, animal health issues and animal breeding efficiency (animal pain inducing more work time for farmers and a less growth rate for animals). But animal pain seems hard to objective depending both on self-sensibility of humans and on the status of animal species considered. It also depends on breeding experience of farmers and social interactions they have with various expertise such as veterinarians or researchers.
This is why, we have considered in our contribution the case of bovine and pig breeding in which both the status of animal sensibility and the organization of expertise between farmers and their advisors differs. We have used two different ways to study how the stakeholders deal with animal pain. At first, we have gathered breeders, veterinarians, farm advisors and trainers in two focus groups (FC): the first one have been focused on empirical pain assessment, the second one to appraise procedure experimented by scientist and engineers in order to better manage animal pain in farms. We have then conducted two qualitative surveys: one in farm and one to grasp how farmers, veterinarians and technicians interact to share information and knowledge about animal pain assessment in order to better manage farm animals.
The first FC led us to clarify the dimensions of a practical assessment of pain combining variability of perception, problem detection and qualification of pain. The second FC highlights the delicate division of roles between stakeholders and the practical constraints and resources of a better management of animal pain. The first qualitative survey shows the relative absence of animal assessment by farmers, except when it is connected with an illness. The second qualitative survey describes the condition of mutual learning between farmers and advisors for catalyzing practical change in animal pain management.

Assessing Family Farm Sustainability using the IDEA method in the Saïs plain (Morocco)

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The increase of irrigated crops in Saïs plain has led to an alarming aquifer over-exploitation and has contributed indisputably to price volatility related to the saturation of local and national markets. Consequently, these dynamics put the sustainability of farms at risk. Hence, to better evaluate how farmers consider the sustainability issue, responses were collected from a survey covering 40-farms related to farmers' perceptions and attitudes towards the sustainability concept. The environmental issues, taking into consideration that they are the responsibility of public bodies and policies, did not feature prominently as a key priority for farmers. In fact, to bring into focus the inherent weaknesses of farmer's agricultural practices, the IDEA method was adapted to evaluate the sustainability of 14 farms. Methodological changes concerns (i) score weighting, in order to highlight local issues (ii) removal of irrelevant indicators and (iii) addition of major local issues. The method enables each single type of farmers to better identify weaknesses that they can improve. Also, it arouses reflections

regarding the technical reasoning as well as the value systems on the origin of the farmers' decisions. However, most farmers were not individually concerned by environmental issues addressed by IDEA. They were mostly concerned about economic aspects as key drivers for their decision-making processes and their perception of sustainability. The discussions of the IDEA results yielded two main reactions; (i) farmers intent to secure on-farm income through diversification of productions and (ii) farmers willingness to take economic risks, especially in speculative horticulture value chains.

Implementation of sustainability assessment and reporting in horticulture: a case study of New Zealand's wine and kiwifruit sectors

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The wine and kiwifruit sectors are New Zealand's most valuable horticultural sectors, representing almost 60% of export value of all horticultural exports. A significant reason for this is that globally they are seen to provide high quality and safe products that are grown ethically and with minimum impact on the environment. This success in part is due to the market assurance programmes within each sector. The kiwifruit sector for example has been underpinned by programmes like GLOBALG.A.P. and an integrated pest management programme. Similarly, the wine sector has been supported by an integrated winegrowing programme which over 20 years has evolved into Sustainable Winegrowing New Zealand. However market expectations also continue to evolve and with it so must the sector's assurance programmes. If both sectors are to maintain and increase market value they must set new aspirational goals. To help achieve this, the NZ Sustainability Dashboard Project has been operating in both sectors to augment sustainability assessment and reporting. In the wine sector, the project has supported enhancements to the Sustainable Winegrowing NZ programme, development of new scorecard tools, and individualised benchmarking reports (with video tutorials on how to interpret them). In kiwifruit, unique online web-based dashboard tools that capture, report and benchmark sustainability-related information are currently being developed and piloted amongst different types of stakeholders e.g. growers and packhouse staff. This paper describes how these initiatives have come about, grower engagement, and the associated learnings.

Comparing the Sustainability Performance of Certified and Non-certified Coffee Farms in Uganda: Synergies and Trade-offs Between Sustainability Themes

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The Sustainability Assessments of Food and Agriculture Systems (SAFA) framework published by the Food and Agriculture Organisation (FAO) aims at harmonising sustainability assessments and making methods and results more transparent and comparable. There is, however, limited understanding of the interactions between SAFA themes under different agricultural production contexts. Synergistic interactions may allow for simultaneous enhancement of more than one sustainability goal, while conflicts in some sustainability goals

might result in trade-offs. In this article: (i) we assess the sustainability performance of certified (organic and fair trade) and non-certified smallholder farms in both Robusta and Arabica coffee production systems in Uganda, employing the indicator-based SAFA-consistent Sustainability Monitoring and Assessment RouTine (SMART) Farm Tool and; (ii) using the respective sustainability scores, we compare synergies and trade-offs between themes using the non-parametric Spearman correlation test. Generally all farms had high scores in the social, followed by environmental, and low in economic and governance themes, irrespective of the certification status. We find that certification improves the sustainability performance of farms, mainly through the enhancement of the 'cooperative effect' which ultimately has positive effects on other sustainability dimensions. This was evident among the certified coffee farms which obtained significantly higher scores in all dimensions than the non-certified farms. We thus found more synergies between sustainability themes among certified than non-certified farms. However the extent of the synergies and trade-offs significantly vary with certification type and other contextual factors. These findings call for caution in generalizing certification effects on sustainability of agricultural production systems.

Sustainability assessment of agro-ecological innovations at territorial and value chain scale

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With growing awareness of global environmental problems caused by agricultural production, producers and retailers increasingly strive to introduce sustainability led changes at farm level. A propagation of cooperative approaches has led to a diversity of niche developments worldwide with multiple but small-scale effects on sustainable land use. The potential for a broader impact is often inhibited by the failure to appropriate the value creation necessary for a long term establishment in the market. The study reported here was conducted as an intermediate step in developing assessment and management tools for innovations in a smallholder farm environment. Semi-structured interviews were analysed based on network analysis, content analysis and case comparison in order to answer the following questions:

- What environmental, economic or social values are expected from the innovation as a contribution to sustainable land use?
- What is the potential and what are the limits of integrating sustainability assessment into innovation management processes in regard to value chain and territorial approaches?

Ethical issues and diversification in farm structure were found more relevant to the sector oriented approach of poultry production. The regional case differed in highlighting consensual strategies, a strong recognition of future generations, property rights and provision making. Issues of local added value, closed circular systems and capacities for development were found to link both territorial and value chain approaches. The approach is discussed for its potential in making explicit the societal and environmental value creation and for fulfilling aspects of plausibility and applicability by the practitioners involved in the project.

Sustainability assessment in Luxembourgish dairy production by CONVIS: A tool to improve both environmental and economical performance of dairy farms.
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The paper describes the sustainability assessment tool developed by CONVIS s.c., a Luxembourgish farm cooperative active in the field of animal husbandry. After giving an overview of the components of the tool, the paper shows how data are collected, processed and reported. A concrete example of results is given for dairy farms, illustrating the relation between GHG-emissions and economic profitability of farm groups. In particular, it was found that the farms with the best environmental performance also tend to have the best economic results. Finally, the paper describes how these results are used to improve sustainability of dairy farms and points out the potential of the tool for supporting long term changes in various environmental fields

Farm transformation process of the groundnut basin and perceptions of farmers linked to the climate change issue
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Family farms of groundnut basin bear the brunt of the effects of climate change and experience severe mutations face changes in their social, cultural and technical. Agriculture, main activity, has less and less importance due to the deterioration of the means of production. In response, it is imperative to identify the constraints and risks affecting farms. Farmers have focused on structural constraints such as lack of inputs and farm equipment and climatic hazards with insufficient rainfall. The analysis of the forms of risk shows that there is a large spatial and temporal variability of rainfall with different drought that ended up impacting negatively on farming activities. These incidences have increased the vulnerability of farms in addition to the low level of adoption of technology, and the low level of market integration. The indicators related to the means and factors of production are behind the vulnerability of farms.

Integrated assessment of agro-ecological systems: The case study of the "Alta Murgia"National park in Italy
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Several indicators and methods have been already applied for sustainability assessment inagriculture. The links between sustainability indicators, agricultural management and policies are not well explained (Wei et al., 2009). The aim of this study is to combine biophysical and monetary sustainability assessment tools to support agriculture policy decision-making. Three methodological steps are considered: i) the environmental impacts of farms are assessed using terrestrial acidification, freshwater eutrophication, soil and freshwater ecotoxicity as well as natural land transformation; ii) the most relevant indicators of

agriculture damages on ecosystems quality are aggregated into an index; iii) the farm index score is combined with farm assets, land and labour, into the Sustainable Value approach (SVA), as indicator of natural resources used by farms. The methodology was applied in a case study on arable farms with and without animal husbandry of the "Alta Murgia" National Park. The sampled crop farms have a higher sustainable value using their economic and environmental resources. Mixed farms need to improve their resource use efficiency. Although crop farms have lower land-use efficiency than mixed farms, our results suggest, that specialized crops farms generally perform better in terms of ecosystems quality preservation. Finally, we find that Life Cycle Assessment (LCA) providing a measure the environmental impacts of farms clearly enriches the SVA.

Lessons learned from a qualitative sustainability assessment method "Farm Talks".
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Welfare Impacts of Agricultural Innovations. A Theory-based Impact Assessment of Biochar as a Soil Amendment and Improved Wastewater Irrigation in West African Cities
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This paper proposes a methodology for systematically assessing the welfare effects of agricultural innovations, exemplified by biochar as a soil amendment and improved wastewater irrigation in the West African cities of Tamale (Ghana) and Ouagadougou (Burkina Faso). Intensive cultivation of vegetables on small urban open-space plots has resulted in declining soil fertility and yields. Insufficient irrigation and nutrients have promoted the use of

wastewater irrigation amongst urban vegetable farmers, exposing urban producers and consumers to health-related risks. Productivity-enhancing innovations may simultaneously improve the livelihoods of urban farm households as well as, through reduced market prices, increase the food security of consumers. Additionally, improved irrigation technology to reduce pathogen loads on vegetables may enhance food safety but increase production costs. In order to evaluate economic impacts of such technology enhancements ex ante, a household production function for urban vegetable farmers that integrates soil fertility indicators is developed, alongside an aggregate supply and demand model for urban vegetable markets. This will allow the dynamic estimation of income effects for urban farmers due to production changes with resulting price changes at the market level. To scrutinize further assumptions pertaining to both consumers‘ and producers‘ perceptions on the costs of illness, studies on the opportunity cost of wastewater-related illnesses of producers and consumers‘ willingness to pay for safe, certified food are being conducted. The combination and integration of a farm-level assessment of productivity changes, analysis of market-level changes and contingent valuation studies on consumers' preferences allows for a holistic and systemic assessment of the sustainability of agricultural innovations.

Understanding the impacts of technology on farming system design using a linear programming approach to resource optimisation – a case study of increasing pasture production in New Zealand hill country environments

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New Zealand is dominated by mountainous and hilly landscapes. Mountain land above 1000 m occupies about 20% of the land surface, while steep, non-arable hill country below 1000 m comprises a further 40% (Blaschke et al., 1992). These lower steeplands are known popularly in New Zealand as “hill country” and comprise two main areas that support livestock grazing enterprises. These are North Island hill country, which covers 3.5 million ha (28% of farmland in New Zealand) (Mackay et al., 1993), and South Island pastoral high country (also known as tussock grasslands, run country, rangelands) which comprises about 3.4 million ha (Anon, 1994). The development of New Zealand's hill country for pastoral farming has had a long and interesting past (Suckling, 1966; Levy, 1970; White, 1973; Blaschke et al., 1992; White, 1999). Significant events include clearance of large tracts of evergreen conifer/broadleaf forests in the 19th and 20th centuries, destruction of areas of tall tussock grasslands, enhancement of soil fertility through application of lime and fertiliser, particularly superphosphate, subdivision to enable improved stock management and control of grazing pressure, and introduction of new species or improved cultivars and selections of existing species. The aerial application of fertiliser and seed using fixed-wing aircraft, commencing in the 1950s, and later the helicopter revolutionised development and management of hill country pastures.
If subdivision, topdressing and utilisation are advanced to the stage where further gains are sought, introducing new germplasm may have potential. Lambert et al (1985) described some benefits of introducing improved plants to existing hill pastures as enhanced annual or seasonal production of forage, higher nutritive value of forage, and more tolerance to factors such as drought, grazing, trampling, pests, or low fertility. They also highlighted the potential value of introducing new germplasm to exploit the many different micro-sites present in hill pastures, and to allow for situations where the material was not introduced earlier, or was introduced but did not persist perhaps because of inappropriate management.

Pasture production in New Zealand hill country can range widely (McNamara, 1992) and produces an average of 5-9 t DM/ha depending on the rainfall (Daly, 1990). However, much higher yields of between 15 and 20 t DM/ha can be achieved when intensive grazing management is applied in conjunction with nitrogen fertiliser, regardless of low rainfall (Lambert et al., 2003; Mills et al., 2006).
When farmers aim to increase productivity and profitability, changes are often required to the farming system. In the first instance current data from operating farms can be used to test whether improvements to the feed supply add value to the farm enterprise. Secondly, changes in enterprise must be assessed to determine the suitability of the changes to the achievable practices.
Farm systems analysis was used to investigate the potential impacts of increasing pasture production through the perpetual use of Italian ryegrass on part of hill country farms on whole farm systems configuration, using real farm data from 3 sheep and beef breeding farms (2 North Island and 1 South Island). The data were supplied by Landcorp Farming Ltd, a state-owned farming company in New Zealand. Whole farm scenarios and variability were investigated using a response surface approach to maximise profit by optimising the chosen system and then providing investment analyses.
Briefly, the process used existing real farm data to investigate potential maximum profit by optimising the use of current resources to provide a base comparison for potential changes. An increase in resource was investigated by adding a specialist ryegrass area to the farm (producing 15t DM/ha/yr).

Choice modelling for selecting and building sustainability indicators

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Agricultural sustainability assessments are becoming increasingly holistic and time consuming, in some instances requiring stakeholders to report performance in over 100 indicators distributed across social, governance, economic and environmental dimensions of sustainability. These increases in complexity, breadth and cost threaten full participation by stakeholders and might undermine understanding and decision making for more sustainable production. Choice modelling (also known as conjoint and decision analysis) – the study of how individuals and groups make decisions) – is one way for selecting valid and reliable indicators and, where appropriate, determining their relative importance ('weights') for prioritising monitoring and farming investments. We outline the strengths and weaknesses of choice modelling for: (i) focusing attention on the most important indicators for a targeted audience; (ii) increasing relevance, reliability and trust in individual indicators, (iii) condensing multiple indicators into composite measures capable of summarising sustainability performance, and (iv) creating measures of decision-makers' emphasis of the various dimensions of sustainability (social, economic, environment, governance). We describe the application of choice modelling, including surveys implemented to simply rank indicators, by

the New Zealand Sustainability Dashboard project (www.nzdashboard.org.nz/) for guiding assessment of sustainability within New Zealand's wine, kiwifruit, forestry, organic and indigenous primary production sectors. We discuss how such methods could facilitate learning at the farmer level around sustainable farming systems and thus induce practical changes on the farm. Our applications are primarily aimed at building resilience and sustainability at the individual farm, orchard, vineyard, forest or processing facility level, but the results can be upscaled and the tools used to assess and promote sustainability beyond the individual farm or enterprise level.

Theme 2: **Methodology and frameworks of farming systems transformation**

Workshop 2.3 **Well-being in rural areas: How is it affected by different farming systems?**

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Economies of Scope: Context of Agriculture, Smallholder Farmers and Sustainability

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Tracing the evolution of theory and practice of '*economies of scale'* during the last three centuries of industrial revolution, the paper shows the irony of adopting *economies of scale* time and again only to face greater economic recession, market failures, climate changes, food crisis and growing un-sustainability of our ecosystem. The article analyzes the significance of '*economies of scope'* in the context of (a) basis of efficiency in agriculture versus industry, (b) operational dynamics of scope and scale across sectors in agriculture (c) organizational design and institutional architecture with the logic of scope. Further, through empirical evidences from smallholder farmers and farmer producer organizations from across India, the paper highlights that '*economies of scope*' in agriculture is not only more efficient for nutritious food production, wellbeing in farmers and their communities, and local climate healing but also for the sustainability of agricultural ecosystems and the overall socio-economic-environment. Based on the analysis and empirical observations from action research during the last eight years, the article provides three tracks viz., science of economies of scope in agriculture, optimal organizational design in the light of economies of scope, and optimal institutional architecture for stable relationship among producer organizations and markets.

Resource endowment and the greater good: balancing labour between family and individual fields on Beninese farms

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In Sub-Saharan Africa, most farms are family farms. In these family farms, the workforce may include a husband, his wife or wives, his children, his brothers, and in-laws if brothers or sons are married. The literature provides evidence that 2 types of fields can coexist within family farms: family fields and individual fields, resulting in complex farm management systems. The

objective of this study was to investigate the diversity in management systems and their interaction with the production system, as the first step towards suggestions for improving farmer livelihoods.
A functional farm typology was developed for two case-study villages in Benin; Zonmon in the Southern part and Pelebina in the North-western part. Differences among farm types were related to the amount of resources and to resource-allocation between family fields and individual fields, as well as between major landscape units i.e. uplands and wetlands.
In both villages, individual fields emerged mostly in better-endowed farms. Granting individual fields may be a reward that only better-endowed farms can afford and a strategy to enhance commitment to family fields. The emergence of individual fields may also reflect differences between the objectives of the farm head and the objectives of the family's individuals. Differences in objectives are more likely to appear in better-endowed farms for which opportunities are diverse. Tipping of the balance from family fields to individual fields was more visible in Zonmon, where family fields on better-endowed farms were either small compared to large female-run individual fields or remained large but were served by hired labour.

Quality of work of vegetable growers, in conventional and agroecological systems, in the Walloon Region (Belgium)

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The present study explores the quality of work of vegetable growers for the fresh markets, in a diversity of conventional and agroecological systems. In the literature, we identified nine *dimensions* determining the quality of work : autonomy and control level, income and social benefits, work (in)security, political experience at work, time at work, job intrinsic benefits, job painfulness, health safety and competence. The production of vegetables in the Walloon Region (Belgium) may be categorized in four main types, ranging from market gardeners on a few hectares to cereal farmers who include some vegetables to their crop rotation. Each type was studied in both agroecological and conventional agriculture. We conducted 41 semi-directed interviews with vegetable producers. In addition to the evaluation of the nine dimensions, production and commercialisation systems, professional path, history, orientation to work and perception of the future were addressed. The first five dimensions appeared to be very central to understand, in our specific context, what distinguishes the different types of production from each other. In the present paper and for each group of producers, we will focus on these five dimensions from a qualitative point of view in order to illustrate our general conclusions to the study on the quality of work. Each group of producers is confronted with the necessary trade-offs between the various dimensions. For each dimension indeed, the quality of work is not systematically better for producers in agroecological agriculture. This appears particularly true for market gardeners on small areas.

"I don't regret that choice, producing less but doing better" – some key lessons learned in the international RETHINK project

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Many farmers are very actively exploring alternatives in farm management, production systems, markets and supply chains, often leading to new configurations in resource uses and relations between different actors, both within the sector and at a territorial level.
Experimentation with new approaches tends to create tensions with traditional systems, and institutions. However, often it leads to lasting improvement in economic success as well as the perceived quality of life and well-being of farm families and the wider rural community.
Our observations of reorientation are not surprising as European agriculture and rural areas as a whole are being confronted with enormous challenges and need to accommodate a variety of demands. Many of those pursuing alternative strategies tend to see these challenges and demands as opportunities for products with particular qualities, new services and new functions. A telling example is the necessary transition of industrialised country economies in particular towards resource-efficient and climate-friendly production systems and consumption. The necessary changes can provide completely new opportunities to farmers, up- and downstream businesses and rural areas.
The transdisciplinary RETHINK research programme connected the development of agriculture with the wider societal and policy goal of vibrant and prosperous rural areas. In this paper, I will use the 14 case studies of the RETHINK programme as illustrative examples when discussing conflicting goals and potential synergies between farm modernization and well-being in rural areas. I also put forward some of the main lessons learned with references to a set of research papers that present the comparative analysis.

Comparing Sustainable Rural Well-being in United States and United Kingdom Contexts

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This paper proposes that a baseline analytical framework approach is a necessary starting position and point of reference for developing default customized indicators of sustainable agriculture and rural well-being. Rural well-being addresses multiple issues including social/cultural, economic, and environmental contexts. Sustainable Agriculture practices are increasing as Industrial Agriculture becomes less acceptable. Rural women, minorities, and elderly have been the most significantly impacted by these changes. The United States (US) and the United Kingdom (UK) have taken positions on these transformative rural issues discussed herein. For these reasons we propose a set of fundamental indicators of rural well-being in the context of evolving agriculture and rural communities sustainability.
We will also discuss a sampling of evolving models of exemplar sustainable agriculture and rural community partnerships from the United States and the United Kingdom. The United States Department of Agriculture is "committed to helping improve the economy and quality of

life in rural America" primarily through loans and subsidies (USDA, 2015). The Sustainable Agriculture Research and Education (SARE) organization is dedicated to supporting sustainable agriculture and sustainable rural communities. The SARE Vision is "an enduring American agriculture of the highest quality that is profitable, protects the nation's land and water and is a force for a rewarding way of life for farmers and ranchers whose quality products and operations sustain their communities and society". (SARE, 2016). The United Kingdom government and non-government agencies have taken a more holistic approach to rural well-being in their efforts to achieve a more balanced social-economic-environmental state of rural well-being. The UK interpretation of Community Supported Agriculture (CSA) is a tested example of this sustainable approach to fostering rural well-being (Saltmarsh et. al., 2011).

To conclude, common generic indicators will be identified in selected models from the US and UK contexts, which can potentially produce positive impacts, supportive of sustainable agriculture, rural community resilience, and rural well-being.

Is the local agriculture related to the well-being of rural community today? A case from Portugal, Southern Europe

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Well-being in rural areas is recognised as one of the primary goals of the European policies aiming at the sustainable development. Rural settlements are closely connected with agricultural areas, and thus, it can be expected that local agriculture influences numerous aspects of rural life. However, the relations between local farming practices and well-being of rural community were up to date scarcely studied. Recent research indicates that especially the subjective well-being ought to be the measure of progress and should be the explicit objective of government intervention.
The aim of the study is to explore contemporary associations between the perceived qualities of the local agricultural characteristics and the self-reported levels of well-being by rural residents. A quantitative survey was applied to rural residents in two municipalities in Southern Portugal. In these areas different development trajectories in agriculture can be observed during the recent years.
Results show significant associations between the perceived qualities of local agricultural characteristics and subjective well-being of respondents. The life satisfaction, happiness and the satisfaction with the municipality as a place to live were the measures of subjective well-being assessed. They were positively correlated with most of the studied perceptions about local food, farming practices, landscape, and the environment.
These findings highlight the importance of further research on existing and possible impact of local agricultural practices on the well-being of rural community, and the need to consider these associations in formulating agricultural and rural development policies.

Transformation of traditional pastoral livestock systems of Egypt

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Background: The Northwestern coastal region of Egypt extends about 500 kilometers along the Mediterranean coastline. The pastoral livestock production systems prevail in this area. The zone has witnessed major changes over the last 50 years; demographic growth, urbanization and degradation of rangelands. More recently, the zone has faced by drought that has become more frequent. Objective: to assess the effect of drought on livestock farming systems and Bedouins socio-economic vulnerability and to identify the most frequently adaptive process developed by Bedouins to reduce the negative impact of drought Methodology: A semi-structured questionnaire was used for interviewing 162 randomly selected Bedouins. Result: Analysis of data showed that drought produce a large number of impacts that affects Bedouins economical standard of living. The annual sheep and goat productivity declined by 18.03 and 8.33%, respectively. Furthermore, the returns on capital invested in sheep and goat production were significantly reduced by around 47 and 34%, respectively. The analyses showed a significant relationship exists between the Bedouins socioeconomic characteristics and the encountered challenges ($p < 0.05$). Breeders have developed different adaptive mechanisms against drought conditions such as decreasing flock size, supplementary feeding , changing herd composition ,early marketing of their lambs/kids and migration of family members to urban areas . Conclusion: Hence, more emphasis should be given to improving livestock productivity and proper utilization of Bedouins resources. It is important to take into consideration socio-economic factors that influence small ruminant development programs to enhance their success.

Theme 2: **Methodology and frameworks of farming systems transformation**

Workshop 2.4 **Temperate agriculture sustainability assessment beyond the individual farm level**

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Climate Vulnerability Analysis Facilitating Transformation of Watersheds in Kerala, India

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Watershed Development Programmes (WDP) receive enormous attention due to their capacity to enhance production in rain-fed agriculture along with restoration of ecological balance and sustainability. Many of these programmes are questionable in terms of building climate change adaptation strategies among the rural poor in watershed areas. This paper analyses vulnerability towards climate change on watershed community level in Kerala, India. A case study was conducted in a watershed, which was implemented by a Non Governmental Organisation (NGO). Primary data was collected using the Rapid Appraisal of Agricultural Knowledge System methodology with its main instruments household surveys, focus group discussions, key informant interviews and personal interviews with various stakeholders. Vulnerability due to climate variability is assessed by developing a Climate Vulnerability Index (CVI) which employs both qualitative and quantitative data. The composite index comprises of three dimensions of vulnerability - adaptive capacity, sensitivity, exposure -, and its ten major components: socio-demographic profile, socio-economic assets, agricultural, livelihood, social networks, health, food, water, climate variability and natural disasters. As a main result, the vulnerability due to adaptive capacity indicators/subcomponents holds the highest value among the three dimensions of climate vulnerability. This implies an urgent need for location specific micro level planning of the watershed programmes with emphasis on activities to address water scarcity, soil and water conservation, farm diversification, production enhancement and livelihood alternatives for better coping strategies and resilience.

Benchmarking sustainability farm performance at different levels and for different purposes: elucidating the state of the art

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Multiple indicators for agroecosystems, sustainable land management, social development, rural livelihoods, biodiversity, etc. were already developed many years ago (Riley, 2001). Nowadays many of those indicators are used in a more holistic way, encompassing several or all of the aspects mentioned. However, this abundancy of frameworks, tools and metrics for agricultural sustainability assessment is still growing (Pope *et al*., 2013; Schindler, 2015). How does one navigate between benchmarking systems and sustainability assessment tools? What are the key characteristics to describe frameworks, metrics and tools that may facilitate the choice between them? How can one select the most appropriate for one's purpose?
Our objective is to provide starting points to answer these questions. We performed a literature review regarding the characteristics proposed to discern metrics and tools. We used state of the art results from the OECD TempAg network, who inventoried integrated sustainability assessment tools and metrics designed for different purposes, to divide existing metrics and tools according to these characteristics focusing on the purpose, level and end-user. This paper first addresses conceptual aspects regarding sustainability assessment. Second, it describes the method used to define the characteristics, the characteristics themselves and third it shows the division of the tools. Our research resulted in a list of 25 characteristics, which were grouped into general assessment related information, information related to stakeholder participation and indicators related information. The division of tools and metrics according to these characteristics raises new questions and starting points for future research and helps us to refine our research questions.

TempAg; An international Research Consortium for Sustainable Agriculture in Temperate Regions

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TempAg is an international research network for national governments involved in agricultural research in temperate climates comprising ten countries. The aim of the network is to deliver resilient agricultural production systems at multiple levels. This includes specific focus on: i) optimising land management to produce food and other ecosystem services at the landscape level; and ii) sustainable food production at the farm/enterprise level. The consortium has launched three pilot activities to start its ambitious programme. These are: i) a survey of experts and the literature to identify concepts of sustainability, how it is currently measured and which indicators are important; ii) a stocktaking exercise to overview ecosystem services to and from different agricultural production systems and in different scales; and iii) a modelling

exercise to identify the reasons for yield gaps (i.e. actual farmers yields as opposed to potential yields under optimal management) and determine ways in which these might be closed.

Initial assessments show that over the last two decades a multitude of frameworks, metrics and tools have been developed to characterise agricultural sustainability. The majority of frameworks were focused at farm scale, largely for use for farm development with indicator scores were aggregated in many to produce an integrated sustainability assessment. It was noteworthy that almost all of the ISAs implemented by farmers were associated with a specific commercial or certification context. A separate study showed that there was no consensus among individual experts about what constitutes reliable knowledge and useable datasets, and thus how agricultural sustainability might best be measured or expressed by indicators.

Assessments of ecosystem services is at an early stage but work to date indicates few studies where multiple services have been quantified simultaneously in agroecosystems. An expert-based survey of yield gaps indicated that nutrient management was the overriding factor that largely explained crop yield and yield gaps. In some countries environmental legislation is putting barriers to the amount of nutrients that can be used, causing some degree of yield gap, while in other countries it is more an issue of lack of resources.

Discerning the stars: characterising the myriad of sustainability assessment methods

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A myriad of sustainability assessment (SA) frameworks, metrics and tools have been developed. As the TempAg network aims to deliver resilient agricultural production systems, a.o. by comparing their sustainability performance, the first step was to identify currently used SAs and discern their characteristics. Therefore, from an SA inventory, integrated sustainability assess-ment (ISA) methods (assessing multiple dimensions) for agriculture were selected for an in-depth survey with the ISA methods' developers or users. A large variation in ISAs was found. Strictly reductionist representations were rare, but holistic ones ranged from less than ten to hundreds of indicators. Next to farm development, other (combinations of) purposes were found; a wide range of end-users; a spectrum of data collection, processing and scoring methods; and variate methods to combine indicators into an ISA. Stakeholder involvement in ISA development was found common practice, especially in the early phases, defining the sustainability framework and selecting the indicators. This first pilot activity shed some light on the complexity of ISA methods and the variability in their characteristics. Further research may reveal how they can be sufficiently enhanced to futureproof agricultural decision making.

Defining and assessing the sustainability of Swedish agriculture by public agencies

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The purpose of this paper is to present an analysis of how 'sustainable agriculture' is defined and assessed by Swedish public agencies. Through a content analysis of key policy documents and web communications addressing farm sustainability in Sweden and interviews with agency officials, the use of the concept of sustainable agriculture is analyzed. The analysis shows that Swedish public agencies deal with many aspects of what can be considered part of the concept of 'sustainable agriculture'. However, the term is not explicitly defined by the agencies but rather filled with meaning according to relevance in different situations on an ad hoc basis. The economic pillar is often given priority by the agency with the main responsibility of agricultural sustainability, the Swedish Board of Agriculture. No integrated sustainability assessment frameworks (SAF) including all sustainability pillars are used by Swedish authorities. Environmental issues are structured into a cross-sector system of environmental quality objectives of which different agencies have responsibility. More ways to measure sustainability at the national level was not deemed necessary by agency officials. Potentially SAFs could be useful for more structured discussions on which sustainability themes to include in different situations and for assessing the sustainability of individual Swedish farms for marketing purposes.

Target Setting and Burden Sharing in Sustainability Assessment beyond the Farm Level

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While great progress has been made towards monitoring agricultural sustainability through the use of indicators, setting sustainability indicator targets that motivate the transformation of farming systems for sustainability and resilience is often overlooked. This paper examines the role of target setting and benchmarking comparisons in sustainability assessment. A review of 186 indicator metrics and their targets from 12 sustainability assessment frameworks showed a preponderance of practice-based rather than performance-based measures. Many targets were implicit and embedded within the way ratings or standards were measured rather than explicitly derived from external information or processes. Ratio scales were rarely used for indicator measurement. Given these limitations, most assessment frameworks are weak tools for the comparison of agricultural sustainability between sectors, regions or nations. We then considered the equity implications of sustainability burden and benefit sharing and drew lessons from recent international climate change negotiations to recommend guidelines when erecting production level sustainability targets and benchmark comparisons between farms, regions, sectors and countries in the way being considered by the TempAg network. Equitable participation by multiple stakeholders in the process of erecting targets is important to achieve fair outcomes that underpin lasting commitment to sustainability. Scrupulous application of equity and fairness is more likely to change values of the farming families, food processors and distributors and consumers for collective action. Adjusting targets to match local social,

economic and ecological constraints on farming performance may be fairer, but this local tuning also challenges the design of and use of targets and benchmarks that have been upscaled to regional and national levels for informing sustainability policies across temperate agriculture as a whole. So will TempAg targets and benchmarking help or hinder transformation for sustainability and resilience?

Theme 2: **Methodology and frameworks of farming systems transformation**

Workshop 2.5 **Beyond participatory methods-approaches for facilitating transformation of agriculture and agri-food systems**

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Participatory design of agroecological farming systems needs to match the collective goal of transformation with farmers' professional projects

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Transforming agricultural systems toward more sustainable production pathways is a current societal demand. Researchers are invited to take part in and to account for this transformation. Consequently, some of them use participatory approaches to re-design farming systems, embedding farmers in the process in order to increase the success of effective transformations. However, the inclusion of the farmers does not always ensure that real transformations will occur. This uncertainty stems from the possible gap between the individual projects of farmers and the collective project that set the transformation goals. We believe that filling this gap requires taking account of and understanding the farmer's situation: the one on which he can actually act. To explore these tensions between the individual and the collective sides, we analyzed a participatory project led by five farmers among a group of 100 dairy sheep farmers located in the south of France. The objective of these five leading farmers was to design a method to trigger the agroecological transformation of farming systems by showing the other farmers that it is possible to improve at the same time their income, their autonomy and to protect the environment. Our analysis of the first steps of this project suggests that taking farmers' professional projects into account when willing to facilitate the transformation of farming systems allows them to effectively consider possible changes in their system. As such, transforming agricultural systems calls for participatory approaches that take farmers' individual projects into account and help them to define their specific situation, identifying the levers that they can actually activate to change it.

The Potential and Limitations of Mobile-learning and other services in the Agriculture Sector of Kenya Using Phone Applications

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Low productivity, income and food security in Kenya are often due to low level of adoption of modern agricultural technologies. Smallholder farmers, who produce the majority of agricultural products, face various challenges, including access to adequate information, services, and key value chains. Effective dissemination and adaptation of generated knowledge, practices, and technologies to diversify production and foster resilience to recover from shocks and stresses amongst farmers are lacking. Regular extension services have

failed to achieve the transformation from subsistence-oriented production to productive (semi-) intensive farming practices encompassing modern agricultural technologies. Information and Communication Technology in Africa is developing fast and the use of mobile phones has progressively moved beyond mere communications. Technology start-ups are taking advantage of the conducive environment in Kenya and build mobile applications that offer health, banking and, increasingly, agricultural services. Agriculture applications can provide farmers with an array of services from production systems management to climate information, and market access. Yet, while many of these applications have real potential to further social and technological transformation, particularly by engaging the youth and providing data to the government, they struggle with distribution and the set-up of sustainable business models.

Participatory research: a comprehensive process for a new generation of researchers
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The participatory research approaches are regularly included in agricultural research project for development. Participatory research is a real comprehensive process. This article shows through two study cases the importance to understand the diversity and the complexity of a problematic and to take this into account before acting.
In the African Great Lakes region, maintaining soil fertility is a continuous challenge; its degradation is highlighted in the majority of the latest scientific publications. Meanwhile, peasants' ingenious practices to overcome this problem haven't attracted much attention. The first case study is about a systemic analysis of soil fertility management in banana-based smallholder farming in Burundi. Exploring the complexity of the rural realities, the method highlighted diversity in the practices as well as the multiplicity of farmers' problem-solving skills.
The second case study gives an example of this second step of the process: acting in a research-action project in South Kivu. Banana crop in the region has been attacked by a bacterial wilt for which there is no technical solutions. In this case, our method allowed co-constructing the reflex of prevention by training based on the local reality of farmers. By working in interactions with stakeholders, we made partnerships with actors at different level. This methodological process redefines the role of researcher as an integrator between the micro level of farmers and the macro level composed with the actors of innovation network. This new kind of researchers needs to acquire some skills to assure this new job for facilitating transformation of agriculture.

Theory-based Innovation Platform management. A contribution of sociology to agriculture research and development.
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Farmers and peasants in the Global South are among the most vulnerable people and constitute the largest segment of their societies of food insecure. Farmers in the Global North are either costing large amount of taxpayer's money and or causing serious environmental threats. But is it fruitful to pinpoint the farm as the relevant system? Could it be a false problem? If so, which system should be at the center of attention of science and practice in

order to transform farms and livelihoods towards sustainability and resilience? In order to answer this question, we have to agree that farms are human fabrics, which have evolved in time and space within specific socio-ecological conditions. They are embedded within people's communities and nations, and globally connected through markets. Human societies have become large and complex, but all of them depend on food in order to sustain its members. No state can afford hunger riots without being destabilized, neither can a state ignore threats caused by unhealthy food and ongoing environmental deterioration. If this thinking is correct, then we have to deduct that societal parameters, combined with economic, agronomic and ecologic ones have to be considered in every design intending to transform such systems. This requires interdisciplinary teamwork and involvement of practitioners covering local to at least sub-national levels. But more important, a new understanding of the evolutionary nature of socio-ecological forms is required, which breaks with the artificial boundaries between nature and culture and considers concepts and ideas like "life", "conscious", "memory", "right", "person" and "freedom" as truly scientific ones which can and shall be applied scientifically when dealing with food and agriculture. We propose therefore as a first prerequisite of implementing successful design methods a broader scientific concept of our object, which enlarges the scope for social and human sciences within the sector. Secondly, as the phenomena studied and treated are forms of life and unique creations in time and space, only locally knowledgeable stakeholders as part of the local society can solve the concrete problems with the eventual support of science and research. Beforehand, the stakeholders need to properly identify the real problems; a process, which is often done too hasty and superficially. Innovation platforms are proposed as an innovative institution capable to manage these processes. The performance conditions of such platforms are discussed as equally important as their structure. We should finally give up the hope to find easy top-down solutions and rather realize the value of the concerned people and institutions on each scale, but particularly at local society level.

Triangulation in participation: Approaches for science-practice interaction in land-use decision making in rural China

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In Xishuangbanna, Southwest China, mono-cultivation of rubber (*hevea brasiliensis*) has fundamentally enhanced farmers' livelihoods but also caused severe environmental and societal problems. Within the Chinese-German project SURUMER, strategies for "Sustainable Rubber Cultivation in the Mekong Region" are developed which are assumed to have a high chance of implementation if validated by key stakeholders. Thus, an ongoing dialogue is established between scientists and practitioners, namely village heads, regional decision makers, and politicians. The overall transdisciplinary approach consists of a triangulation of methods—informal and open interviews, workshops, focus groups, a poster exhibition, etc.—which are adapted to each praxis stakeholder group and adjusted along the project phases. The intention is to gradually deepen and broaden participation in problem definition, knowledge integration, development of applicable solutions, and final implementation.

Searching for possibilities of improvement, the objective of this paper is to discuss the effects of the approach, with reflections on the strengths and challenges, considering the specific situation in Southwest China. Particular emphasis is placed on the question of ownership, i.e.

whether stakeholders are empowered, their ideas are taken into account or even solutions developed in the project are implemented. We find that the triangulation approach of participation is promising even in hierarchic situations. The broad range of methods and their flexible application allow us to target certain stakeholder groups with great effectiveness. It is necessary to give time and space for the adaptation and trust building process especially in communities where participation is not a tradition.

Theme 2: **Methodology and frameworks of farming systems transformation**

Workshop 2.6 **Management of interdisciplinary research processes**

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The role of sustainability assessment tools in enhancing dialogue and joint learning in transdisciplinary research on dairy farming

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Dairy farming is confronted with a wide range of environmental, economic and social challenges. To address these challenges, a transdisciplinary approach in which researchers and practitioners collaborate is needed. In the AUTOGRASSMILK project, researchers, farmers and farmers' organizations collaborated to address current challenges in European dairy farming. By combining a scientific background with the practical context, the project aimed to develop and implement strategies and technologies to combine grazing and AMS in dairy farms appropriate to the different European regions. An indicator-based sustainability assessment tool was developed to assess the sustainability performance of dairy farms. Results from using the tool on 26 dairy farms in six European countries illustrated current economic challenges in dairy farming.
The collaborative development of the tool supported participants to engage in dialogue on what constitutes sustainable dairy farming. Developing the tool improved understanding of regional differences in dairy production, and challenges involved in defining generic strategies and policies to improve sustainability in dairy farming. The development of a sustainability assessment tool involves decisions on sustainability themes, indicators and reference values and brings forward differences in perspectives and values on sustainability. As such, the process of developing a sustainability assessment tool can enhance dialogue and learning in transdisciplinary projects.

Experiences with knowledge integration methods in an inter- and transdisciplinary project of sustainable land use in North East Germany

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This paper draws on experiences of the inter- and transdisciplinary research project ELaN which has been carrying out various methods of knowledge integration throughout a five years research process. ELaN had the aim to develop innovative water and land use options in the North East of Germany. During the initial phase of the project, a joint problem formulation has been developed in several iterative loops with the method of constellation analysis. Further along the process the results of the 14 sub projects were integrated in several synthesis products: an administrative manual with recommendations regarding the use of treated waste

water, a decision support system for farmers that contains a variety of land use options depending on different groundwater levels, scenarios of land use options depending on different framework conditions and governance recommendations for sustainable water and land use options. Additionally the main results of the project were summarised in 11 core statements. These synthesis products were discussed with the respective target groups to different extents.
The paper provides in-depth empirical insights of applying a range of methods and whether they were more appropriate for integrating knowledge from different disciplines or to serve as boundary objects between science and practice. We analyse whether knowledge integration via the different synthesis products results in system, target or transformation knowledge. Furthermore we differentiate between consultative and participative transdisciplinarity referring to the intensity of exchange with practitioners and processes of mutual learning. Finally, we refer to restrictive and favorable structural factors for successful knowledge integration.
The paper concludes that a systematic design and management of knowledge integration processes is crucial but that the nature of the problem at stake, as well as political or societal windows of opportunity are just as important for successful transdisciplinary research processes.

Managing transdisciplinarity: using the situation analysis approach for a joint problem framing

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Inter- and transdisciplinary sustainability research aims at generating knowledge to deal with regional and global problems like biodiversity loss. One challenge is the methodological design aligned with the project management fostering the cognitive and social integration of heterogeneous knowledge and actors. We argue that generating a joint understanding of the situation is a necessary precondition for successful knowledge production already in the starting phase.
The research project ginkoo develops tools for the management of innovation processes for sustainable land use. It accompanies ongoing innovation processes in two case studies in the Berlin-Brandenburg-area in Germany. One characteristic of the ginkoo-project is an intense collaboration with two organisations from the practitioners' side, which develop innovations for sustainable land management. These project partners are the Biosphere Reserve Spreewald and the organic farmers' association "Naturland Marktgesellschaft".
The article describes the transdisciplinary approach of the research project in its starting phase and discusses the approach with respect to methodology, project structure and management, applicability and consequences for the following inter- and transdisciplinary work. The project uses the situation analysis approach as developed by Clarke (2012) for a joint problem framing. A thorough process planning, coordination and documentation of the situation analysis made this approach transparent.
The findings of the situation analysis capture the heterogeneity of the situation, including different social and discourse arenas and provide a holistic picture. It provides scientists with in depth insights and guided the reflection of practitioners. As a consequence, the situation analysis assured that the research approach is closely linked to real life problems. Further, it

builds a base for disciplinary research approaches as well as the knowledge integration to come in the project.

The challenges of transdisciplinary action research in the case of the project "Urban Agriculture Casablanca/Morocco".

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The objective of the project "Urban Agriculture Casablanca" was to identify urban and peri-urban open-space systems for the rapidly urbanizing region of Grand Casablanca that include agriculture as key components of urban planning and which contribute to addressing the challenges to which cities are confronted: mega-urbanization, nutrition and food, weather and climate, endogenous resources and governance.
One component of the project design was the transdisciplinary action research which took place through so called pilot projects. The pilot project "Peri-urban tourism and agriculture" explored the possibilities on how to conserve and further develop the recreational benefit of small scale agriculture while improving the livelihoods of the farming families linking local tourism and peri-urban agriculture, processing and direct marketing.
This article aims to reflect on the transdisciplinary action research process which took place within the pilot project. This reflection is based on the results obtained, the feedbacks of the participants and the difficulties that the project team experienced during the application of the methods and collaboration with the various actors.

Theme 3 **Pathways towards sustainable agri-food systems-tensions or synergies?**

Workshop 3.1 **Sustainability of food chains: contested assessments**

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Meat alternatives compared: their pathways of change and sustainability

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From a technological point of view, a more sustainable food production would imply i) reduction of the use of fossil energy sources, ii) reduction of the use of clean water, iii) a more efficient use of raw materials (resources). The inefficiencies related to meat consumption originate from the fact that plant materials, especially proteins are decomposed and restructured again into proteinaceous materials. To produce meat, animals consume protein-containing feed, which they decompose into amino acids, which are then converted into new proteins (amongst others muscle tissue). Depending on the animal species, the ration between fed protein and protein suitable for human consumption ranges from 4 to 26 (Sebek & Temme, 2009). Meat production is optimized in an economical manner. The price of meat is low, suggesting that the production of meat does not require much processing or handling. In other words, meat production is not efficient in resources, but efficient in terms of economy. This indicates that replacing meat by alternative products will not always be more sustainable, especially if much bio-refining and other processing is involved. The second question for the comparison of the meat alternatives hence relates to the desirability of the meat alternatives from an environmental sustainability point of view: What are the potential sustainability gains from each alternative, i.e., would their eventual success significantly reduce the use of scarce resources compared to current best practice? In other words: Is it worth the effort, and which alternatives are most promising?

To contribute to this discussion, this paper adopts an interdisciplinary perspective on alternatives for meat provision and use. Being an interdisciplinary team ourselves, we will develop a conceptual framework – the Reflexive Integrative Comparative Heuristic (RICH) – to conceptualise plausible pathways for the production and consumption of five widely discussed meat alternatives and surrogates: cultured meat, algae, insects, plant-based meat surrogates and pulses. Aided by the RICH heuristic, we will estimate their environmental

sustainability potential and comparatively appraise the level of complexity regarding the needed technological and social-institutional innovations. This approach resonates with the r ecent call for a changing role of science in the Anthropocene by contributing to societal goal clarification, exploration of supporting or obstructing trends and analysis of "factors that might propel or impede transformations towards desirable futures" (Bai et al., 2015).
This approach allows us to compare the environmental sustainability potential of the known meat alternatives, the socio-technological changes required for an upscaling of each and the possibilities for them to develop into a supportive relationship. In this way, it will be assessed whether and under what conditions the advocated high-tech alternatives can help the transition towards a sustainable system.

On the use of LCA indicators for the environmental assessment of food systems: the case study of the Mediterranean Diet

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The broad recognition of Life Cycle Assessment (LCA) as a science-based methodology for environmental assessment of products has paved the way toward extending it into a framework for sustainability analysis. This work analyses the applicability of the method to environmental sustainability questions posed from different points of view. The case study of the Mediterranean Diet is considered, as it allows formulation of options under two different perspectives on food system sustainability. The approach is inspired by conceptual modelling and focuses on analysis of the modelling paradigms of LCA. Our findings confirm hypotheses expressed in the literature that not all perspectives on sustainable food systems could be captured by such modelling paradigms.

Long-term sustainability assessment of market-gardening farms involved in short supply chains: a case study in South of France

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In France, one market-gardening farm in two is nowadays involved in short supply chains (SSC). Involvement in SSC has been proved to be a driver of farming system modifications and can therefore affect farm sustainability. Impacts of SSC at farm scale have been however little assessed at medium and long term. Our study aimed therefore at analysing why and how market-gardening farms involved in SSC evolved over time and at assessing current farm sustainability. Comprehensive interviews were conducted from April to July 2015 in 28 market-gardening farms located in two areas of South of France to describe and analyse their evolution trajectories from the time when they were first involved in SSC up to nowadays. Current functioning was analysed as well and combined with a sustainability assessment. We fund that farm strategies and evolution trajectories differed mainly by the intensity of SSC use, the complexity of the marketing strategy, the level of crop diversity and the intensity of input use. Farms the most involved in SSC displayed the better agro-ecological sustainability and a higher contribution to local economy and life. The economic assessment resulted in contrasted scores depending on farm types and sustainability components but the available farming income was a share issues within the surveyed farms. The social assessment highlighted

mediocre working conditions but life quality was assessed as correct to good by the farmers. We highlighted a high diversity of situations, regarding evolution trajectories and current farm functioning, and this diversity affected sustainability assessment results.

Sustainability auditing: a tool for governing wine production in New Zealand?

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With a twenty year history of sustainability program and more than 94% of the winegrowing area certified 'Sustainable Winegrowing New Zealand", "Organic" or "Biodynamic", the NZ wine industry is becoming an exemplary case of sustainable wine production. This paper discusses the history of the NZ wine industry over the past 20 years to trace the ways that the sustainable narratives used by the industry have influenced environmental governance. By creating a premium market for a rapidly growing wine sector, the 'Sustainable Winegrowing New Zealand' program grounded its environmentalism in markets through branding while also coordinating wine production practice through associated auditing. The historical development of the program suggests that this was achieved through the wholesale industry adoption of what had been a voluntary program. As a result of this unique history, growers and winemakers relate to this sustainability program as being both governing in a regulatory sense and market-motivated. The results have implications for considering how collective market strategies paired with sustainability assessments may create a new kind of governance mechanism that sits across economic and social spheres. We discuss this mechanism in the context of neoliberalism and post-neoliberalism.

Theme 3 **Pathways towards sustainable agri-food systems-tensions or synergies?**

Workshop 3.3 **Pathways for land-use: the sustainable avenue of agroforestry**

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Consumer perceptions and behaviours regarding traditional pork products from agroforestry pigs in Veneto region (north-east Italy)

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Outdoor free-range pig production is rare in the Veneto region of Italy and where it exists it is mainly linked to organic farming. Farmers who use agroforestry systems for pig production often process a large proportion of meat on-farm and they expect to receive a premium price from consumers for products such as traditional fermented salami. In order to understand consumer perceptions and behaviours towards agroforestry pigs, an investigation was undertaken which involved 387 consumers associated with nine local fair-trade groups that usually purchase products directly from farms. Although this sample does not represent all consumers, it provides information about consumers choosing "environment-friendly agriculture" such as organic or agroforestry systems. Questionnaires composed of 12 specific multiple choice questions plus questions, for example, regarding age, activity, education, and income were completed by consumers who had just seen a brief presentation on the main benefits of agroforestry systems for environment, pig welfare and product quality.
Preliminary results indicated that the majority of respondents (74%) knew little about the positive effects of agroforestry. Nevertheless they were interested in the capacity of trees to reduce nutrient leaching in the soil and water (67%), increase carbon storage (43%) and improve pig welfare (37%). Agroforestry applied in an organic farming context appeared to be more valuable than agroforestry applied with conventional agriculture. People who had already eaten farmhouse fresh pork and processed salami from outdoor free-range organic system thought that the quality is better than similar factory-produced products available in conventional retail shops and supermarkets. A majority of them (68%) believed that higher

quality traits depend mainly on breed, feeding and processing techniques, whilst 23% thought that quality was linked to the presence of trees, improved welfare, and a "natural" environment. Three main consumer groups were identified in terms of the responses to premium prices. A majority (54%) was unwilling to pay a higher price, a second group (34%) was willing to pay an additional 10-15%, and only 12% were willing to pay a premium of 20-25%. Answers about the premium price are not surprising considering the high price of farmhouse organic salami which costs about 30-50% more than similar organic products in a specialised retail shop. However, a small premium price (10-15%) could be achieved by farmers who promote organic agroforestry systems for fattening pigs if combined with an appropriate information campaign for targeted consumers.

Nurturing agroforestry systems in temperate regions: an analysis of discourses for an enabling environment in Flanders, Belgium

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In Flanders, the northern region of Belgium, agroforestry systems are increasingly recognized as a multi-functional land use that can balance the production of commodities with non-material outputs such as environmental protection and landscape amenities. Yet, the uptake of agroforestry among farmers remains relatively low despite policy incentives such as a subsidy program covering 80% of the establishment costs. To study this implementation gap, transition literature was consulted which states that the transition from conventional to more diversified farming systems depends on a fundamental change in not only the structures and practices, but also the cultures of a societal system. Whereas actors and stakeholders may hold a wide range of viewpoints regarding agroforestry (e.g. the form, the feasibility and the desirability), policy initiatives typically only address one form of agroforestry. This could be a reason that current incentive programs are not very effective. Therefore in this paper we focus on cultures of a societal system, and describe a study design using Q-methodology to examine the different narratives and discourses on agroforestry in Flanders. Furthermore, general discourses and narratives on agriculture and agricultural policy are related to the identified perspectives on agroforestry. This is important since different general discourses on agriculture will create different meanings and interpretations of agroforestry and this can help identify an enabling environment for agroforestry in terms of research, policy, market and economic conditions.

Sugar beet yields in an alley cropping system during a dry summer

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Agroforestry (the integration of trees with crop and/or livestock production) offers a pathway to diversify agricultural production. Agroforestry systems have the potential to improve on-farm

use of water through enhanced soil water holding capacities, the provision of shade, and the creation of wind shelter. These three characteristics can also improve the resilience of agricultural production in response to changing weather patterns. The objectives of this study were: 1) to measure how alley cropping systems with varying alley widths affect crop microclimate, 2) to measure the effects of this microclimate on sugar beet (Beta vulgaris) yields, and 3) to assess how moisture availability affects sugar beet growth patterns. Measurements were made in a 70 ha alley cropping system comprising black locust (Robinia pseudoacacia L.) and hybrid poplar Max1 (Populus suaveolens subsp. maximowiczii x P. nigra). A sugar beet crop was grown during the relatively dry growing season of 2015. Sugar beet yields were reduced in close proximity to the hedgerow, but yields were higher at and beyond an intermediate distance when compared with those in a nearby conventional agricultural field. Moisture availability significantly affected growth patterns of sugar beet roots.

Alley coppice: an evaluation of integrating short rotation coppice and timber trees

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This paper summarises the main results from a recent research project focused on an innovative Alley Coppice (AC) land use system. We report on an AC system comprising standard trees for the production of valuable wood and the alley intercropping of short rotation coppice trees (SRC) for the production of bioenergy. Much of this work was carried out within the European project AgroCop (2012-2014) that combined field experimentation with bio-economic modelling. Two experimental plantations are located in Italy and France. The first plantation (9 years old) was used to study the intercropping of *Pyrus* spp. and *Sorbus* spp., as standard trees, with poplar SRC. Current measurements do not show any difference in stem height between intercropped standard trees and trees in pure plantation forestry. This was probably due to shading by the SRC canopy on standard trees. Nevertheless, this light competition has improved the stem form of standard trees, with a main bole almost straight and free of defects. In France, the poplar SRC crop was established into the alleys of a hybrid walnut tree plantation (18 years old) in a system we term: delayed alley coppice. Poplar growth was strongly limited by the shade of the walnut trees, although some microclimatic mitigation of water stress was observed on poplar shoots during the peak of summer heat. Biophysical modelling was conducted with the calculation tool YDEAL, comparing AC (hybrid walnut intercropped with poplar SRC) vs SRC monoculture vs walnut forestry monoculture. Simulations were performed on a 60 years rotation cycle of AC (harvesting cycle for the standard trees), and three cycles of 20 years for the poplar SRC, with triennial coppicing. Three growth condition scenarios were studied, namely poor, medium and optimum site conditions, mostly according to average yield data of poplar SRC (6, 10 and 15 t dry matter ha^{-1} $year^{-1}$, respectively). The financial analysis was performed using a calculation tool named FinAC. The AC system could be as profitable as the forestry monoculture, in the best financial and environmental scenarios, with the wood price determining absolute system profitability. AC can provide a landowner with a periodical annual income during the growth of standard

trees. The feasibility of AC is partly limited by wood market uncertainty, the use of farmland for a medium-long period with the same culture, and the current difficulty in estimating AC profitability. AC could be used as a temporary system (10-15 years) to improve the stem form and wood quality of standard trees.

Silvoarable agroforestry: an alternative approach to apple production?

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Novel land use systems that integrate woody species into the agricultural landscape have the potential to balance productivity with protection of the environment and the maintenance of ecosystem services. Integrating top fruit production into an agroforestry system, where woody species are integrated with arable crop production, may have a beneficial effect on the control of plant pathogens such as apple scab (*Venturia inaequalis*). However, the introduction of such systems into European high-yielding traditional apple production systems will meet substantial obstacles as the approach affects not only agronomic performance but also well-established fruit production traditions. This paper reports on research that evaluated an apple-arable agroforestry approach as a sustainable strategy for reducing copper inputs in organic and low input systems using two contrasting case studies; Wakelyns Agroforestry in Suffolk, and Whitehall Farm, Cambridgeshire. The results presented here focus on three elements that are likely to be impacted by an agroforestry systems approach to apple production: (i) yield and quality of apples; (ii) emergence of primary and secondary pests and diseases; and (iii) impact on management activities. Potential synergies and tensions are identified and discussed.

Managing traditional hedges for biofuel

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With around 700,000 km, hedges are the most widespread semi-natural habitat in lowland Britain. As well as being an important landscape feature in their own right, hedges fulfil many functions and are increasingly recognised for their importance in regulating environmental processes. However, the 2007 Countryside Survey found that just 68% of Britain's hedges are managed. Recent research has sought to address this by investigating the economic potential of using biomass from hedgerow management for local energy or heat production. This work has brought farm hedges back into focus and sought to answer questions about whether biomass can be sustainably and economically harvested from hedgerows, and as such, whether hedges can be a viable source of woodfuel?
Here we outline the results of trials carried out in Southern England to assess the efficiency, cost and viability of coppicing hedges as a local and sustainable source of woodfuel. Machinery and methods were tested at different scales and the impacts on the local environment assessed. Building on work in South West England and Northern France the trials demonstrated that that hedges can be managed effectively and economically to produce woodfuel of reasonable quality which meets industry standards. However, the introduction of

coppice management of hedges for woodfuel is likely to have both positive and negative impacts on the wildlife of individual hedges and on biodiversity at a landscape scale. To address this, alongside the trials a protocol was developed to assess the likely impacts on biodiversity of managing hedgerows for woodfuel.

The biodiversity protocol enables landowners to carry out an assessment of their resource prior to carrying out any management, it identifies hedges suitable for harvesting woodfuel and those of potentially high biodiversity value as well as those in need of improvement and offers general management recommendations based on different indicators.

Theme 3 **Pathways towards sustainable agri-food systems-tensions or synergies?**

Workshop 3.4 **Boundary spanning between agroecological and conventional production systems: Implications for pathways towards more sustainable production**

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Agriculture models at the crossroads of farming systems, food systems and territorial dynamics

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Different agriculture models can be developed to deal with sustainability issues. The objective of this paper is to present a new analytical framework allowing the identification of key agriculture models at the crossroads of farming systems, food systems and territorial (local) dynamics. The first dimension of this framework is based on the distinction between three key types of farming systems: synthetic inputs-based, biological inputs-based and biodiversity-based. They are more or less dependent on exogenous inputs and ecosystem services. The second dimension is based on the identification of how each of these three types of farming system interacts with global food systems and territorial dynamics i.e. circular economy, local food systems and integrated landscape approaches. Our framework makes it possible to specify agriculture models corresponding to a type of farming system and to the nature and level of its interactions with its socio-economic context. Finally, in considering six key agriculture models we sketch out key associated scientific issues.

Learning from organic farming: Overcoming barriers to adopting agroecology

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Certified organic production has existed for decades and many of the social challenges faced by organic farmers are also faced by farmers who are considering the philosophy of agroecology. Examining how organic farmers, who are easily identified by their certification, have overcome social barriers to conversion could shed light on how farmers may be motivated to adopt agroecological practices. The aim of this study was to identify whether social factors provide barriers to conversion and, if so, to identify strategies by which these barriers might be overcome. Interviews were conducted with 39 farmers of mixed and arable farms in the

German (n=24) and French (n=15) speaking parts of Switzerland, which were analysed according to their content. The results suggest that attitudes towards the concept of organic production are often formed on the basis of quickly-formed impressions rather than considered deliberation. Furthermore, farmers perceive social pressure to focus on productivity, and organic farming is often perceived by non-organic farmers to be less productive. On the other hand, non-organic and organic farmers were found to have more similarities than differences in their goals and practices, with organic farmers reporting that conversion to organic had turned out to be less difficult than foreseen. These findings lead to several proposed courses of action for organisations wishing to promote organic farming practices; with most based around encouraging dialogue between conventional and organic farmers to counteract feelings of 'us versus them'.

The re-innovation of mixed cropping – who's interested?

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Mixed cropping (MC), the growing of two or more main crops in one field that coexist for a time, can help to design a more sustainable agricultural land use, due to a variety of ecological benefits relative to mono-stands. Specifically, we look at the industrialized alley cropping approach for cereal and grain legume mixtures which reduces synthetic fertilization needs, improves biological pest management, increases drought resistance and can limit the risk for lodging (a full list of ecological benefits and references shall be published with the full paper). MC goes hand in hand with benefits for agrodiversity and the associated biodiversity (Malézieux *et al.* 2009).

Despite its ecological benefits, there is a lack of political support or consideration of MC, due to a lack of interest among stakeholders within the agricultural sector. Such interest can spill over among farmers, agribusinesses and researchers, but today's interest in MC is restricted to the assessment of ecological benefits. Overall knowledge of implementations is scarce among farmers (in 2014 about 0.007 % of cropping land is distributed to MC in Germany) and among researchers (Duc *et al.* 2015). All research and development and agriculture machineries evolve around monocultures. Economically, MC does not receive financial support like pure legume stands within the EU and therefore needs to compete with pure cereal stands. While grain productivity of MC is higher than in comparable mono stands in low input systems (Brooker *et al.* 2015; Duc *et al.* 2015), research is not conclusive in high input systems. Additionally many stakeholders believe substantial technical barriers to hinder the industrialization of MC.

To learn more about the lack of interest among stakeholders that hinders the development of this agroecological production system, we profile who is interested in the diffusion of MC in relation to potential promoters and antagonists. A potential promoter is a critical perception of sustainability issues, in case MC is considered suitable to ease these issues. Such issues may be the intensive use of synthetic fertilizers or the steadily declining biodiversity in agricultural systems. In contrast a critical perception of different technical barriers, involved in efficient MC implementation, might reduce interest. Recalling that MC is closely linked to the ideas of agroecological production methods, another barrier can be an actor's conventional paradigm rather than alternative/agroecological paradigm. It is probable that ideas based in one paradigm are somewhat difficult to endorse by supporters of the opposing one. MC might need to span the paradigm gap in order to encourage adoption.

Increasing searches for autonomy among French farmers: a starting point for agroecology?

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In Western European agriculture, an increasing number of conventional farmers are actively augmenting the autonomy of their farm enterprises. They do so, amongst others, through decreasing the external inputs, whilst simultaneously improving the use of internal resources. Thus, low external input farming systems emerge that increasingly enhance ecological processes. Simultaneously, the farmers involved may maintain key features of their entrepreneurial mode of farming. In this context, the network of French farm machinery cooperatives witnesses a movement of collective innovation experienced by farmer members to become more autonomous.
The present paper aims at better understanding this phenomenon visible within some French farm machinery co-ops. Our methodology is based on an exploratory survey of 15 machinery co-ops and a range of six in-depth case studies among them. Our work combines a farming system and a sociological approach. Most of the studied farmers mainly seek to become more autonomous from markets, notably from input markets. A part of them also claim to gain autonomy from advisory services and regulatory institutions. The current price volatility context appears as one of several decisive factors, of many of the farmers interviewed to seek the means to become more autonomous. The collective organisation provided by the socio-technical network of farmers' arrangements associated with their machinery co-op, has allowed them to benefit from favourable conditions under which to undertake the new practices.
We conclude by suggesting some lessons from these experiences to strengthen local networks of farmers' sharing arrangements as a conducive arena for agroecological transition.

Informed participatory research, a methodological approach for investigating the potential of organic farming in the transition of food systems

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A study on the prospects for organic agriculture in 2025 suggested four possible evolution scenarios, from the most optimistic, where organic farming would be the main agricultural model, to the most pessimistic, where organic farming would have been diluted into a new form of sustainable conventional agriculture.
Two main elements could lead to the most pessimistic scenario. The first element is the heterogeneity of organic farming (e.g., different scales, various levels of mechanization, varying degrees of adherence to agroecological principles). This diversity complicates organization among farmers and is potentially confusing for consumers. The second element is the development of short food marketing channels that give priority to local products regardless of their organic farming status. The role of research is not to decide on the best pathway in the transition of farming systems, but to provide the tools for investigating the

possible pathways and for supporting decision-making. In this regard, we developed a series of 'informed participatory research' (IPR) steps designed for use by research centres. IPR combines the classic elements of participatory research and a specific, comprehensive and multi-dimensional assessment of the diversity of farming systems. The method has been implemented in Wallonia, Belgium, where public institutions are supporting a strategic plan for the development of organic farming. The IPR approach provides a way of integrating technical and social tools within a dynamic framework of analysis and action.

Theme 4 **Emergence and application of new technologies**

Workshop 4.1 **Boosting research outputs: novel approached for integrating research translation with interactive co-innovation**

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Viewpoints-based method and tools in territorial participatory design

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As a part of the Tatabox project exploring ways to define and locally experiment « transition to Territorial AgroEcological System » (tTAES), researchers and rural stakeholders (policymakers and farmers) organized territorial participatory design (TPD) workshops. Such TPD are especially challenging since actors projecting their activity into the future confront many viewpoints or controversial dimensions (farming systems, natural resources, food–chain…). To facilitate multi-viewpoints TPD, we propose a multi-ViewPoints model for both organization and knowledge purposes. It allows for adequate organization of TPD activities and agendas; it also supports knowledge sharing, capitalizing, annotating and category-building with respect to the plurality of semantics of the TPD actors. It is presently experienced by rural actors in face-to-face meetings using classical maps and paper devices. In this paper we demonstrate and propose guidelines for Viewpoint-based software tools supporting meeting recording, annotation, information retrieval, cross-viewpoints visualization all along the TPD process.

Inserting co-innovation into research translation: experiences from the VALERIE project

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Although innovation is understood to encompass much more than R&D, science continues to be an essential ingredient. In particular translation, adaptation and ‘valorisation’ of research results, the responsiveness of research to users’ needs and improved access to results are all regarded as important in achieving a more sustainable European agriculture. These challenges can be addressed in a number of ways including increased collaboration, networking, transdisciplinary research and co-operation between researchers and practitioners. From a theoretical and practical perspective such approaches often involve

inserting elements of co-innovation into the traditional science-driven model. Whilst a number of studies have examined the processes entailed in co-innovation, such as co-reflection, learning, reflexivity, and co-creation of knowledge, less attention has been paid to integrating co-innovation processes into the translation of existing scientific research outputs. This paper examines this topic within VALERIE, a project using an iterative stakeholder-driven methodology to create an effective retrieval facility for science-driven research outputs. Specifically the paper aims to understand the interplay between users' identification and articulation of research needs and providers' matching of these needs. The evolving methodology provides useful insights into the process of, and highlights some challenges associated with, integrating co-learning and research outreach.

Agronōmics – an arena for synergy between the science and practice of crop production

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Progress towards sustainable intensification depends on effective exchange of knowledge and data between industry and academia. This requires engagement of both farmers and researchers, recognition that innovations can occur in the field as well as in the lab, and that researchers have as much to learn from farming and farmers as vice versa. A number of initiatives in the UK are recognising the value of farm networks for effective knowledge exchange and for asking questions of relevance on-farm; however the value for science is less well recognised. Uptake of digital record keeping and precision farming technologies is now becoming ubiquitous, giving new opportunities for farmers to share data amongst themselves and with researchers to provide new insights, but crucially also allowing farmers to make interventions in-field and to measure their impacts on-farm, for example by yield mapping. New statistical approaches are required to draw robust conclusions from this sort of data, but the authors believe its use could be transformative of agronomic science, so much so that we have created a new term to describe the approach; namely, 'agronōmics'. The major benefits of experimenting in fields with farmers are; i) working at a relevant scale with the ability to test treatments not possible at the plot scale; ii) the potential to assess treatment interactions with soil differences (experimenting with soils is challenging with conventional plots); iii) the potential for greater precision to evaluate treatments with confidence intervals of less than 0.5 t/ha; iv) engagement of farmers, hence embedding knowledge exchange within research. However, it is crucial for effective knowledge exchange that farmers and researchers share the same concepts and metrics. ADAS has thus established the Yield Enhancement Network to allow both arable innovators and researchers to compare actual farm yields with theoretical 'potential' yields (estimated using conventional crop science concepts) and hence to develop the common conceptual framework necessary to underpin yield-targeted innovations.

Co-innovating in agroecology: integrating stakeholders' perceptions of using natural enemies and landscape complexity for biological control into the research and innovation process

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Scientific findings in landscape ecology suggest that a patchy landscape including hedgerows, meadows and woods favours insect pest biological control by conservation of habitats for natural enemies. Some scientists foresee the possibility for farmers to act together in order to generate such conditions in their landscape. For such grass-root collective action to be possible, local stakeholders must first perceive landscape elements and/or natural enemies as resources; and the same stakeholders must be willing to co-operate through a collective management approach. Our objective was to investigate stakeholders' perceptions of landscape elements and natural enemies in relation to the potential for innovation in the form of coordinated management of the landscape. To do this, we used a participatory research approach in an area specialized in fruit tree production in south-west France, known for its high pest pressure and use of insecticides in orchards, and consequently high risk associated with any alternative approach in this domain. We conducted thirty comprehensive interviews with stakeholders about their pest control strategy to explore their perceptions of landscape elements and natural enemies in particular. The results indicated that natural predators were regularly perceived as resources. Stakeholders mostly perceived them as public goods requiring public institution interventions for their conservation, acclimation and management. Some interviewees perceived natural enemies as private goods where they can be captured and released onto specific crops, as is the case in greenhouses and with new technology such as anti-insect nets surrounding orchards; a practice on the rise in the region. By contrast, landscape elements were not perceived as resources in biological pest control. Our analysis of stakeholder perception indicates that a public or private approach to natural enemy action are favored in natural predator management. Finally, most farmers did not relate landscape to any biological control benefit and were therefore not motivated to act in this regard. Consequently, our co-innovation process with stakeholders will be oriented towards questioning the knowledge gap between scientists and local stakeholders regarding the effect of landscape on natural predators and biological control.

Lessons learned from the implementation of three different research postures within a participatory research framework

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This paper analyses how the use of different research postures (participatory, ecocentric and technocentric approaches) in participatory research with organic farmers can lead to misunderstanding and legitimacy questioning, and therefore to tensions between the different actors involved (funding administrators, advisory services, farmers and researchers). This underlines the importance of clarifying the commitment of different partners involved in participatory research as early as possible in the research process to limit any misinterpretation, develop trust and enable collaboration. To ensure an effective process, including agreement of targets, it is recommended that funding should be made available to

allow sufficient time for a staged approach with a diagnostic phase, including charactersiation of the diversity of farming systems within a sector, followed by a participatory research phase to test innovative approaches to solve a shared problem. Finally, for a successful outcome, researchers must be equipped and trained in the implementation and facilitation of participatory research methodologies.

Theme 4 **Emergence and application of new technologies**

Workshop 4.3 **ICT to help on participatory approaches for the agroecological transition of agriculture**

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From citizens' to farmers' science: are smartphone technologies a useful tool in participatory agricultural research?

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Over the last decade citizen science approaches have become increasingly popular in several disciplines supported by the proliferation of mobile communication technologies such as smartphones. However, citizen science methodologies involving large numbers of participants seem not yet have been widely adopted in agricultural research, even though participatory on-farm approaches involving small farmer groups are now more widely used.
Here, we present results of an online survey amongst British and French farmers, investigating i) smartphone use in various farm management practices, and ii) the interest of farmers to participate in citizen science projects. Eighty-nine per-cent of the 57 respondents from Britain and France owned a smartphone, which was also the device they used most often on a daily basis for farm management when compared to other communication devices (including laptop and desktop computers, tablets, landline telephones). A third of farmers using their smartphone for farm management were not using any farm management specific applications on their smartphone, but of the farmers that did, an average of four applications were used. Farmers were very positive about citizen science regarding it as a useful tool for data collection, real-time monitoring, identification of research questions, experimental work, and wildlife recording on farm. They showed strong interest to participate in citizen science projects with varying and often high time commitments. Experimental work was the most likely activity for which respondents felt some financial support was necessary.
This paper is the first to quantify and explore farmers' use of smartphones for farm management in Europe, and to document farmers' support and potential interest to participate in farm related citizen science projects. Smartphone technologies offer great potential for participatory agricultural research, and our results show that farmers tend to have sufficient knowledge of the technology as well the enthusiasm to engage in citizen science. This paper provides a basis and justification for the wider application of smartphone technologies in future participatory research projects that are concerned with exploring pathways towards greater agricultural sustainability and resilience.

The Horizon 2020 CAPSELLA project: Collective Awareness PlatformS for Environmentally-sound Land management based on data technoLogies and Agrobiodiversity

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Only agricultural and food systems with reduced use of external inputs can meet the challenges of sustainability. Agrobiodiversity is key to this, being the basis for improving agricultural production through smart utilization of the functionalities that agroecosystems offer. Improving food systems where consumers play an active role in driving produce demand and offer is also crucial. Alternative, agrobiodiversity based agricultural models are more likely to be supported by open, horizontal and dynamic Agricultural Knowledge and Innovation Systems in which research, education, extension, support systems and farmers, citizens and consumers, are gathered in networks. Just like the tiny yet sturdy little plant it takes the name from, the Horizon 2020 CAPSELLA project (www.capsella.eu) will deepen the roots of sustainability in agri-food systems by harnessing scientific and local knowledge, people's energy, motivation and innovation skills around the theme of agrobiodiversity by making use of novel, improved and demand-driven ICT solutions. CAPSELLA will focus on two complementary domains (agrobiodiversity and the food supply chain) through participatory bottom up data collection and top down data integration to develop solutions. The project will build from scratch open data repositories concerning regional agrobiodiversity, and build upon and enhance existing data sets on the agrobiodiversity and food domains. Based on these, the project will develop a number of community-driven data powered ICT solutions, which will be tested by the communities engaged in the project and will result in a number of pilots running around three multidisciplinary, community-driven use cases: the field, seeds, and food scenarios.

Sustainability as a governing principle in the use of agricultural decision support systems: The case of CropSAT

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Precision agriculture (PA) is an important part of sustainable intensification, where information and communications technology (ICT) and other technologies are necessary but not sufficient for sustainable farming systems. Many agricultural decision support systems (AgriDSS) have been developed to support farmers to manage an increased amount of gathered data. However, the traditional approach to AgriDSS development is based on the knowledge transfer perspective, which has resulted in technology being considered as an isolated phenomenon and thus not adapted to farmers' actual needs or their decision making in practice. The aim of this study was to improve understanding of farmers' use of AgriDSS. The theoretical framework of distributed cognition (DCog) was used as a lense when investigating and analysing farmers' use of a software tool developed for calculation of variable rate application (VRA) files for nitrogen (N) fertilisation from satellite images called CropSAT. In a case study, the unit of analysis was broadened to the whole socio-technical system of farmer's

decision-making, including other people and different kinds of tools and artefacts. The results reveal that CropSAT functions as a tool to support decision making and promotes social learning through the use of *enhanced professional vision*.

Experiments on the use of knowledge management tools for agriculture

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Agriculture must be both sustainable and economically viable. Sustainable agriculture requires new knowledge and expertise. However, knowledge management is not sufficient in current sustainable agriculture. To overcome this, we have made the assumption that the knowledge management practices used in industry can be transferred in agriculture. In this paper, we propose to apply to agriculture, the methodological tools developed by the French knowledge management group. These tools are based on theoretical approaches for the transformation of explicit and tacit knowledge within an organization. These tools are generic and suitable for any knowledge. We have tested the tool CFK for knowledge criticality in order to identify the knowledge to make explicit within a farm. This knowledge is critical because they are valuable, rare, complex and difficult to formalize. They must therefore be managed. We have determined the criticality of knowledge in a farm for organic agriculture field crops, in prairies and on various flora grain legumes. In the French research project TATABOX related to the agro-ecological transition study in a land between Tarn and Aveyron in France, we also have experimented another methodological tool (TRACO) for characterizing the most appropriate knowledge transfer tools to use between an agricultural cooperative and farmers. Among 16 knowledge transfer methods proposed, TRACO allow highlighting supervised self-education but also traditional teaching courses, communities of practices and workshops. Our conclusion is that the proposed knowledge management tools seem relevant to manage knowledge in agriculture, but they still require training and adaptation to agricultural fields.

Dissemination and Implementation of Agricultural Innovations Using Video on Mobile Phones in Mali

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A challenge for researchers and other developers of new technologies in agriculture is to find ways of communicating their results and recommendations. This challenge is particularly acute in regions in which farmers have limited access to education and where illiteracy is widespread, such as in the rural areas of Mali. One approach that shows potential, yet remains largely unused by extension services, is the dissemination of educational video on mobile phones with video and Bluetooth technology, which are widespread in the region. This article aims to explore the potential of video on mobile phones as a tool for farmer-to-farmer exchange and agricultural extension in Western Africa. Three videos showing agricultural innovations were shown and shared with 200 farmers in twelve villages in Mali. The villages were revisited 10 months later and farmers were asked about their experiences with the videos

that had been shared and their previous knowledge of the innovations shown in them. It was found that participating farmers had shared the videos on their phones with an average of 5.9 other farmers, and had shown the videos to an average of 9.9 other farmers. Of the farmers who had watched one of the videos (N=148), 60.1% had adopted at least one of the videos' innovations. Mobile-phone videos could be accessed by people who have previously received limited access to information sources, such as younger women, and video based information was found to be understandable for illiterate farmers. These results allow the conclusion that use video based information transfer can enhance information transfer and thereby expand its outreach. The use of video on mobile phones is a novel approach to farmer-to-farmer exchange and has tremendous potential for enhancing dissemination programs or specific research and development projects to enable more resilient, inclusive and democratic systems.

Theme 5 **Enabling governance, policy and institutions**

Workshop 5.1 **Developing agricultural advisory systems for innovation: Governance and innovative practices**

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Setting up an innovation network: Public and private sector collaboration to solve pasture performance issues in the New Zealand dairy industry

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Dairy farmers in the northern regions of New Zealand expressed widespread dissatisfaction with the performance and persistence of their pastures following drought conditions in 2007/08. Farmers were becoming disillusioned with the practice of renewing pasture as a means to introduce modern perennial ryegrass cultivars in their paddocks. This paper describes the formation and operation of an innovation network, consisting of private and public sector actors, that was formed in 2010 to improve the quality and consistency of advice provided to farmers. All parties sought to restore farmers' confidence in pasture renewal and modern cultivars, and critically, commercial interests were set aside. A series of activities were coordinated by this group from 2010 up to this date.

Data is presented that describes the interactions between actors and the impact of this innovation network in addressing pasture performance issues. Critical success factors for the group are discussed and how this network has adapted over time is also described. Results to date suggest this innovation network has been effective in addressing pasture performance issues. A broad range of stakeholders, agreeing a shared vision amongst stakeholders, having clear roles and responsibilities, and a supported governance structure were critical success factors for this innovation network. These results have been influential within DairyNZ, an industry good organisation for New Zealand dairy farmers, in providing evidence that collaborative approaches are effective and consequently are being applied more widely in the New Zealand dairy industry.

Privatisation of agricultural advisory services and consequences for the dairy farmers in the Mantaro Valley, Peru

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The private sector's presence in agricultural advisory services worldwide has been on the increase for over three decades. This trend has also been observed in the Mantaro Valley (Peru), in a context of dairy family farming. The objective of the communication is to analyse the modalities of advisory services privatization and assess the consequences of this privatization for the farmers and their livestock systems. Data were collected through input suppliers, different types of advisers and producers interviews. The activity of private advisers is most often associated with the sale of livestock inputs, which, while facilitating access to technical support for almost all producers, does not take the overall producer needs into account. This study shows the importance of improved coordination of advisory activities between public and private actors for an efficient agricultural advisory system, a condition that encourages a sustainable farming system approach.

Agri-environmental advisory services in pluralistic AKIS in the EU - an analysis framework for governance structures

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Great challenges regarding biodiversity conservation, water protection and sustainability are increasingly important in agricultural funding und regulations. As such, knowledge exchange, learning and innovation are crucial aspects of current EU funding for rural development. Funding for advisory services dealing with these challenges exists, but first evaluations concluded that the delivery of the knowledge transfer and advisory activities was not sufficient relative to the measures' importance and the expected outcomes for such activities . From a governance perspective, the objectives and organisational features of advisory programmes are crucial elements to be considered when designing advisory programmes related to agro-environmental advice. The objectives and organisational features of such advisory programmes have mainly been studied at the case-study level; comparative analyses on EU level have not been found. Here, we present a conceptual framework for investigating governance structures of agro-environmental advisory services in the EU with a special focus on coordination aspects in privatized advisory systems. To develop this framework, an overview of theories and concepts is provided, which are related to 'agri-environmental advisory programmes' and particular attention is given to governance structures and coordination aspects. The IFPRI framework for designing and analysing pluralistic agricultural advisory services (see Birner et al. 2006) and the framework of Vatn (2015) for environmental governance structures are theoretical bases for the analysis framework and is further adapted to the specific characteristics of agro-environmental advisory services. The framework, briefly tested with two German cases, is helpful to differentiate actors according to their organisational background and their roles regarding coordination tasks.

Governance & operational dilemmas of a pluralistic and demand-driven extension services

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Governance and operation of a pluralistic and demand driven extension services system is very different from a top down centralised system of extension. While many actors sing about it unfortunately this has eluded many. We designed a qualitative study to understand how a pluralistic and demand driven extension service is governed and operated in Malawi. We identified four districts two of which were known to have successfully implemented and the other two were struggling in implementing pluralistic and demand driven extension services. We targeted two structures and these were the Area Stakeholder Panel (ASP) and District Stakeholder Panel (DSP). Focus group discussions and key informant interviews were conducted with actors at ASP and DSP respectively. We used content analysis to analyse the data. Our findings showed that governance and operation was double faced. On one had we found that the structures were there on paper. On the other hand we found that actors had not embraced pluralistic and demand driven extension service provision. Ultimately we noted a dual existence of top down and bottom up approaches with a dominance of the former. There is in general a big governance and operational dilemma amongst the actors as they try to embrace pluralistic and demand driven services. There are struggles amongst actors for recognition and attribution of results of projects. On the other hand there is an inferiority complex amongst farmers and local structures over shadowing each other. There is also political interference in the structures. We recommend setting up a district sector wide approach for single basket pooling of resources. Besides we strongly recommend for attitudinal change through capacity building on governing and operating a pluralistic and demand driven extension services.

Enrolling advisers in governing privatised agricultural extension in Australia: challenges for the innovation system

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The Australian agricultural research, development and extension (RD&E) system is an interesting and complex case of impacts and governance challenges arising from the privatisation of agricultural extension in Australia and internationally. This paper is an inquiry into the process of setting up a national, multi-stakeholder project collaboration aimed at stimulating the role of the private sector in the Australian agricultural extension and innovation systems. Following description of the project's action research design and use of a theoretical framework adapted from agricultural innovation systems (AIS) scholarship, the paper discusses the challenges the project faces in pursuing its aim of establishing an innovation platform to reframe current RD&E practices and governance arrangements towards an enhanced agricultural innovation system based on the collaboration of multiple actors. One fundamental challenge for the project emerging from initial findings is that its objectives tend to lead stakeholders toward an instrumental conceptualisation of the role of the private

advisory sector in the AIS as one of demand and supply of services. This understanding poses challenges to the project process itself and potentially inhibits the project's vision of establishing and facilitating the governance of co-innovation processes by supporting new roles for advisers as key actors and contributors within the Australian innovation system. The paper describes these emergent challenges and initial project responses. In this way, the paper addresses the project as an 'innovation platform in action', offering to progress understanding of how to advance the establishment of innovation platforms within situated AIS more widely.

Achieving best-fit in Norway: Challenges for advisory services to offer relevant advice to various types of farmers

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As in other countries, the agricultural knowledge and innovation system (AKIS) in Norway has transformed from a public sector dominated towards a market driven system. This also affects the advisory system within the AKIS. In this ongoing transformation, various types of farmers have various support needs: a full-time farmer using the latest precision agriculture technology may have different needs than a part-time farmer using production methods that are more traditional. A theoretical typology for farmer information searching behaviour based on Jansen et al. (2010) is applied in this paper. The aim of this paper is to present and discuss challenges for advisory service to serve various types of farmers when they search for and acquire advices for their farm business, in light of the discussion on 'best-fit'. The research question of this paper is how they achieve this best-fit and what arrangements emerge. The empirical basis for this paper is workshops and interviews with stakeholders in the Norwegian AKIS, and interviews with progressive farmers. Findings indicate that there are emerging configurations serving the different types of farmers, i.e. private advisors serve different clients in different ways, which could be considered 'sub-systems' within the overall advisory system. The theoretical implications for thinking on best-fit and AKIS are that 'best-fit' systems dynamically emerge and have particular configurations within a country setting, to make advisory service organization more suited to meet challenges related to various types of farmers.

Role and interactions of agro-pastoral organizations and finance institutions in agricultural innovation: the study of Rahad Agriculture Scheme- Sudan

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The Establishment of the Rahad Scheme in Eastern Sudan in the 1970s established an agricultural innovation system where formal actors such as extension, research, finance institutions and informal actors such as agro pastoral organizations are networking to provide better livelihoods within the irrigated scheme area. This investigation focuses on the roles and interactions of agro pastoral organizations and finance institutions in relation to extension work in Rahad Scheme. The challenges that hinder interactions of agro pastoral organizations and

finance institutions are also discussed, accordingly, suggestions to improve interactions of agro pastoral organizations and finance institutions are presented on this paper

System thinking was suggested as a methodology to analyze knowledge networking among and between finance institutions and agro pastoral organizations. Social network analysis was used to study connections and relations of agro pastoral organizations and finance institutions in Rahad Scheme. As a result new connections and relations has been suggested to improve the performance of the agro pastoral organizations and finance institutions in Rahad. Hoping that improvement of connections among the studied actors can lead to better appropriation of the innovation system within Rahad Scheme.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.2 **Farm succession, inheritance and retirement: Challenges for agricultural futures**

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The Potential of Farm Partnerships to Facilitate Farm Succession and Inheritance

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The prominence of collaborative farming arrangements in countries such as New Zealand, Norway and the Netherlands has been investigated with varying reasons as to why farm structures of a collaborative nature have been undertaken. The motivations for this contain a mix of economic and social facets. At present, the rising average age of farmers and low level of young farmer entry is being theorised as problematic on a global scale with Ireland being no different. Here, farm partnerships are presented as a possible means by which farm succession and inheritance could take place in a timely manner. This research aims to investigate a recent proposal by government to introduce a tax relief as an incentive for farmers to part take in farm partnerships. A hypothetical microsimulation model is used to investigate the possible outcomes of such a tax relief, with scenarios created to examine how this would materialise. It draws on the Teagasc National Farm Survey data which provides Irish data to the Farm Accountancy Data Network in the European Commission. The Net Present Value (NPV) of income streams for farmers and their successors are calculated to assess which scenarios have the highest/lowest financial effects. The findings illustrate that even with a tax relief cattle rearing farms would struggle to reap any economic benefit from entering a farm partnership, while their dairy counterparts would receive more value from tax reliefs. Results also indicate that farm viability will play a large role in whether or not collaborative farming is viewed as an option for farmers.

Willingness of youth to practise agriculture: implications for farm succession and sustainable farming systems in Nigeria

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Nigeria is an agricultural nation having forty-one percent of her Gross Domestic Product (GDP) from agriculture which also employs about seventy percent of her workforce. Approximately thirty-three percent of the nation's land is used as arable land although about eighty percent of the land is potentially cultivable. The rural farming population is noted to be ageing while the youth are migrating from rural areas to engage in activities other than agriculture. This study examines the factors which influence the willingness of youth in tertiary agricultural institutions to practice agriculture after graduation. A sample of final year agricultural students in four tertiary institutions in south west Nigeria was used for the study. Data and information were obtained through structured questionnaire and secondary sources. Results indicate only forty-nine percent of the students had aspirations towards the practice of agriculture as a profession after graduation while fifty-one percent had aspirations for other things apart from agriculture. Reasons given for the lack of interest in agriculture after graduation include labour-intensive nature of farming in the country, perceived low profitability of agricultural enterprises and lack of easily accessible funds for agricultural activities. Recommendations made by the students include increased government participation in the agricultural industry with particular reference to funding of agricultural institutions (research and banking institutions) and provision of good social infrastructure in rural areas. With these recommendations appropriately addressed, the students are hopeful that more youth will take agriculture as a profession and thus take over from the ageing farmers.

Starting a process: Practice and policy lessons from a farm succession planning intervention in the Australian dairy industry

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Intergenerational succession on family farms typically unfolds through several stages over an extended period: it is a *process,* not an *event*. Amidst the continued concern in many countries that farm succession is not proceeding well, there are two salient questions that arise in relation to succession planning *as process*: (1) how can farm owners be assisted to *start* the process and (2) what policy settings are needed to support succession planning *as a process*. This paper addresses these questions through discussion of a study of a succession planning intervention in the Australian dairy industry. The study involved in-depth interviews with participating farm families (N=10), and facilitated reflection with the two consultants who delivered the intervention. Nine of the ten families reported that the intervention had generated concrete steps in their intergenerational transition process. A key feature was that the delivery method was flexible enough to identify and work on one or more specific points of current "stuckness" within each individual family's situation. The nature of the "stuckness" differed greatly between farms and the consultants observed that they fully expect a number of the farms to become stuck again when a future point of difficulty is encountered. In the context of Australia's pluralist agricultural advisory system, these findings suggest that an important role

for succession planning interventions is to build connections between farm families and the range of different advisory professionals whose assistance will be needed to deal with different points of “stuckness” as they arise.

Intergenerational Family Farm Transfer: An Insight into the Human Side

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Similar to what is occurring on a global scale, Irish agriculture is populated by an older generation of farmers. Consequently, intergenerational family farm transfer is increasingly viewed as crucial to the survival, continuity and future sustainability of the family farm and agricultural sector. A review of existing research highlights how financial incentives that encourage succession and retirement from farming have stimulated little change in the behavioural intentions and attitudes amongst elderly farmers. This paper sets aside economic enticements and presents an insightful, nuanced analysis of the human factors that influence the process of transferring the family farm from the perspective of the senior generation. This research employs a multi-method triangulation design, consisting of self-administered questionnaires in conjunction with complimentary Problem-Centred Interviews, to acquire data on the complex emotions involved in the process. The prominent themes to emerge from the empirical data are farmer’s concerns regarding potential loss of identity, status and control upon transferring management and ownership of the family farm and retiring. There is also a cultural expectation within the farming community that ‘farmers don't retire’. The paper concludes by suggesting that future policies and programmes encouraging family farm transfer must develop effective strategies that addresses the emotional well-being of elderly farmers.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.3 **Rural development policies in the peripheral Southern and Eastern European regions**

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Global overview of the Rural Development Programme: the mainland Portugal case-study

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This paper provides a global overview of the implementation of the Rural Development Programmes (RDP) in mainland Portugal, based on the collected and analysed information concerning to the rural programmes and some parameters of that place. These RDPs have been focused in the agriculture sector because the main Portuguese figures pointing that its rural territory is dominated by the agroforestry complex and about 1/3 of their population lives in rural areas. Their agriculture is very diverse, with prevalence of a small-scale structure where farms with big dimension accounts only 9% of the total, but represents 67% of the utilised agriculture area (UAA) and 77% of the total standard output value. The implemented RDPs show a positive impact in Portuguese economy due to the increasing of agricultural products, mechanization and buildings. Also, the decreasing of agricultural population has been balanced by the best living standard level of farmers (the increasing income). The recent RDP (2014-2020) pursue the previous programmes and is centred on five priorities with the main emphasis given to enhancing farm viability and competitiveness of all types of agriculture in all regions and promoting innovative farm technologies and sustainable management of forests.

A model for the agricultural planning at farm level for the European Union countries

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The agricultural sector considering its specificities needs frequently good strategic plans, since the production until the commercialization. However, the planning in the agriculture is not easy, because depends on several factors, as the climate conditions, the biologic vulnerabilities (pests and diseases), the socioeconomic conjuncture, the changes in the legislation and the farming markets. The linear programming models, as optimization techniques, usually are adjusted methodologies to help in the construction of these agricultural plans. In these frameworks, this investigations pretends to be an stimulating contribution for the scientific community and for the several agricultural operators (farmers, policymakers, etc) building an

accessible (namely for the farmers) and simple planning model, based in the linear programming methodologies, with the data available in the Farm Accountancy Data Network (FADN, 2014), across the period 2007-2011, for the former twenty seven European Union countries. These models are flexible and easily adaptable for new circumstances, helping, in this way, in the prevision of the respective implications. This pretends to be a first approach with these methodologies and these kind of data.

The impact of subsidies on the agricultural sector: A linear programming approach to Portuguese farming

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Since the adhesion to the European Economic Community (EEC), in 1986, Portugal has benefited from several forms of financial support, in the context of Common Agricultural Policy (CAP), towards the farmers' income and the farms' structure. The framework for these income subsidies has changed from that time until now, namely, because of the CAP reforms in 1992, 2000, 2003 (with its application since 2005), 2007 (less importantly) and 2013, and the structural subsidies experienced transformations in 1994, 2000, 2007 and 2014. In this context, the principal objective of this study is to analyze the implications of the various subsidies, within the Portuguese agricultural sector, that came as a consequence of the adhesion to the ECC and of several farming policy reforms after that date, with data obtained from the FADN (2014) and through a model of linear programming solved with the LINGO (2015) optimization software. This study is an interesting contribution to scientific literature and for the agricultural policy makers and designers. There are no existing studies, considering the literature consulted, covering these subjects for Portugal and using the linear programming with this statistical information. The linear programming has some advantages, because it allows for optimal analysis and obtains exact results. This is a first approach with these methodologies and data.

The Efficiency of POSEI and PRORURAL Programs in Azores Islands Development

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Azores is one of the outermost regions (ORs) in European Union (EU). Isolation of the islands raises the issues involving socio-economic difficulties, remoteness, small size, the competiveness of agriculture, which makes the region one of the poorest in EU. Due to this consequences government introduced programs: Programme d'Options Specifique à l'Éloignement et l'Insularité (POSEI), Rural Development Plan (RuDP), Azores Rural Development Programme (PRORURAL) and PRORURAL +. The objective of this project is to analyze the efficiency of these programs in Azores agricultural development. Firstly, the main feature of the Azorean economy is agriculture. This economy represents 2.1% of the Portuguese Gross value added. Azores Gross domestic product per capita in 2013 is 14,900€ and its contribution of the agricultural sector is 9.6% (2012). Secondly, POSEI aims to compensate the additional costs of transporting certain agricultural products to the ORs. RuDP

was the first rural development program applied to Azores. PRORURAL + it is the next of PRORURAL. It has six priority measures, they are:1: Measures for the transfer of knowledge and innovation, 2: Enhancing the viability and competitiveness of farms and agro-industry, 3: Chain improvement, 4: Preserving agricultural and forestry ecosystems, 5: Energy and climate change and 6: Local development. After, the brief analysis of the information available in the Azorean, the agricultural ratios are: economic, agricultural, market, agricultural labor market and financial market. This evaluates the impact of these programs in the rural economy and development. Finally, it shows a positive impact of European programs in Azores economy.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.4 **Exploring farmers' conditions, strategies and performances in a context of multi-dimensional policy requirements, market imperfections and globalisation: Towards a conceptual model**

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How transaction costs shape market power: conceptualization and policy implications

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This paper conceptualizes how market imperfections and transaction costs influence farmers' strategies addressing changing external conditions. Such an integrated understanding is necessary for a new appraisal of the public policy role in order to develop robust solutions. .We list the current changes affecting the agricultural sector and discuss how market power and adjustment costs may affect the spectrum of actions a farmer could take. Then we analyze the resulting new organizational forms emerging in agriculture. In particular, we focus on horizontal cooperation and vertical coordination. Finally, we question the changing role of government and how public and private mechanisms may reinforce each other or instead counteract.

Adaptation strategies and performances of three producer groups in times of change: lessons learned from the application of the CSP framework in three case studies

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This paper aims to contribute to the further development of the theoretical framework of the Conditions-Strategies-Performances (CSP) framework by testing it in three case studies. The

CSP framework helps to explore farmers' conditions, strategies and performances in a context of multi-dimensional policy requirements, market imperfections and globalisation. The basic assumption sees conditions as drivers for farmers' strategies that then result in performances of the sector. The approach consists of four steps aiming to identify changes in framework conditions over time, resources among relevant groups of primary producers, adaptation strategies and finally, to explore the related social, economic and environmental effects. The practical application is based on three case studies, two farmers' cooperations in Germany and Sweden, and the carp farming sector in Franconia. Results show that the approach provides a suitable conceptual framework. Its particular strength is the holistic nature of the assessment and that it focusses on changes, dynamics, strategic decisions and impacts that matter in societal terms. However, a wider application requires the operationalisation of the framework with sufficiently meaningful indicators and data and other questions emerging from the application of the CSP concept.

Strategies for sustainable farming: an overview of theories and practices

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The paper aims at developing a conceptual framework for the analysis of primary producer's strategies through the creation of three inventories of the conditions in which they operate, of the possible strategies they can implement, and of the related performances. The inventories and the description of the decision-making process are based on a literature review in which contribution from different research fields are gathered.
Starting from the Porters' model for farm competitiveness (Porter, 1998), farms' internal characters and eight groups of external conditions are identified. The former are gathered into two components: the "Farm" (assets and other elements of the farm as a structure and business, like core business, location, logistics, land, technology); and the "Household" (elements characterising the farmers' household context, like off-farm income sources, familiar composition and needs). External conditions are referred to the whole farms' business environment. They are grouped as follows: Factors, Demand, Regulation & Policy, Finance and risk management, Technological, Socio-institutional, Socio-demographic, Ecological. Then, strategies types are listed, ranging from risks-management contracts to financialisation, from diversification to networking, from multifunctionality to part-time farming. Finally, performances types are identified, ranging from the business-oriented ones to the ones focused on households' welfare and to the broader environmental and social impacts.
This framework can be used as a starting point for the analysis of the complex relations between conditions, strategies and performances characterised by time lags and feedbacks, and to explore opportunities towards producers' sustainability.

Applied and planned risk management strategies of Austrian farmers

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This article presents results on Austrian farmer`s perceptions of risk management measures as well as currently applied and planned risk management strategies. A postal survey of

Austrian farmers (N = 486) has been conducted to provide data for the analysis of differences with respect to farm types (cash crop farms, permanent crop farms, forage-growing farms, intensive livestock farms, mixed crop and livestock farms and forestry enterprises), farming methods (organic and conventional farms), employment situation (full-time and part-time farms), and geographic location (mountain farms and non-mountain farms). The results indicate that all subgroups of farmers expect the strategy of financial management to be most effective in coping with risks. Organic, part-time and mountain farmers are more confident in the strategy of off-farm diversification, on average. In comparison with their part-time colleagues, full-time farmers regard farm expansion and insurance as well as cost and revenue management to be more effective. All subgroups of farmers plan to increasingly pursue risk management strategies of adaptive capacity building, cost and revenue management, financial management, and on-farm diversification.

Revealing strategic conversations around future visions of agriculture to improve the debate on transformation pathways towards sustainable farming systems

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To address sustainability of agro-food systems, different innovation models are proposed, which carry underlying pathways for change. Making explicit the divergences between these visions for the future could give more visibility to alternative visions, which otherwise could be dismissed by visions of the dominant regime. The generation and discussion of future visions for agro-food systems can open up or close down options for radical change. Therefore, we aim at analysing the cross-relations between the representations of pathways for change carried by actors and their strategies for change. We follow future-oriented debates, consisting both of a corpus of future representations, and of a community of actors associated to their discussion. We focus on one case study: the future-oriented debate on agriculture and water quality, in the Seine river watershed in France (between 2000 and 2016). We organise the materials from documentary sources and interviews through a narrative of the links between the future-oriented debate and strategies. Our results highlight three types of strategies: (i) opening the map of options for change; (ii) promoting radical change for agro-food systems; (iii) using the future-oriented debate to build an intervention strategy. We identify a gap in this debate: very few explicit transition pathways exist, while it may improve their credibility. We show that some alternative visions integrate performance criteria of the dominant narrative to strengthen their credibility. We conclude by suggesting that another strategy could be to embed future visions in a consistent alternative narrative, revealing the social dimension of water management by agriculture.

Effects on territories of ending milk quotas - exploratory findings from two contrasting French case studies: the Niort Plain and the Chartreuse Massif

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In France, the ending of milk quotas marks a breach in the mode of milk supply management and dairy farmers' conditions. Regulation administered by public authorities gave way to private regulation by dairy companies. In this context, farmers and actors of territorial

development are concerned about the future of dairy farming at local scale. This paper explores the effects of ending milk quotas at the local level by comparing two contrasting case studies: upland and lowland areas. It is based on the same conceptual framework of socioeconomic metabolism, which addresses the biophysical exchange relationships between societies and their natural environments. We sought a better understanding of the effects of ending milk quotas, through looking at milk flows and uses of local resources, and the system of actors activating and regulating these flows, and their strategies. Our research is based on interviews and presentations of our characterization of milk production designed to prompt discussions between farmers and local actors. We show that the ending of milk quotas, and the ensuing high price volatility, means increased disparities between farmers. It generates (i) in the upland area, rivalry and tensions at the local level, and (ii) in the lowland area, difficulties in sustaining cow milk production in an area that is turning towards crop production. Lastly we discuss, among other topics, the multidimensional and growing requirements and systems boundaries that farmers are facing.

Three-fold embeddedness of farm development

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Farm development strategy is affected by, and affects, the biophysical and socio-economic context of the farm leading to agri-environmental challenges for farm development. For effective policies and support programmes it is important to understand the drivers for choices farm development. Three-fold embeddedness is used to study how farmers relate to the context in which they operate. Ideal-typical farms were constructed for three patterns of farm development found in a quantitative study of dairy farmers operating in highly comparable conditions. The patterns are 1) Milk Max: maximising total milk production; 2) Milk Balance: optimising milk production based on own resources; and 3) Milk Plus: diversified on-farm production. Their embeddedness in three sets of relations were conceptualised as: 1) value chain relations, 2) socio-cultural relations, and 3) resource relations. The extent of the embeddedness has been determined on a scale ranging from a Close to a Stretched set of relations. These ideal-typical farm types showed to have different sets of relations for the three dimensions. A set of relations that is stretched outside the everyday routine of dairy farming appears to be important for farmers' perception of options for farm development.

Asymmetric information along the food supply chain: a review of the literature

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Market failure occurs when the market is not able to reach optimal output. In literature, among the main causes of market failure there is asymmetric information. Asymmetric information occurs when parties involved in a transaction are not equally informed. There has been a considerable increase in attention on asymmetric information in economic literature over the last twenty years in several fields, such as agro-environmental scheme payments, food quality and chain relationships. The literature reveals that the agri-food sector represents a field particularly exposed to the effect of asymmetric information. In particular, issues are related

on the lack of information on quality, price and safety that frequently occurs in the transactions along the supply chain until the final consumer. Many actions in terms of regulation and policies have been undertaken in order to control attributes in the food transactions, however there is still need to improve conditions in order to achieve a more efficient and competitive market. The purpose of the paper is to review the literature on asymmetric information issues affecting the agri-food chain, the main solutions proposed and the modeling approaches applied in economic literature to understand asymmetric information along the food supply chain.

Adaptation strategies and performances of three producer groups in times of change: lessons learned from the application of the CSP framework in three case studies

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This paper aims to contribute to the further development of the theoretical framework of the Con-ditions-Strategies-Performances (CSP) framework by testing it in three case studies. The CSP framework helps to explore farmers' conditions, strategies and performances in a context of multi-dimensional policy requirements, market imperfections and globalisation. The basic assumption sees conditions as drivers for farmers' strategies that then result in performances of the sector. The approach consists of four steps aiming to identify changes in framework conditions over time, resources among relevant groups of primary producers, adaptation strategies and finally, to ex-plore the related social, economic and environmental effects. The practical application is based on three case studies, two farmers' cooperations in Germany and Sweden, and the carp farming sector in Franconia. Results show that the approach provides a suitable conceptual framework. Its particular strength is the holistic nature of the assessment and that it focusses on changes, dy-namics, strategic decisions and impacts that matter in societal terms. However, a wider applica-tion requires the operationalisation of the framework with sufficiently meaningful indicators and data and other questions emerging from the application of the CSP concept.

Strategies of fishers and fish farmers: a preliminary analysis for Sustainable Fisheries and Aquaculture

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Coastal capture fisheries and aquaculture are interconnected resource systems and economic activities, presenting evolving and complex dynamics, constrained by several socio-economic, policy and biophysical factors. Overfishing and climate change are modifying the distribution and productivity of marine species and altering food webs. The general economic situation has worsened, influencing markets, costs and purchase power. This paper aims to present a preliminary analysis of the multidimensional causal dynamics of key drivers and market factors influencing the decision-making process of Fishers and Fish Farmers, identifying conditions

in which primary producers are involved, the related strategies developed to manage those conditions and the consequent performances in terms of profitability and sustainability.
Derived from industrial organization and agrofood value-chain management a research process is proposed for analysing conditions, strategies and performances of primary producers of fisheries and aquaculture.
The analysis in this paper is situated in two specific contexts: inshore fisheries in Cornwall (UK) and coastal fisheries and aquaculture in Tuscany (Italy). Sustainability of fisheries and aquaculture is jeopardised by a set of socioeconomic and biophysical conditions such as habitat degradation, over-exploitation of resources, complex and restrictive regulatory frameworks, increasing illegal competition, rising costs, market concentration and excessive fragmentation of holdings. Response strategies can be found in investing for innovation, regulating catches and capacity of fleets, training of operators, reorganising the supply chain, multifunctionality and diversification, implementing cooperative programmes and supporting sustainable development. Engaging with stakeholders and experts and accessing qualitative and quantitative information will be key to comprehensively analyse how primary producers develop decision-making process and transformation strategies towards sustainable solutions for fisheries and aquaculture.

Risky business - a genealogy of the financial discourse in Danish agriculture
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Currently Danish farming is in a financial crisis, as Danish farmers have adopted a mode of agriculture which is dominated by high investments, high debt and high risk exposure compared with other countries in Europe. In our paper we conduct a discourse analysis exploring the Danish mode of farming, focusing on the development in the past 250 years. In the paper we identify one diagram for Danish farming, characterised by 7 implicit norms: (1) Farming is the backbone of society (2) Self-ownership is a superior organizational form, (3) Agricultural policies should be based on liberal ideas, (4) Unity makes stronger, (5) Agriculture should be oriented at export markets, (6) Agriculture should be science based (7) Standing still is going back. Furthermore, we identify three discourses that are concrete manifestations of this diagram. 1) **Family farming** which is characterized by understanding farming as a nation building project, institutionalised as an individual and export oriented activity, enabled by collective organization. 2) **Welfare state farming** characterised as a social contract giving access to subsidies. Productivity comes to be seen as the guarantee for peace and security, which justifies, economies of scale, mechanization and specialization. 3) **Industrial farming** emerges as farmers embraces growth as the fundamental condition of the farming. Several mechanisms have worked to subjectivate famers as financial farmers, such as the introduction of tradable milk quotas, harmony regulation and a reconfiguration of the public subsidies from production support to direct payments and volatile commodity market.

The role of financial support: Strategies of farm households on diversification of income sources under two policy scenarios

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External framework conditions such as financial support provided under the European Common Agricultural Policy (CAP) influence decision-making of farm households on how to distribute labour resources on and off the farm business to earn household income. To assess the relation of income diversification strategies and financial support, we have tested two policy scenarios as benchmark cases of farm behaviour: One describes the status quo and the other assumes a complete termination of financial support. Using survey data of 2,154 farm households, preferences regarding future income generation through agricultural production, on-farm diversification activities, and off-farm employment, including a shutdown of production were compared across scenarios. To account for the heterogeneity of investigated farm households, a typology approach was applied to distinguish type-related decision-making structures. The typology generated by factor and cluster analysis integrated relevant variables and depicted six farm types. The farm types showed strong variations regarding their behaviour under both scenarios. Results indicate that under hypothetical conditions of termination of CAP support, an increased share of farm households – throughout all types – would choose to quit farming, yet to varying degrees. Farms opting for continuation tend to diversify activities in order to cope with increased income risk and exposure to markets. The behavioural patterns thus show the complex interrelationships of internal household and business characteristics and external framework conditions in farm households' decision-making for their survival. Those are relevant for the design of targeted rural development policies.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.5 **Value chain research and development-approaches for diverse farming systems**

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Market quality gradients in smallholder dairy farming systems: How spatial factors affect smallholder production and marketing strategies in the East African highlands - Conceptual framework paper

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Market integration of smallholder farmers is seen as an important pathway to secure food supply to growing urban markets in developing countries. However, it is still a question under which conditions such market integration can effectively emerge. Adequate configurations for input supply, output marketing, and service provision are required to foster market orientation, in which increased utilization of external inputs and services leads to intensification of production. This paper describes the conceptual basis and set-up of research that is currently being carried out in selected study areas in Ethiopia and Kenya. To combine analysis of spatial distribution of dairy farming systems, quality of in- and output markets, and factors determining market orientation, it focuses on spatial factors along double market quality gradients, denoting proximity-remoteness from urban centres and from service centres. The analytical framework for this study looks at smallholder dairy farming systems as being influenced by spatial factors in farm assets, in- and output markets, and end markets.

Participatory assessment of value chains for diversifying small-scale farms – developing a tool for practitioner-led analysis and innovation

Susanne Hofmann-Souki, Napoleón Molina, Wolfgang Bokelmann, Robert Cárcamo Mallen
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Diversified income sources and land use options are sought in small-scale farms and rural households like those in the Nabanhe River Watershed National Nature Reserve (NRWNNR) in Southwestern China, in order to ensure sustainability of their livelihoods. Alternative income-generating activities, such as trying out new crops, are often chosen by small-scale farmers using few criteria for decision-making such as expected profitability, government recommendations and labour need. While such trials bear certain risks, poor households may have little buffer in their resources – they depend on success of their trial. Governmental entities in the region have been trying for many years to support farmers in diversifying their activities. However, success depends not only on aspects of production itself but on various conditions within and around the respective value chains. A system view is needed when assessing in how far the conditions for successful participation of farmers and rural families in

particular value chains can be fulfilled. Within a Sino-German transdisciplinary research project an assessment tool is being developed which aims at assisting extensionists and government entities in this endeavour. Embedded in consultative or collaborative innovation processes, the tool is meant to assist communication and system diagnosis. In this article the general functioning of the tool is described and first insights from the development process outlined. Based on practitioners' feedback, conclusions are drawn for its further scrutiny and development, with a view on different possible uses within and beyond the currently specified circle of stakeholders, e.g. farmers' groups, rural cooperatives, value chain committees and other public-private entities. The paper therefore discusses the tool in the context of a variety of theories and development approaches. A future purpose of the tool could be – possibly via the use in extension - to increase farmers' ability to make own assessments when choosing livelihood activities. Based on the tool, supporting organisations may help design specific measures to overcome any difficulties in fulfilling the necessary conditions. Instead of leaving value chain analysis to researchers alone, stakeholders can then use the assessment framework for their own purposes, or commission research to be done on its basis.

The potential and challenges of fairtrade: A case of certified organic SRI rice in Madagascar

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The process of establishment of a cooperative for smallholder rice farmers in Madagascar, and how a US-based company supports them to export certified organic SRI rice, was documented through a semi-structured interview survey. Various stakeholders played unique and indispensable roles to initiate this project in timely and complementary ways. International aid agencies facilitated the organization of the farmer cooperative with local NGO technical support, capitalizing on a heritage of local food culture and linking it with biodiversity conservation, obtaining organic certification and engaging with a private-sector entity to obtain fairtrade status. The farmers achieved high yields thanks to the technical support, but the price premium was not high enough to attract more participants. The case presents an opportunity of inclusive value chain in which, the local heritage (Dista rice) combined with a new knowledge (SRI) generates an information valued and certified by international actors (Slow Food, ECOCERT), and is capitalized as fairtrade business by a private company (Lotus Foods) leading to rural development. To make this scheme sustainable, it is necessary to make the cost structure of the full value chain transparent for all stakeholders. To foster a sense of belongingness and fairness, matching the local farmers and the consumers abroad with some communication on their daily experiences and their respective value concepts is recommended

Theme 5 5.7 Enabling governance, policy and intuitions

Workshop 5.6 Food governance for metropolitan and local food systems- Connecting urban and rural

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Urban food governance in German cities: actors and steering instruments

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Although in Germany food is increasingly an emerging topic on the municipal policy and planning agenda, a structured investigation of activities and political processes is lacking. This paper aims to identify existing municipal strategies and plans related to food as well as the application of specific policy and planning instruments. We analyse relevant actors and policy fields at the local level and gain new insights into the origin of initiatives for policy action. We studied the situation in ten large German cities and employed different data gathering methods like reviewing municipal documents and conducting guided interviews with experts and decision makers in city administrations. Our findings show that integrated urban food policies and their implementation in form of urban food plans or strategies are still in their beginnings. Municipality administrations and other regional actors follow sectorial approaches and use a wide array of steering instruments, i.e. informational instruments and public procurement policies. The potential of the food topic affecting multiple sectors is still underexploited due to the absence of comprehensive horizontal urban governance. Food-related policy and planning action is driven by individuals in administration and civil society initiatives, but often lacks financial and staffing resources as well as continuity. More integrated urban food policies are needed to overcome sectorial thinking and acknowledge the cross-cutting nature of food policy.

Analysing ‘local place’ and the contribution of the peri-urban farming to four local food system approaches

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The food security debate has given rise to reflections on the contribution of the peri-urban farming (Peri-urban Farming System - PuFS), considering its proximity with urban dwellers. Thus, a link can be made between PuFS and Local Food Systems (LFS). Nevertheless, in literature, what exactly identifies a food as “local” is a matter of debate. Moreover, urbanisation

influences the production conditions of PuFS, so special attention have to be paid to the notion of 'local place' within production. The objective of this study is to analyse the contribution of PuFS to Local Food Systems, considering four existing LFS approaches: the Systèmes Alimentaires Localisés (Local Agro-Food System), the Foodshed, the Urban Food System, and the Alternative Food Network. A broad literature review was conducted focussing on how "local" is defined by LFS approaches, to understand how the particular local place conditions of PuFS production have been or can be included. Results show that each approach associates the term "local" with different definitions of "place", affecting the inclusion of different aspects of the farming system in a specific place. Thus, one risk might be to simplify the PuFS complexity while at the same time the four approaches are able to valorise different aspects of per-urban in local farming systems, supporting the importance of peri-urban agriculture in food security debate.

Urban Food Governance in Tamale, Northern Ghana

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Urban food system governance is especially complex, comprising of a dense configuration of heterogeneous interacting individuals, organisations and institutions. We conceptualise this governance as a process. Within it, multiple state, customary, civil society and vernacular institutions, with different objectives, interact as they attempt to exert their preferred mode of governance on each other and other actors. Such governance systems are created recursively, as subjects negotiate attempts to govern them. We demonstrate these processes using interview and observational data from research and policy-making activities in Tamale, Northern Ghana. These activities took place within the context of the UrbanFoodPlus research project on West African urban food systems. We show how farmers, chiefs, NGOs, consumers and local authorities interact around the themes of irrigation and land. As they shape the governance process, they use strategies described in models of institutional and forum shopping. Actors take advantage of overlaps and ambiguities in governance to make selections between different discourses and institutions and the governance modes these represent, for example by acquiescing to irrigation water quality norms or challenging a chief's prerogative to sell land. Actors also create hybrid governance systems, comprising multiple institutions. In our case study, they carry out these processes within specific fora such as courts, NGO advocacy situations, media platforms and vernacular discourse, selecting the arenas that they think will benefit them. In doing this, they lend legitimacy to the institutions hosting those fora. We show how food system governance is therefore a process co-performed by individual, organisational and institutional actors.

Governance of agricultural programmes in South Africa - potentials and constraints for local food systems adopting a right to food lens

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In South Africa, centralised food systems not only shape unhealthy food environments but also contribute to decreased economic activities and employment in rural areas. In contrast, local food systems (LFS) can promote more equitable, empowered and resilient local communities.
This study explores the governance of programmes supporting local food production and distribution. National food security, nutrition and agriculture policies and programmes were analysed and implementation of three government-supported projects investigated, conducting focus groups and interviews with different actors. A right to food lens was adopted, focusing on the commitment of programmes to the human rights principles Participation, Accountability, Non-discrimination, Transparency, Human dignity, Empowerment, and Rule of law (PANTHER). While the legal framework in South Africa is supportive towards LFS, various challenges are being experienced with regard to implementation of programmes, such as lack of transparency and accountability of projects, and limited participation and empowerment of beneficiaries. The focus is on food production while important aspects of LFS such as healthy nutrition and environmentally sustainable production and consumption are neglected. The projects observed have the potential to empower farmers and the wider rural community and therefore to promote LFS if training, infrastructure, tools and production inputs reach beneficiaries. We conclude that adopting a right to food lens enables to perceive people as rights holders instead of beneficiaries, who actively participate in programmes that promote LFS and enhance rural livelihoods. The PANTHER principles can serve as a guideline to assess and monitor projects in order to reveal potentials and constraints of LFS.

Governance for urban food systems – Recommendations from SUPURBFOOD project

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Within the EU framework 7 project SUPURBFOOD different urban and peri-urban initiatives were analysed, which are involved in recycling of nutrients, water and (food) waste, short chain delivery of food and multifunctional land use. Backed up by a survey among 262 private and public experts, recommendations are given how the governance of urban food systems could be improved. The survey and the best practice examples showed the important role of innovative and flexible organisational and administrative structures of local city governments in order to facilitate and support more sustainable and efficient food systems in cities. To reduce food waste and optimise recycling much can be done at city level with education and awareness rising measures as well collaborating with innovative private initiatives. To shorten food supply chains high priority was given to support farm-to-school programs and promote local and sustainable public food procurement, e.g. with financial public support for start-up

companies, learning/cooperation networks and specialist advice. To ensure a sustainable and multifunctional land use priority should be given to support of innovative SMEs and organisations by enabling access to land for food production and developing new ways of managing urban and allotment gardens, aiming at wider societal functions in those gardens. There is a need for more adapted and regulatory framework.

The Health Belief Model as a Tool for Food Safety Governance for Milk and Cheese Produced by Settled Fulani Pastoralists in Southwest Nigeria.

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This study analysed consumers' perception on safety of milk and cheese produced by settled Fulani pastoralists (SFP) in Ogun and Oyo States, Nigeria in terms of microbial and organic contaminations using the Health Belief Model (HBM). Data were collected from 55 pastoralists and 222 consumers of pastoralists' milk and cheese from 13 communities in the two States. Two hundred and twenty (220) milk and cheese samples were collected for heavy metals and bacteriological analyses. Descriptive statistics were used to analyse social data while the heavy metals were investigated using an Atomic Absorption Spectrometer. Furthermore, the study investigated bacteria present in the milk and cheese samples using standard micro-bacteriological methods. The result of chemical analysis shows contaminations in Zinc, Copper, Chromium, Lead, Nickel and Cadmium. All the heavy metal analysed were higher than the European Union (EU) of 5.0 ppm permit on intake of Heavy metals in Food. Result of bacteria analysis shows the presence of *Escherichia coli*, Coliform bacteria and *Staphylococcus aureus*. These contaminations have grievous implications on public health although the HBM analysis shows that respondents' perceived a low risk of susceptibility to disease through the consumption of contaminated SFP milk and cheese. They also have insufficient orientation on possible health threats that could result from consuming unsafe food products. In conclusion, the perceived benefit of the respondents was higher than the perceived barriers, which implies that they have confidence in SFP milk and cheese. As a tool for food safety governance, HBM analysis will help in safeguarding public health through consumers' orientation. Enforcement of food safety practices by environmental sanitation officers during milking and processing will help to improve quality of milk and cheese produced by SFP households in Nigeria.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.7 **There are other options: boundary issues in innovation system governance**

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An Investigation into the Aspirations, Governance and Management Challenges of Māori Farming Trusts

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This paper investigates areas for possible improvement in the governance and management of large New Zealand Māori dairy farm businesses. Building on the innovative practices of their tūpuna (ancestors) Māori are defining their own aspirations, realities and goals in the dairy farming world and their accompanying challenges, as expressed by individuals and collectives currently engaged in Māori Dairy farm businesses. Māori strategic plans and business values place emphasis on relationships, responsibilities, reciprocity and respect. These are exemplars of a Māori world-view, which explicitly acknowledges particular historic and cultural contexts. The Māori way of doing business is described in this study as having a Quadruple Bottom Line of Profit, People, Environment and Community business objectives. More specifically, 'Māori farms often have an inverted Quadruple Bottom Line. People, Environment and their Community often come before Profit….but without Profit none of it happens.' Māori Trust farms have different strategic objectives and are not solely profit focused, but poor governance may explain why some Māori farming families fail to meet their business objectives.
Māori are genuine leaders of dairy farm environmental management, due in part to their attitudes to land ownership, business values and holistic world views. The top tier of Māori farming trusts comprises fast growing enterprises, which are rapidly improving business performance. Their expertise and governance of large corporate farms has much to offer other farming businesses.

Ecosystem services and the role of Indigenous Knowledge as rubber plantations take over land use. A case study from Xishuangbanna, China

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The expansion of rubber plantation in Xishuangbanna, Southwest China, is eroding indigenous knowledge (IK). IK still plays an important multi-dimensional role in the lives of

ethnic minorities in the region, especially those living in the higher elevations. This highlights the role and functions of IK in traditional and in fostering ecologically sustainable rubber plantations by protecting sacred and culturally significant places and encouraging expanded use of indigenous food resources and wild edible and medicinal plants. Based on a case study employing the empirical and analytical instruments of Participatory Rural Appraisal and Rapid Rural Appraisal, the findings show that conversion of natural forests into monoculture rubber plantations has resulted in a steep and rapid decline in the availability of wilds food and medicinal plants and associated IK. Although monoculture rubber plantations provide farmers with better income and higher yields, farmers no longer apply the methods such as crop rotation that sustain natural fertility and help prevent soil erosion. Younger farmers no longer know much about such practices. The analysis shows that utilization of IK could foster the wider use of sustainable farming methods, but this would now require the active involvement and co-operation of the government and plantations owners.

Institutional change: challenge for agricultural extension and the science that supports it. Evidence from West Africa

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Even in this age of small government, agricultural extension provided by public, private, and civil society actors still is the profession of thousands of 'front line staff', managers, policy makers, consultants and other change agents. It continues to be a crucial interface between science and agencies of collective action, on the one hand, and the rural communities and industries that use land, on the other. Extension usually is seen as an instrument to help farmers adopt technology, i.e. ride the treadmill of technological innovation and capture the economies of scale that, at macro level, ensure food security at minimal costs in terms of human resources and consumer spending. Though not a discipline, the body of knowledge that informs extension professionals and the actors that deploy extension as a policy instrument, extension studies, is an applied social science with researchers, academic departments, conferences, and a journal or two, that usually is part of an agricultural faculty, college or research organisation. This paper is based on twelve years of innovation system research in West Africa that was instigated by the question whether the body of knowledge that underpins agricultural extension imposes severe limitations on the impact of the resources invested in it, and leads to high opportunity costs in terms of what could have been achieved. The paper presents evidence that institutions provide a crucial but neglected context for innovation on smallholder farms, that they can be changed, and that innovation platforms can be effective in initiating such change. This evidence raises important issues for extension professionals and the social science that informs them.

Evaluating public participation by the use of Danish water councils –prospects for future public participation processes

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With the introduction of the Water Framework Directive (WFD) in 2000, a significant shift in the European water planning tradition occurred. Public participation became a key part of the WFD as an important element in improving regional water planning, strengthening the local

involvement and increasing public support for the implementation of Programme of Measures (PoM). To fulfill article 14 of integrating public participation in the WFD planning process, a paradigm shift happened in Danish water planning in 2014. Water councils in all 23 River Basin Districts were established to provide input on how to improve the physical conditions in Danish streams. The water councils were to advise the local municipalities on developing PoM as part of the implementation of River Basin Management Plans (RBMPs) in Denmark. The results indicate that Denmark complied with requirements of making important background information available for the public and ensuring public consultation of the second cycle of RBMPs. However, article 14, stating that member states should encourage active involvement has only been complied with at a very basic level and the public participation process has not been institutionalized and anchored in the policy process. The water councils are presented as the "new option governance" in Danish water planning; however, the water council process was limited and controlled by the competent authority, the Nature Agency. Thereby the water council process can only be characterized as an expanded stakeholder consultation part of the policy process and only touching very little upon active involvement, with future consequences for public participation in Denmark.

Performing and orchestrating governance learning in practice

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Nothing less than a systemic transformation of our societies, our economies, and our world will suffice to solve the climate crisis and close the ever-increasing inequality gap." That was the key message of a new document—titled "The People's Test on Climate 2015" —endorsed by an unprecedented coalition of civil society organizations from around the world and sent to world leaders ahead of United Nations climate talks as well as ahead of the widely-anticipated UNFCCC's 'Conference of the Parties in Paris' (COP21) at the end of the 2015. Also in academic literature it is becoming increasingly recognised that effective responses to complex environmental issues require such systemic transformations.

But how can systemic transformation come about when institutions are deeply embedded in dominant norms and beliefs, seemingly naturalized and difficult or impossible to influence in particular locations? How can more respectful and less dominant alternatives be generated in such circumstances? How can new ways of organizing and doing grow in influence to shape socio-technical change in water management and climate change adaptation? Little is known how this is actually done in practice.

This paper contributes to this by analysing the enactment of governance learning for systemic transformation in practice and its intended and unintended consequences, drawing on examples of the international CADWAGO project. The CADWAGO project is a three year projected that aimed to address the global challenge of water security in the context of climate change by promoting systemic and adaptive transformations in water governance. To contribute to transformation of the European water governance context a series of governance learning events were organised that brought together CADWAGO researchers and European water governance practitioners.

The case study demonstrates that governance learning does not merely serve as a neutral place in which reality represented and actors learn about the state of affairs from each other during exchange of knowledge, but instead it serves as a place where a certain reality is created. Recognizing this means reconceiving governance learning as performative practice. Such a perspective goes beyond overly optimistic views of governance learning as a technique whose application can be perfected, as well as pessimistic views of that see this as repression or domination. Instead, it appreciates both intended and unintended forms of learning as meaningful and legitimate ways to bring about change, and recognizes knowledge and reality as being constituted in interaction in the context of these co-creation processes.

Renegotiating boundaries for systemic water governance: some experiences from the implementation of the Water Framework Directive in England

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Water governance is becoming an increasingly important issue as climate change, population growth and changing demands for water are predicted to exacerbate potential and actual threats to food, water and energy security. However, the current lack of progress towards achieving the environmental objectives of the Water Framework Directive in the UK and EU raises many questions and concerns about how we think and act in relation to water governance in a changing world, and in particular about the implications of boundary choices. This paper reflects on the implementation of the Directive in England. The evidence demonstrates that the implementation process failed to start out systemically. There have been some changes in the water management regime which emerged from the adoption of the Catchment-Based Approach, but the overall water governance regime continues to be encompassed within the top-down implementation process operated by the Environment Agency. New pathways and options for change have recently emerged from a systemic co-inquiry, which emphasise the importance of institutionalising community action at catchment scale and re-framing the enactment of the Directive as part of an iterative social learning system.

Mediating boundaries between knowledge and knowing: ICT and R4D praxis

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Research for development (R4D) praxis (theory-informed practical action) can be underpinned by the use of Information and Communication Technologies (ICTs) which, it is claimed, provide opportunities for knowledge working and sharing. Such a framing implicitly or explicitly

constructs a boundary around knowledge as reified, or commodified – or at least able to be stabilized for a period of time (first-order knowledge). In contrast 'third-generation knowledge' emphasizes the social nature of learning and knowledge-making; this reframes knowledge as a negotiated social practice, thus constructing a different system boundary. This paper offers critical reflections on the use of a wiki as a data repository and mediating technical platform as part of innovating in R4D praxis. A sustainable social learning process was sought that fostered an emergent community of practice among biophysical and social researchers acting for the first time as R4D co-researchers. Over time the technologically mediated element of the learning system was judged to have failed. This inquiry asks: How can learning system design cultivate learning opportunities and respond to learning challenges in an online environment to support R4D practice? Confining critical reflection to the online learning experience alone ignores the wider context in which knowledge work took place; therefore the institutional setting is also considered.

Sustainable food and nutrition security: Is there a need to pay much more attention to smaller farms, smaller food businesses and local food systems?
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This paper brings together relevant theoretical perspectives and insights that we want to test in the new Horizon 2020-funded research programme 'Smaller farms, Small Food Businesses and Sustainable Food and Nutrition Security (SALSA)'. We briefly outline the novel integrated multi-method approach that we want to apply at international and regional levels in Europe and Africa. Explicit references will be made to the particular values and goals that underpin smaller farm systems, small food businesses, their role in local food systems and their capacity to contribute to sustainable FNS. In doing that we pay particular attention to boundary issues and the way we want to address them.
The main part of the discussion focusses on the need for gaining a better understanding of the idiosyncrasies of smaller farms and more localised food systems with their relative strengths and weaknesses. The general background for our discussion is the increasingly globalised, uncertain and resource-constrained world. In the discussion, we pay particular attention to the capacity of smaller farms to contribute to FNS in different regions and contexts. Related to this we examine the dynamic properties of smaller farms and their capacity to adapt to changes in their economic, social, technological and natural environment. We explore the balance between the social, environmental and economic dimensions of sustainability in the development of smaller farms and the potentially higher resilience of smaller farm production. We expect that the feedback received from workshop participants will contribute to finalising our implementation planning and open up numerous opportunities for cooperation with the Farming Systems Research and Extension community.

Theme 5 **Enabling governance, policy and intuitions**

Workshop 5.8 **Enabling Innovation- the transformative (innovative) capacity of farmers and rural institutions**

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On-Farm Energy Generation: Enabling Innovation?

Jonathan C. Cooper
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This presentation examines the role of renewable energy generation in enabling innovation in the agricultural sector by comparing and contrasting policy incentives in two territories: Nova Scotia, Canada, and the United Kingdom. The Nova Scotia Community Feed-In Tariff (COMFIT) is the world's first example of a scheme which provides financial incentive for the local generation of electricity from renewable resources (such as wind, solar and hydro) and it has resulted in the transformation of the agricultural landscape of this region of Atlantic Canada and a rapid transition of the electricity generation mix there. This scheme was closed in 2015 and the full extent of the impacts of its closure are poorly understood. The system of feed-in tariffs operational in the United Kingdom was placed under review soon after the General Election in 2015 and reduced financial incentives have been announced recently; it is widely predicted that the scheme is likely to close altogether in the near future. A comparison between these two regions, therefore, might be advantageous in order to make predictions about future impacts upon farmers in the United Kingdom. This presentation discusses a research project currently in the planning phase.

Step by step towards a reduction in antibiotics in French dairy cattle farms: a typology of trajectories of change based on learning and advice

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Since 2011, French public policy has been encouraging a reduction in the use of antibiotics in animal farming. In this context, breeders have conducted initiatives for the reduction of antibiotics in their farms. The aim of this paper is to describe their trajectories and the management changes performed to achieve this goal. Our aim is to highlight the roles of private and public advisors in achieving a reduction in antibiotics. This study was based on semi-structured interviews conducted in spring 2015 with 14 French dairy cattle farmers, their veterinarians and advisors. We employed the concept of the "trajectory of change" to examine the comparison of the technical, economic, social and organisational determinants for the reduction in antibiotics. We built a model of demedicalisation trajectories inspired by a dynamic model developed by management sciences. Our hypothesis was that not only farmers' motivations and trigger events were critical to achieving a reduction in antibiotic use, but also farmers' requests for specific advisors. We identified three trajectories of change that include:

the duration of the trajectory, the levels of antibiotic reduction, the learning processes, and the specific advisors. We identified three levels of transition: (i) direct without learning, (ii) direct with learning, and (iii) step by step with learning and compared these results with the conceptual work of Hill and MacRae, "Efficiency, Substitution, redesign". Stakeholders involved in providing advice on practice changes may then build on the degree of transition of the farmer to ensure greater efficiency in their interactions.

Renewable energy transitions – lessons learned from rural pilot regions and communities in southwestern Germany

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The paper explores the implications of renewable energy and bio-economy strategies for rural communities and farmers' roles. Focusing on two administrative districts in southwestern Germany, we discuss the related developments in a low-carbon economy transition perspective.
The regional initiatives related to renewable energy are cross-sectoral in scope, and rely on effective multi-actor partnerships and (co-)learning networks, governance thus playing a central role. Farmers feature as pioneers in innovations such as the cultivation of alternative energy crops, the advancement of technology, and as providers and keepers of resources such as land, biomass, and knowledge.
Cross-sectoral and cross-scale integration requires learning and facilitation, e.g. in the form of network management. The Federal Ministry of Agriculture funded management and coordination in 25 German bio-energy pilot regions over the period of 2009-2015. Support included knowledge exchange among actors interested, e.g., in setting up a local heating system based on renewable energy sources and the establishment of so-called 'bio-energy villages'. These function as small 'innovation cells' providing models far beyond the local level. The transitions associated are located at the interface between agricultural and wider economic and community-level development. Contributing to improved agriculture-society relations and rural areas' enhanced attractiveness as places to live and work (not least for younger people), the bio-energy villages potentially to some extent help to counteract rural demographic change.
Findings also support the view that a stronger integration of different sectoral policies and funding mechanisms contributes to a harmonisation between renewable energy and bio-economy strategies and broader rural development goals.

Analysis of indigenous institutions for collective action in fostering co-operation for sustainable land use among pastoral communities of Ogun State, Nigeria

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Indigenous institutions have been perceived as the nested structures crafted to regulate access of natural resources among different rural users. Therefore, there is a need to bring to the fore the contribution of indigenous institutions in promoting collective action in the effort at fostering co-operation and collaboration among settled Fulani Agro-pastoralists in Ogun State, Nigeria. The leadership institutions in pastoral communities were found to be involved in the process of making authoritative decisions in respect of land access and sustainable use of

natural resources in pastoral communities. This form of collective action becomes important as it fosters a good relationship between the pastoral groups and their hosts. Securing sustainable land resources access and use for cattle and crop production in pastoral communities is dependent on the prevalence of strong local institutions for collective action (co-operation and collaboration). Purposive sampling technique was used to select 435 respondents. Data were collected using a Semi-structured Interview Guide. Fulani respondents maintained that some of the challenges facing them were loose collaboration/contradiction between statutory and indigenous institutions, intrusion of migratory pastoralists (*Bororo*), illegal entry of new herders, lack of policy support by government to settle Fulani agro-pastoralists. The Spearman-rho correlation analysis revealed that there were significant relationships ($p< 0.01$) between local rules ($r=0.252$), leadership institution ($r=0.234$) and conflict management. The study concludes that negotiation and self-regulation are important collective action processes in promoting co-operation in the pursuit of mutually benefitting goals for gaining access to land and as well as ensuring sustainable use of biophysical environment for food security and poverty reduction. Therefore it is recommended that the leadership institutions should be strengthened and indigenous rules be formalized among different users to enhance their effectiveness in fostering co-operation and reducing biophysical deterioration.

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Workshop 5.9 **Public Food Procurement Policies: Local and Organic Food in Public Catering Systems**

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Organic produce in municipal foodservice operations and other public bodies in Germany

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In Germany, federal, state and local authorities are increasingly integrating issues of environmental and social sustainability into procurement policies. The network of German organic towns is one of the pioneers and drivers of this development, working together with the aim of promoting the production, processing and consumption for organic and local food.
The aim of this study is to determine the status quo for the use of organic foodstuffs by local authorities and other public bodies throughout Germany.
Research was carried out by means of a desk study of pertinent literature, the websites bioC.info and oeko-kontrollstellen.de, as well as personal communications from organic suppliers, consultants and companies that assist caterers submitting tenders. Municipalities already using organic foods to a significant extent in their service provisions were identified and examined regarding their process in establishing organic use, the extent and areas of their use. Students of the M.Sc.-degree programme "Sustainability in service management and food industries" were involved in the survey.
This paper presents the results of the municipal survey in the form of contrasted case studies, all of which target organic use for meal provision of children and youth in kindergartens and schools. Exemplary projects include "Bio für Kinder" (translation: Organic for Children) by the city of Munich together with Tollwood GmbH, the latter of which organizes a cultural tent festival in Munich twice a year. A further case is the resolution by the city of Munich that in kindergarten and school meal services at least half the foodstuffs procured must be of organic production.
In conclusion, even without specific policies, many catering facilities in the public sector are already using organic food in divergent ways and to varying degrees. The use is strongly linked to individuals in administration and to supportive political climates in the states.

Holistic approach in the design of public catering for old people: a case study of fish consumption in Italian hospital and elderly care facilities and implications for public food procurement

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The article presents a case study of the introduction of fresh fish, of local species, cooked with the revival of traditional recipes in the canteens of geriatric hospital wards and elderly care facilities of five Italian coastal municipalities. Fish consumption protects against natural age-related cognitive decline and has been associated with a reduced risk of dementia, Alzheimer's disease and stroke. These recipes have proved popular with elderly people and fish consumption has thereby been increased.
The project "Italian fresh fish in the canteens of healthcare facilities" works to introduce Italian fresh fish, from fishing and aquaculture, into collective public catering services. Increased purchasing of Italian fresh fish reduces the procurement of intensively fished species, from heavily exploited fisheries outside Italy. The procurement of fresh rather than frozen fish avoids the freezing process along the supply chain which is responsible for a very large expenditure of energy.
The supply of the innovative fish meal was accompanied by a questionnaire survey that involved 500 patients, mainly octogenarians. For these people, mealtime is important not only for its nutritional value, but also for its social and cultural significance. If the food is of good quality, also from the organoleptic point of view, and is prepared according to traditional recipes, beloved by the old patients, it has a profound impact on their physical and mental wellbeing.

Exploring the role of parents in sustainable school food procurement

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This paper aims at assessing whether and how to involve parents in public school food procurement. In Italy parents provide financial support to the school canteen service but they have a marginal role in decision-making and food education at school. The study assesses families' willingness to participate in school catering decision making, their accuracy in predicting food preferences and choices for their children, their ability to find the right food compromises with their children and their propensity to consume sustainable foods. The results contribute to (i) the ongoing discussion about how to help children eat a more sustainable diet at school and how to help parents support their children in this effort and (ii) the duty of policy makers to design proper strategies to involve parents in choices relating to food in public catering. In particular this relates to procurement of fresh trout from local and organic aquaculture as a more sustainable substitute for frozen fish from heavily fished species such as cod and plaice.

Local food and public food procurement

Helmi Risku-Norja
Natural Resources Institute Finland, Economy & Society

As part of a wider concern with sustainability issues, throughout Europe there is increasing interest in alternative food supply chains. Local and organic food (LOF) is gradually gaining ground also among institutional customers. Public food purchases are constrained by the legal framework of the EU law on public procurement. The law encourages the use of most economically advantageous tender (MEAT), which enables the contracting authority to take into account criteria other than only the lowest price.
One of the restrictions in increasing the use of LOF items in institutional kitchens is the tedious procurement process. Using a case study approach, this paper explores the tendering process and its development from price-based competitive bidding towards anticipatory dialogue and interaction between the suppliers and catering personnel. The implications for SMESs are discussed.
It is concluded that when the purchasing know-how is used wisely public catering constitutes a protected space for the SME:s to develop. The most important steps in increasing LOF in public catering are taken at local level. It requires local policy makers' strategic decisions and strong commitment to long-term development work. Access to LOF items vary, and the goals in increasing the use of LOF need to be defined so as to address the case-specific circumstances and by paying due attention to the experts by experience, i.e. the actors of the catering sector and their customers. Important ingredients are the role of the path-breaking municipalities and exchange of experiences both nationally and internationally.

Short food supply chains and "infrastructure of the middle": The role of university food procurement in sustainability transition

Lori Stahlbrand
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This paper argues that university food procurement can play an important role in the development of short food supply chains (SFSCs) supporting sustainable local food systems. The paper presents evidence from two programs that have contributed to the creation of successful SFCSs in university settings – the Food for Life Catering Mark in England and Local Food Plus in Canada – based on detailed interviews with practitioners. The author herself was a practitioner (as the founder and former leader of Local Food Plus), and thus brings a perspective informed by both theory and praxis.
The paper discusses why the notion of SFSCs is especially useful in describing the evolution of local and sustainable food systems. The paper then introduces the term "infrastructure of the middle", and proposes that the understanding of SFSCs can be amplified by this concept. Infrastructure of the middle describes the hard and soft infrastructure that enable mid-size farmers and institutional purchasers such as universities to develop meaningful connections. In effect, infrastructure of the middle is the operationalization of SFSCs, to move beyond direct markets into working relationships with larger purchasers. The author adapted the term from Kirschenmann et al.'s concept of "agriculture of the middle", which describes to the mid-size farms and ranches most capable of meeting the needs of a sustainable local food system. A typology of infrastructure of the middle is outlined briefly (Stahlbrand, forthcoming). The paper concludes with a discussion of how SFSCs and infrastructure of the middle can be positioned within Sustainability Transition Theory.

Investigating reasons for low take up of Universal Infant Free School Meals in schools in South-East England, 2015

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This research paper examines a number of schools which have been engaged in implementing an important new UK school food initiative – Universal Infant Free School Meals (UIFSM). The paper examines the practices of school catering managers and show how managers may choose practices, which have the potential to increase or reduce take-up of school meals by children. It considers the following:

- Quality of food on school menus and presentation during the dinner hour
- Food waste levels
- Best ways to change the menu when introducing healthier and more sustainable food
- Proper management of external caterers
- Dining room environment
- Proper supervision in dining rooms
- Packed lunch policy
- Communication with parents.

Capturing the value of sustainable food procurement through Social Return on Investment analysis: Lessons from the Soil Association's Food for Life programme

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Caterers in public service institutions are increasingly encouraged to procure local and organic foods, and to become active partners in promoting healthy and sustainable diets. Food for Life (FFL) is an initiative led by the Soil Association that supports caterers, schools, hospitals, children's centres and other institutions in taking steps to enhance good food culture and, notably, to increase their use of ingredients that are local, organic, seasonal, fair trade and better for animal welfare.

As a whole settings programme, one attraction of FFL is that it can have multiple and systemic impacts that extend beyond those that accrue to local farmers and producers. Such forms of holistic understanding are critical in order to bring together stakeholders with different priorities in relation to local food system reform. The aim of this paper is to show how Social Return on Investment (SROI) research has been used to assess the value of Food for Life and the potential of the methodology in driving public food procurement policies particularly at local and regional levels.

SROI case study analyses of FFL show that the initiative delivers tangible benefits to schools (and the educational sector more widely); health agencies and their strategic partners; community groups and other voluntary agencies; caterers – as well as to local food businesses. Where the programme has been commissioned as part of a local authority local food strategy, this can be expressed as a SROI ratio of £4.41 of social value created for every £1 of investment. Sensitivity analysis showed that the range of values was closely clustered around the £3 to £5 range.

SROI analyses of FFL have been innovative because they take into account a considerable body of evidence from local stakeholders, evaluation fieldwork and external research to develop a whole system account of the social value of a healthy and sustainable food settings and area-based programme. This type of research can be used to inform policy makers of benefits of coordinated action with public service caterers. It also provides additional support for producers and farmers seeking to mainstream the supply sustainable food through leading catering services.

Discrepancy between theory and practice: procurement of local and organic food in public catering systems

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Spending approximately 19 % of the EU´s gross domestic product, public authorities are major consumers in the EU Member States and their decisions have significant impact on the market. The procurement of local and organic food for public kitchens is considered an instrument that contributes to the regional economy and sustainable use of resources. Although the reform of public procurement law enables EU Member States to include environmental and social criteria in award processes, research results point out that public authorities do not yet use these legal possibilities.
For the purpose of identifying factors hampering local and organic food purchases in tendering procedures, this paper aims to point out the differences in theory and practice in public procurement processes. The analysis is based on case studies on school catering in Berlin and the Federal State of Brandenburg, which present two different models of procurement policies. The methodical approach consists of an analysis of tender documents and guided interviews with different stakeholders involved in public procurement processes.
Results show that the fulfilment of the potential to procure organic and local food services varies in the two different model regions. Supporting factors for the procurement of local and organic food are e.g. the determination of a fixed-price and standardised award criteria which caused a quality competition among caterers driving an increase of organic food in Berlin to 40%. Based on our results we make recommendations for public authorities that aim to close the gap between theory and practice in their organic procurement procedures.

Competing school food agendas and green public food procurement

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Public procurement constitutes a significant share of public expenditure and as such it is a politically significant instrument that can be used to promote ideas that governing actors find important. Latvia introduced mandatory Green Public Procurement (GPP) in 2014. This was generally seen as a response to foreign policy developments – a means to strengthen local farmers and food industry. However, early on the practices that municipalities used while implementing GPP demonstrated that there are differences in ways how regulations were seen; in ways how municipalities were solving practicalities related to the procurement process; and in communication with actors involved related to school food. Recognizing these differences the paper asks two questions: first, what are the policy making and policy

implementation points where the original ideas can be reshaped; second, what consequences these modifications may cause in quality of greenness, for the range of agents who may participate, in the selection process and in other aspects related to GPP. The paper concludes that the openness of GPP offers possibilities for people to push through practices they might benefit from. However, municipalities' and schools' willingness to participate in GPP planning, execution and monitoring can promote pupils access to high quality meals.

Sustainable school food procurement: factors affecting the actual and potential adoption of organic food

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Public catering services (PCS) are recognized as drivers of food security and nutrition. Researchers and institutions are thus focused in designing sustainable school food procurement, especially including organic products. This study explores the factors affecting the adoption of organic food in PCS at regional level. The analysis is applied on the PCS of Lombardy in Northern Italy. In the framework of the Bioregione project: 524 out of 1554 municipalities have participated in a survey about their public food procurement system. Among the municipalities procuring organic food, a zero-inflated negative binomial model has been implemented in order to assess the main factors affecting the introduction and the intensity level of organic food in PCS. Five sets of factors have been analysed: environmental factors, market constraints, PCS management factors, governance factors and variables linked to local quality indicators/agriculture.
Results show that the introduction of organic food is correlated to a higher population density, bigger farms in the area, PCS with private direct management, and pressure for environmental sustainability and health coming from the control board. The costs perception is considered as a constraint in the adoption of organic food.
This analysis is relevant for several stakeholders. First, farmers and other supply actors have finally access to a systematic dataset about the food demand coming from schools, in order to improve the organisation of the food supply. Second, institutions and policy-makers are supported in coordinating the meeting between food demand and offer, with benefits for local food security.

Field Trips

Field Trip 1: Farming at different scales and intensities

This field trip visits two different farms that have alternative approaches to production. The first is Wall Farm, Kynnersley, Shropshire. Wall Farm is a 162 hectare mixed livestock farm which has been managed under UK Government Environmental Stewardship schemes for the last 25 years. The farm has received payments to reduce the intensity of agricultural management and has based their farming system wholly around this requirement. The farm has a mix of Aberdeen Angus, Stabiliser and Red Poll cattle and Hebridean sheep, two thirds of which are crossed with a continental ram. The farm sells animals as breeding livestock and for meat through outlets including Dovecote Park, for Waitrose, and local rare breed butchers. 24 hectares at the centre of the farm is a Scheduled Ancient Monument (statutorily protected under UK legislation). The earth ramparts of the Iron Age Lowland Hill Fort can still be clearly seen today and restrictions are placed on how this land can be farmed. The whole farm is managed under an extensive grazing system which suits the range of habitats that have been created under the various environmental agreements. As part of the environmental enhancement of the farm, a large area of species rich wildflower meadows and wet grassland for both breeding waders and over wintering birds have been established. We also have a small area of arable ground which is managed primarily for environmental objectives.

The second farm is Lea Manor dairy farm (http://www.grosvenorfarms.co.uk/our-farming/dairy-farming.aspx), part of the Grosvenor Farms estate, owned by the Duke of Westminster. Grosvenor Farms produce about 48,000 litres of milk a day, some 17.5 million litres a year which is processed by Müller Wiseman Dairies and sold to Tesco as liquid drinking milk. The new Lea Manor dairy farm is a significant investment into the future of food and energy and is intended to help meet the increasing demand for milk in a sustainable way. The farm has been carefully designed to be as comfortable as possible for the cows to live in. It has been built to the highest standards and incorporates the latest technologies to develop a farm that is industry leading in terms of animal health, welfare and comfort. This is considered to be best way both to ensure the health and wellbeing of the herd and to provide the efficiencies which modern day farming requires to meet the nation's demand for good value milk. The system includes: a sophisticated monitoring system identifies each cow for lameness as they walk across a sensory platform after every milking enabling staff to identify any issues approximately two weeks before there would be any visual signs. The whole facility has also been fully badger proofed in order better to protect the herds from TB infection. Water is provided through an environmentally friendly bore hole and is used to clean the sand in the cattles' living areas ensuring about 85% can be reused. Solar panels on the south facing roof of one the farm buildings will generate the energy to power the farm with the residual entering the national grid. Large cubicles and sheds provide space for the cows to eat, sleep, walk around and socialise in.

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Field Trip 2: Agroforestry and forestry.

Delegates opting for this programme will visit two contrasting land management systems in which trees play a fundamental role, one in England, the other just over the border into Wales. The first visit is hosted by Mr. Peter Aspin at The Hollies, Wem, North Shropshire (http://www.silvaspin.org.uk). His specialist, organic small-scale (approximately 16 hectares) agroforestry system rears youngstock for dairy use on high-quality pastures with 'alleys' of grassland divided by rows of mixed species of trees. This system is described as, 'a method of land use whereby trees, perennial ground cover crops (in this case grasses, clovers and herbs) and livestock (in this case bovines) are produced on the same piece of land'. The system allows both grazing and browsing by the cattle and 'a rich and varied diet naturally leads to healthier and more disease-resistant animals.'

The second part of the trip will cross the border into Wales, heading to to Coed Llandegla, west of Wrexham, where we will be hosted by Tilhill Forestry (http://www.tilhill.com) the managing agents for the forest owners, the Church Commissioners. We will have lunch here and then explore the forest using the forest road system, guided by the forest managers. Coed Llandegla is a 650 ha. mixed-age commercial forest producing high-volume conifer crops, principally Sitka spruce (*Picea sitchensis*). It is also home to an award-winning outdoor recreation business providing extensive mountain bike, running and walking trails that attract over 250,000 visits per year (http://oneplanetadventure.com).

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Field Trip 3: Organic and Community Farming

The first part of this trip will involve a visit to Fordhall Farm Community Land Initiative (http://www.fordhallfarm.com). Fordhall Organic Farm, based in North Shropshire, England has been chemical free for over 65 years and rear cattle, sheep and pigs on an outdoor extensive grazing system and has been in community-ownership (8000 people) since 2006. This means that the owner, Fordhall Community Land Initiative, is committed to building a sustainable future whilst guaranteeing that farming will be an affordable way of life for generations to come. Fordhall Farm is also one of the longest running natural organic farms in England. Many of the initial supporters were personal friends of the late Arthur Hollins and recognised his ground-breaking research into organic farming. The visit will focus on community ownership and eco-diverse approaches to sustainable land and livelihood systems.

The second part of the trip will visit Timothy Downes farm at Longnor, South Shropshire. Tim is a partner, with his wife Louise, in the family 284 hectare organic dairy farm near Shrewsbury. He milks 300 cows, as well as producing 150 mostly Aberdeen-Angus cross beef cattle per year. The milk is free from antibiotic and is sold to the Organic Milk Suppliers Co-operative (OMSCo). The milk is exported to the US market which goes into cheese, milk protein & baby foods. Tim also plants trees on his farm to support his farming system (https://www.woodlandtrust.org.uk/publications/2013/05/how-trees-benefit-dairy-farms)

Organiser: David Gibbon, Agricultural and Rural Livelihood Systems

Field Trip 4: Integrated & Organic Farming

The first part of the trip will be a visit to Robert Kynaston's Great Wollaston Farm, at Halfway House near Shrewsbury, Shropshire. Great Wollaston is a mixed lowland farm which has been a LEAF (Linking Environment and Farming) demonstration farm since 2002. The main income is from a dairy enterprise consisting of an 85 cow closed herd with dairy replacements and beef cattle. Most of the feed for the cattle is grown on the farm with 85ha of arable cropping consisting of winter wheat and barley combined for grain and spring barley and peas taken as an arable silage. The grassland area consists of high clover leys and the remainder of the farm is managed as a variety of different habitats for wildlife including 10ha of woodland which also provides the feedstock for a 65kwatt biomass boiler. Robert has also recently installed 20kwatt of solar voltaic panels. Robert has worked with the Royal Society for the Protection of Birds on various projects and field trials as well as hosting various research projects and student visits for Harper Adams and other Higher Education providers.

Green Acres Farm is a 220ha mixed organic farm in Shropshire. The cropped land follows a five year rotation driven by a one year clover ley, used either for grazing or silage by the pedigree Hereford cattle, or red clover seed production. Crops grown include, milling oats, wheat, peas and quinoa. Three types of peas are produced specifically for a retail company and packaged with the farm name. There is a substantial green-waste composting enterprise which receives garden waste from local communities and produces around 4000 tonnes per annum of compost, all of which is used on the organic land, raising soil organic matter and improving fertility. All the land is farmed under agri-environment schemes both to preserve and improve conservation and provide educational opportunities for local schoolchildren. Green Acres Farm is diverse in its enterprises, its cropping and its marketing.

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Field Trip 5: Upland Resource Management

This field trip will consider upland resource management and the issues that affect farming with multiple partners and owners and the transitions to sustainable land management. The first visit will begin at Carding Mill Valley which is part of the Long Mynd, a 2000 hectare area of upland in South Shropshire. Much of the land is owned and managed by the National Trust. The Long Mynd is also part of the Shropshire Hills, Area of Outstanding Natural Beauty, a statutory designation offering protection to important landscapes. The Shropshire AONB is an important place for wildlife, geology and archaeology. Following an overview of the Long Mynd at the Tea Rooms in Carding Mill Valley, the visit will drive to the top of the Long Mynd for interactive discussion with National Trust Staff and a landscape officer for the Shropshire Hills AONB Partnership. Discussion will focus on conservation, agri-environment and the Upland Commons Programme. Following lunch, the trip will continue with a visit to the Stiperstones National Nature Reserve (NNR) and a walk to the top of this contrasting Upland Area, lead by the reserve manager from Natural England. Topics for discussion will include visitor management and sustainable grazing.

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Field trip 6: Special Workshop and Demonstration of Harper Adams Robotics

This special IFSA workshop/ and demonstration will consider social and environmental risks of robotics and autonomous systems (RAS) in major farming systems. The morning will give delegates an opportunity to learn about some of the current and possible future developments in RAS for farming. This will include demonstrations of robotics and autonomous systems in the Harper Adams Agricultural Engineering Innovation Centre. In small groups, participants will receive demonstrations of:

- autonomous laser weeding
- controlled traffic farming
- robot tractor
- unmanned aerial vehicles

In the afternoon there will be a chance to hear about the relevant risk governance issues in other recent technology advances, and to contribute to discussion of the wider impacts and risks of RAS in different farming systems. There will be a keynote presentation from Professor Phil Macnaghten (University of Wageningen, The Netherlands) on 'A framework for responsible innovation - lessons learned from GM crops and other technological innovations'. Four breakout groups will each discuss one major farming system:

- large-scale agricultural commodity crop production
- protected horticulture and/or plantation crop production
- extensive rangeland livestock grazing
- intensive housed livestock

The session will culminate in the identification of emerging themes and their relevance and impact on farming systems.

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