

Facilitating practice-led co-innovation for the improvement of animal welfare

Lisa van Dijk¹, Henry Buller², Louise MacAllister³ and David Main⁴

¹ *University of Bristol, School of Clinical Veterinary Sciences, lisa.vandijk@bristol.ac.uk*

² *College of Life and Environmental Sciences, University of Exeter*

³ *College of Life and Environmental Sciences, University of Exeter*

⁴ *University of Bristol, School of Clinical Veterinary Sciences*

Keywords: Practice-led, Innovation, Collaborative learning, Innovation networks, Facilitation, Animal welfare

Abstract: 150 to 180 words

Introduction

There is a growing policy interest in agricultural innovation generated through practice-led collaborative learning processes. The EU H2020 research strategy, for example, is currently promoting a multi-actor interactive approach to innovation that includes a high level of farmer engagement (SCAR, 2013). For many years, the assumption in animal health and welfare policy has been that scientists working in institutions and large enterprises are best placed to provide the technical solutions to our policy challenge. However, despite large investment, there remains a gap between applied science and farm practice (Pretty, 1995). In recent years, there is an increasing realization that, to deal with the current challenges in agriculture, there is a need to go beyond linear models of knowledge transfer to more systemic forms or processes of knowledge co-generation focusing on multiple actors including farmers (World Bank, 2006; Conroy *et al.*, 2008). These system innovation processes go beyond technology development and transfer to farmers, to seeing innovation as a process to build capacity and create change at farm and institutional level to increase productivity and sustainability (Darnhofer *et al.*, 2008; Röling, 2009)

Akrich *et al.* (2002) argue *“the evaluation of the disadvantages and advantages of an innovation is entirely in the hands of the users: it depends on their expectations, their interests, on the problems which they raise”*, in short, their practice. Thus practice-led innovation reacts to the demand for innovation in practice to solve local problems using practical knowledge and creativity at the local farm level (Vogl *et al.*, 2016). This practical local knowledge is an essential foundation for local innovation however literature shows this is often not enough for local innovation to occur (Eastwood *et al.*, 2017; Arkesteijn *et al.*, 2015; Lambrecht *et al.*, 2015); to enable this process requires creating space for joint learning and knowledge sharing through innovation networks, bringing together a variety of actors, with different (forms or sources of) knowledge (Spielman and Birner, 2008; Moschitz *et al.*, 2015; McKenzie, 2013). Innovation networks can include a wide variety of individuals and organizations (e.g. producers, scientists, advisory services, consumers, SME's, NGO's and local policy makers) and research shows innovation networks are dynamic in nature (its composition can change over time as priorities and access to resources of actors change), vary in shape and size and in strength of their relationships between actors (Moschitz *et al.*, 2015; Brunori *et al.*, 2013).

The role of a network facilitator is essential to bring actors together (network brokering) and stimulating joint learning (Wielinga and Herens, 2013; Klerkx and Nettle, 2013) This role is different from more

traditional advisory roles of knowledge transfer and involves to mobilize the networks, guide the network through the innovation process, promote learning and linking with support actors (Klerkx *et al.*, 2012; Röling, 2009). The function and role of facilitators in the innovation process has been widely described in literature (Klerkx and Jansen, 2010; Howells, 2006; Moschitz *et al.*, 2015; Kilelu *et al.*, 2013; Klerkx and Gildemacher, 2012) however much less is written on how to actually support the facilitator to perform this role. Klerkx and Gildemacher (2012) indicate that facilitators can use existing methods and tools however facilitating the innovation process is learning by doing. Existing methods and tools include the Free Actors in Networks approach developed by Wielinga *et al.*, (2008) and the Reflexive Monitoring in Action developed by Van Mierlo *et al.*, (2010b). Both methods focus on monitoring of the innovation process and self-reflection by the facilitator to identify what is happening within the network and support and stimulate the network members to reflect and take the next step in the process.

Practice-led innovation processes evolve as the actors within the innovation network come together to share common problems, experiment with possible solutions and learn. The process is influenced by a variety of factors such as the institutional context, policy environment, current market forces and wider Agricultural Innovation Systems in a specific country (Klerkx *et al.*, 2010). The participatory and iterative nature of this process, its collective outcome and the influence of external factors on this, leads to uncertainty in process and end-results (Klerkx *et al.*, 2012; van Mierlo *et al.*, 2010a). This raises methodological challenges in the management of such processes and requires a flexible and adaptive management approach focusing on learning and reflection (Wielinga and Vrolijk, 2009; Arkesteijn *et al.*, 2015; van Mierlo *et al.*, 2010a). Hence the operationalization of this process for institutions in which innovation is still seen as a linear process and where the reward systems are not acknowledging this type of research can be quite challenging and becomes a process of trial and error (Neef and Neubert, 2011; Botha *et al.*, 2014; Klerkx *et al.*, 2017).

This paper describes the process of facilitating practice-led innovation through innovation networks as part of the Hennovation project. It aims to provide insight in the facilitation process and tools used, including a framework for the facilitation of practice-led collaborative innovation processes. It outlines how the Hennovation project has uses a participatory research methodology to explore mechanisms to facilitate and stimulate practice-led innovation. And the paper finalizes with the discussion of the lesson learned after 18 months co-innovation by the Hennovation networks.

Practice-led innovation in egg-laying hen sector

While there is a considerable body of work on how local innovation is generated and facilitated in the field of natural resource management (reference), far less has been done in the area of farm animal welfare (reference). Using the egg-laying-hen sector as a case study, the EU-funded 'Hennovation' project has been testing mechanisms to enable practice-led innovation through the establishment of innovation networks of farmers and within the laying hen processing industry, supported by existing science and market-driven actors, that are facilitated to proactively search for, share and use new ideas to improve hen welfare, efficiency and sustainability. The Hennovation project was the first thematic network funded under the EU H2020 programme and implemented between January 2015 and August 2017, Figure 1. The consortium consisted of six consortium partners, five academic institutes and one agriculture advisory service in five European countries.

In total 19 multi-actor networks were mobilised on local and regional levels across the Czech-Republic, The Netherlands, Spain, Sweden, and the United Kingdom. The networks worked specifically on two particular areas of concern in the production chain: feather (or injurious) pecking on-farm and the transport and use of end-of-lay hens. 15 networks focused on finding practical solutions to problems related to feather (or injurious) pecking on-farm. Beak trimming is the commonest measure used to reduce feather pecking in laying hens however there is a clear move in many member states towards more widespread implementation of a prohibition of the practice (EU wide beak trimming ban), which is regarded as an ethically undesirable mutilation. This creates strong demands from the poultry industry for practical and effective alternative measures to reduce feather pecking without resorting to beak-trimming. Four network focused on practices and potential for practice-led innovation in the problematic and largely unsustainable, after-use of end-of lay hens. This is a fundamentally distinct area from the former, involving different actors and procedures and raising significantly different aspects of practice-led innovation.

The project team deliberately did not predefine the meaning of a 'network' to allow for various routes to network formation (Kanter, 2000). Several networks were formed from larger pre-existing producers groups connected to a specific egg packing company or veterinary practices. Producers who were interested formed smaller groups. Some networks were pre-existing groups, either for example a study group, or a group of producers connected through proximity or friendship attending training events, and other activities together. Others, especially in case of the end-of-lay, networks were formed from

previously unrelated actors. The links to these actors were directly and intentionally facilitated by the project. The network size of the on-farm networks varied from five to eight producers with variably supported by scientists, veterinarians, advisors, feed company based on the specific topic addressed by the network. The laying-hen production system also varied between networks, e.g. organic, free range, barn (aviary) or (furnished) cage systems, some networks are mixed. Network meetings were almost always face to face, some networks use telephone meetings in order to overcome the organisational issues that arose with a geographically dispersed network for example in Sweden.

Hennovation Project Methodology

The Hennovation project adapted a participatory action research approach to explore and test mechanisms to facilitate and enhance practice-led innovation. The research methodology, based on Moschitz *et al.* (2015), includes two interlinked learning spaces; a reflection and action process at the facilitators(project) level and a co-learning process at the network level., Figure 1. At the facilitators' level, the facilitators (who were also the project researchers) were supported to develop and implement the approach and reflect on its application through reflection workshops, skype meetings and the use of an online peer discussion platform (wiki). At the same time the innovation networks were working together with the facilitators and guided through an innovation process to develop innovative solutions for their problems faced.

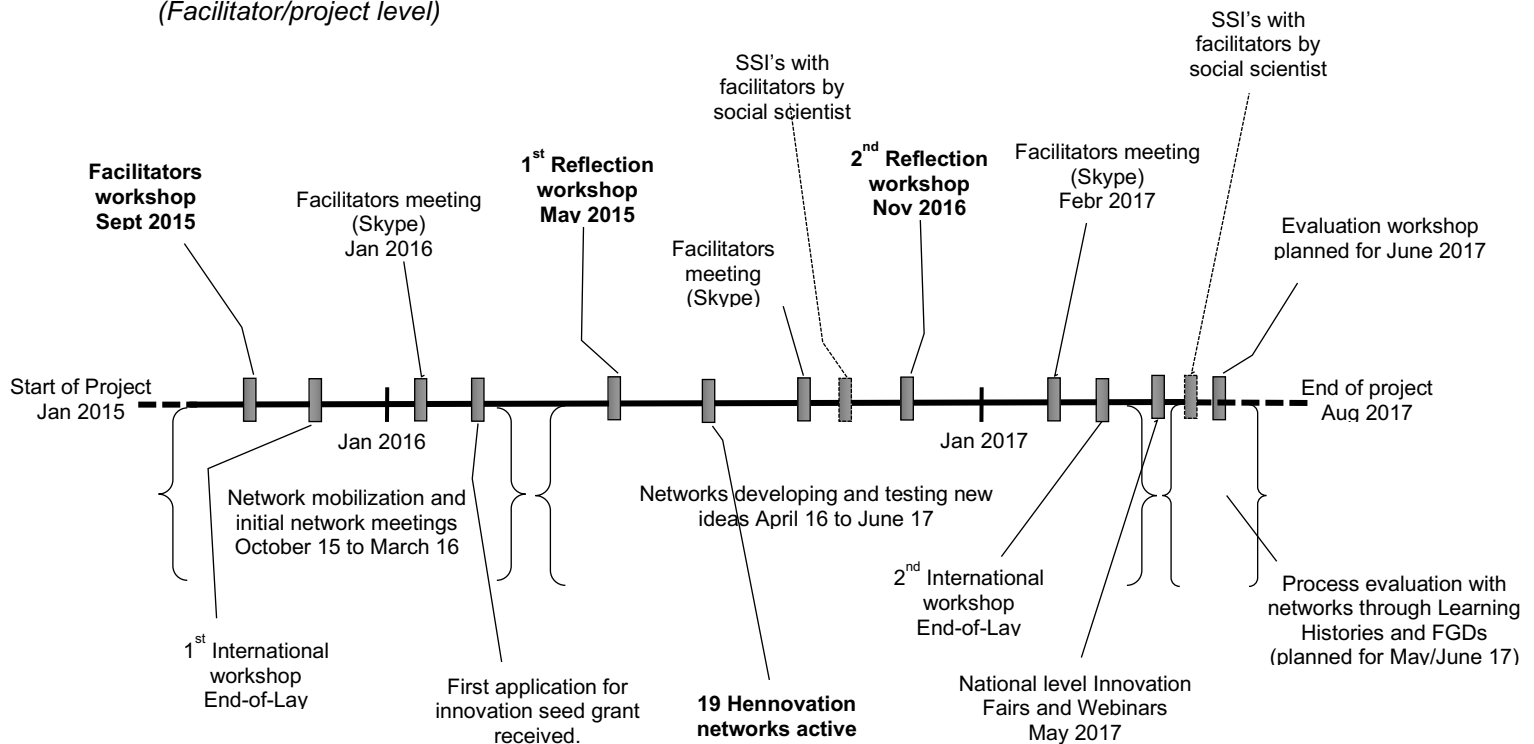
A facilitators' coordinator supported the facilitator as well as performed the role of 'reflexive monitor', challenging the way the facilitators work and their underlying assumptions through reflection workshops (Van Mierlo *et al.*, 2010b; Botha *et al.*, 2014). Data on network performance and facilitators reflection was systematically collected using the project wiki. Social scientist involved in the project observed the process, analyzed the data and conducted interviews to provide further insight in the effectiveness of approach.

At the time of writing this paper the hen novation has progressed with the facilitator training and two reflection workshops. The focus of the first facilitator's workshop was to conceptualise innovation in the context of practice-led innovation, to identify the process by which innovation might occur and their role as network facilitators. A framework for the adaptive management and facilitation of practice-driven innovation was developed by and with the facilitator. The two reflection workshops focused on sharing progress and experiences, draw learnings and (self) reflect on the innovation process (use of the

framework) and its outcomes and discuss potential challenges. Tools such as network mapping, Venn diagram for stakeholder analysis and the learning history (Kleiner and Roth, 1996; Wielinga and Geerling-Eiff, 2009) were used to monitor network performance and self-reflection by facilitators, with the idea that the facilitators could also use these tools for self-reflection with their networks.

Figure 1 Timeline of the Hennovation project outlining important events in two learning spaces.

Learning space 1 Facilitator reflection & action process
(Facilitator/project level)



Learning space 2 Network co-learning process
(Network level)

Hennovation Network Facilitators

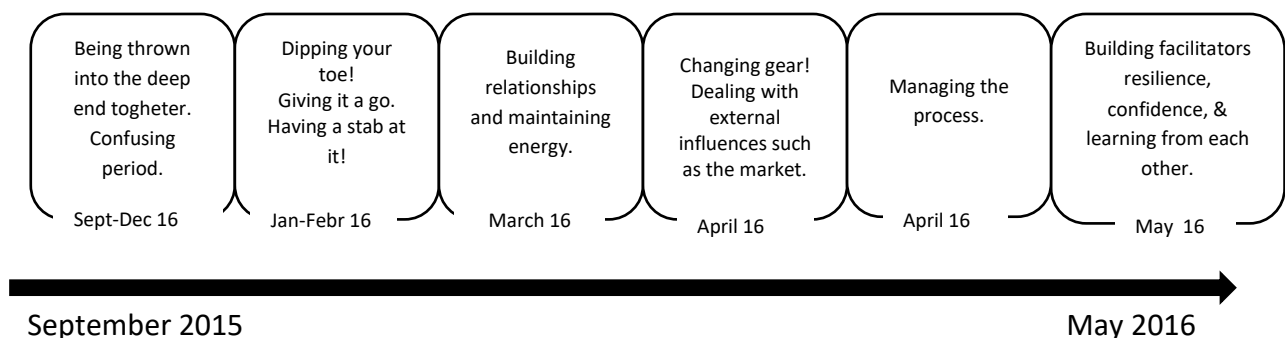
In total 11 facilitators from five different countries in Europe, namely the United Kingdom, The Netherlands, Sweden, Czech and Spain were recruited to support the innovation networks. All facilitators, bar one, were already employed in a research position either as a research technician or in a post-doctoral position by the academic institutes before implementing the project. All facilitators had university degrees in animal health and welfare related or veterinary sciences. All had experience working in the livestock sector in the in their country, some had experience working in the laying hen sector. The facilitators had a varying degree of experience in working in more collaborative research

projects, some had little or no previous experience whilst some had facilitated more collaborative research processes, not necessarily focusing on innovation by farmers.

Through a workshop exercise a facilitator's 'job description' was collaboratively developed by facilitators themselves. The facilitator's role was summarised as comprising of a range of dynamic and situated roles that work towards the recruitment of existing or establishment of new networks, support their progress towards practice-driven innovation, develop connections and link networks with actors who have similar interests as the network, and monitor and reflection on the functioning of the network to determine support and action, including self-evaluation and learning by the facilitator. The reporting on network meeting and network performance (on the wiki) and to actively share experiences with other facilitators through discussion forum and planned workshops was also an essential part of the facilitators role. The uncertainties in process and outcome was quite daunting for the facilitators embarking on facilitating this innovation process for the first time. Over the course of the learning programme the confidence of the facilitators increased evident from the learning history exercise conducted after the first six months. The Learning History methodology adapted from Wielinga (2012) shows a clear progressing in ability and confidence of the facilitators to support the innovation network, (Figure 2).

Figure 2 Hennovation Network facilitators Learning History September 2015 to May 2016

The facilitators were asked reflect on the previous six months individually and write on sticky notes, positive, negative and light bulb moments. On a large piece of paper a timeline of six months was drawn and the piece of paper was divided in three sections from left to right. Each facilitator was requested to stick their notes at the appropriate place on the timeline and in plenary the sticky notes were read aloud and analysed. After the initial analysis the facilitators were asked to identify the most important events/periods in scenes, like in a movie script. Each script was provided a newspaper heading representing the content of the scene, below.



Framework for facilitators' reflection and action

Facilitating a dynamic, practice-driven innovation process is at the heart of the Hennovation project. The focus of the first facilitator's workshop was to identify the process by which innovation might occur in

practice-driven innovation networks taking into account that nature of individual innovation processes is also, at least in part, contingent upon the networks themselves (reference). Through a series of workshop exercises, the facilitators went on to chart the process and the distinct stages, or 'process steps' towards innovation. These were subsequently used to frame the ways in which facilitators understand and evaluate the development of innovation, and the functioning of their networks and further developed into a framework for reflection and action.

Initially the facilitators identified six key steps in the innovation process:

1. The identification of the need for innovation; shared problem/opportunity,
2. The generation (and assessment) of innovative ideas which could provide potential solutions,
3. The selection of an innovative idea and plan action to 'test' the idea including resources required in terms of time, technical support and monetary,
4. The practical 'testing' / development of the idea on-farm, during transport or at the slaughter house,
5. The implementation and upscaling of the innovation in practice,
6. Finally the wider dissemination of the innovation amongst the sector.

Further discussion on the activities that might be done by the networks in each step led to the development of guiding questions to encourage facilitators to reflected on the functioning of their networks, asses 'network health' (Wielinga *et al.*, 2008) and deciding whether their intervention (action), and what kind of intervention was necessary to move the innovation process forward, Table 1. Facilitators used the framework to assess each network by scoring each question (using a non-value based measure of High. Medium, Low, Not applicable). Apart from individual reflection by facilitators of each networks, facilitators were also asked to compare the progress and functioning of each network the facilitated and identify why similarities or differences in performance emerged. The comparison of the networks between countries was also facilitated at different moments in time, during the reflection workshops (and planned evaluation work in June 2017).

Table 1 Framework facilitation of practice-driven innovation processes (based on workshop exercises and adapted from (ENRD, 2013))

Step 1 Innovation identification	
1.1	Level of clarity of purpose and shared objective as a network?
1.2	Level of agreement on network function, e.g. decision making, common rules, reaching consensus etc.?
1.2	Problem identified based on shared need (is there a clear common problem)?
1.3	Market or other actors value the problem (relevance)?
1.4	Capacity of network to find practical solutions to the problem identified (perceived capacity of the network by the facilitator)?
Step 2 Generation of innovative ideas	
2.1	Level of which the idea/solution is shared by the network?
2.2	Feasibility of the idea (includes financially viable)?
2.3	Level of diversity of knowledge (resources) used: science, advisors input, practical experience etc. ?
2.4	Capacity of network to trail the practical solutions selected (perceived capacity of the network by the facilitator)
Step 3 Action planning & resource mobilization	
3.1	Robustness of the action plan including timeframe and task division (every one knows what is happening, when and by whom)?
3.2	Level of clarity on anticipated result (research question) and system/criteria in place for to monitor/ measure results (e.g. viability)?
3.3	Level of resources the members within the network commit towards trialing.?
Step 4 Practical testing/ development	
4.1	Level and rate of innovation - action plan leads to action.?
4.2	Willingly to discussed and shared within the group successes and failures (to learn from failures) ?
Step 5 Implementation and upscaling	
5.1	Level of satisfaction of members with regard to relevance and affordability of solutions developed?
5.2	Number of group members applying the innovation as common practice across their farm.?
5.3	Farmers pride of what they achieved - wanting to share the idea and upscale.?

The framework was developed as a tool to guide the facilitation of the innovation process and to stimulate learning by the facilitator on how to manage this process and was not intended to be a comprehensive set of criteria to evaluate network performance. Although the framework is presented stepwise the innovation process is not linear and the time allocated for each step cannot be predicted (Klerkx and Gildemacher, 2012) and depended amongst others on a variety of factors such as network capacity and the specific idea tested. The challenge in the development of the framework was that on the one hand it needed to provide enough structure to be useful for the facilitator whilst on the other hand the framework needed to be generic and flexible enough to accommodate the diversity and unpredictability of the process (Klerkx and Gildemacher, 2012).

Lessons learned from facilitating practice-led innovation in the laying hen sector.

The reflections using the framework as well as workshop exercise, facilitators meeting minutes and analysis of the wiki data provided insights and lessons learned in facilitating practice driven innovation.

Formation of Hennovation networks

In many countries the networks were formed from bigger existing groups connected to a specific egg-packing company, veterinary practices or farm assurance scheme. Reflection on network mobilization by the facilitators during the first reflection workshop in May 2016, revealed that the use of such key contacts (intermediates) was perceived as pivotal in enabling network formation. Facilitators succeeded in forming networks through persisting with these key contacts however subsequent involvement of these intermediates in the innovation process was in some cases positive and constructive and in others destructive as the intermediate tried to enforce their own agenda and interfered in the innovation process. The formation of networks took much longer than expected. Initially three months was planned to form two to four networks in each project country however this exceeded six months and facilitators who were relatively new to the sector found it particularly challenging and time consuming. Several forms of network formation emerged which potential implications for the subsequent functioning of the network. Whilst pre-existing relationships between network members equate with higher levels of trust, Kanter (2000) indicates that increased network density does not necessarily leads to more innovation and could actually limited the amount of knowledge available within the network. Although formation of the network took longer with previously unrelated members, reflection showed that there was no clear indication that the subsequent steps in the innovation process took more time or were more or less effective. Relationships were also shaped by the kind of contract that producers had, and whether these fosters collaboration or competition. The highly integrated supply chain of the laying hen sector for example in the Czech Republic and Spain did not lend itself easily for collaboration. In these countries the forming a network was an innovative outcome in itself as this was not commonly practiced.

Understanding of and expectations of the practice-led innovation approach.

Differential understanding of what innovation is and how it is framed gave also rise to differences in network processes and outcomes. Individual understandings of innovation are unlikely to be uniform, with network members as well as support actors bringing pre-conceived ideas of innovation to the

network. The ways in which networks frame innovation translates to the actions of the network. The challenge for facilitators was to ensure a clear articulation of the concept of practice-led innovation as something which producers have the capacity to realise. This was specifically challenge for facilitator with limited experience in facilitating innovation as they themselves might not always have been clear of the approach yet. The process of practice-led innovation in which the practitioners are empowered to develop their own solutions was not valued equally (legitimacy). On network level some members were sceptical of the approach and were expecting or were more motivated to learn from “experts”, passive knowledge acquisition rather than generating new knowledge. This brought challenges for the facilitator in of overcoming a culture of receiving rather than generating knowledge.

Transition from gathering knowledge to generation of new knowledge

A particular challenge for many facilitators was recognising the point at which a network had sufficient new or adaptive knowledge and/or understanding to progress into action. Several Hennovation networks found it difficult to progress beyond idea generation (Table 1 step 2) and gathering knowledge on many areas to focus on a single targeted idea to develop and test. Other found it challenging to progress into action after having selected a particular idea and thus returned to gather further knowledge on a new topic (Table1, step 1). This impasse presents a particular challenge for facilitation. The challenge here for facilitators was, first, to recognise whether new information/knowledge is required by the network to begin to address the issue and innovate and, second, to appreciate when it is right to encourage the network to focus on a particular area and plan to trial or test something new. The difficulty that networks experience in the progression from information gathering to action planning may not only be one of a balance of different types of knowledge (e.g. science and practice) but may also lie in issues of network and facilitator confidence, in the nature and coherence of the problem addressed, and in the tangibility and achievability of the intended innovation.

Different types of innovations

Over a period of 18 months Hennovation networks have tackled a range of technical challenges through the development of different types of innovations; alongside technical or ‘hard’ innovations (e.g. new type of litter material to reduce stress and encourage natural behavior or the use of alpacas in organic systems to reduce predation), a variety of often less expected and sometimes unintended ‘soft’ innovations also emerged through these network (e.g. a new way of marketing low valued hen meat and new relationships between production chain actors, pullet rearers). The process lead to innovation on

both individual as well as collective network level. Some ideas developed and tested were innovative in a specific farm context (for example the use of different range covers, sheds, cover crop and trees to encourage birds out onto the range) though not necessarily innovative for the laying-hen sector others had a potential to have a great impact on in the sector (for example the use of trolleys when catching hens and immediately placing them into drawers in which they are transported to the processing plant).

Facilitators role and support needs

Overall there is a large diversity in capacity and functioning of the innovation networks, both within as between countries. This provides a great opportunity as well as a great challenge for the facilitators learning to manage the innovation process. The role of the facilitator is structured by the context in which the network operates. Facilitator confidence, experience, and personality all impact on the ways in which networks are facilitated, how any challenges are approached and resolved and, ultimately upon the eventual outcome of the network. The role of the facilitators was not static and varied between networks and process steps. During a reflection exercise at the workshop in November 2016 the facilitators reflected on the personal attributes required to facilitate the innovation network. The facilitators identified many similar attributes despite large diversity in context, personality and experience. The key attributes identified were: flexible, adaptive, patient, observant, focused, committed/dedicated, determined, resilient, energetic, sociable, open-minded, resourceful and cooperative.

Reflection on support needs of the facilitator during the reflection workshop the following support needs emerged:

- Access to a support actors (scientist, advisors and others) to link the right actors to the network
- Tools to facilitate the network process to reach the best possible outcome.
- Opportunities to share knowledge and experience between facilitators
- Group facilitation training to feel confident in dealing with challenging individuals in the networks
- Administrative and logistical support

Concluding comments

The Hennovation project demonstrates:

- Networks are a good mechanism for generating innovation (or a certain kind of innovation) at the 'on-the-ground' level of farming practice.

- Network facilitation takes many forms but is critical in creating the capacity for achieving innovation, or moving towards innovation within networks
- The sorts of innovation generated through practice-led networks are different from the kinds of innovation emerging from science and more traditional top-down pathways of innovation delivery but are equally valid in practice.

By focusing on the dynamics of practice-driven, grass root innovation and its articulation with existing science and market-driven actors, this project will create the conditions necessary for a significant and lasting shift in the enabling mechanisms and procedures for practice-driven innovation both in impacting upon science-driven innovation and in delivering practical solutions within the animal production industry.

Acknowledgements

The paper draws upon research and discussions conducted under the HENNOVATION project, a H2020 EU collaborative research project with 6 academic partners funded under the topic 'Innovative, Sustainable and Inclusive Bioeconomy' ISIB-2-2014/2015: Closing the research and innovation divide: the crucial role of innovation support services and knowledge exchange. Grant agreement no 652638.

The authors wish to thank the many people involved in that project who collaborated in that research and contributed to the material of this paper. network facilitators, Paula Baker, Monique Mul, Francesca Neijenhuis, Marleen Plomp, Anette Wichman, Jenny Yngvesson, Deborah Temple, Jiří Žák and Jessica Stokes for their active participation in developing and testing this framework.

The views and opinions expressed in this article are those of the authors and do not necessarily represent a position of the Commission who will not be liable for the use made of such information.

References

- Akrich M, Callon M, Latour B, et al. (2002) The key to success in innovation part I: the art of interressement. *International Journal of Innovation Management* 6: 187-206.
- Arkesteijn M, van Mierlo B and Leeuwis C. (2015) The need for reflexive evaluation approaches in development cooperation. *Evaluation* 21: 99-115.
- Bank W. (2006) Enhancing agricultural innovation: how to go beyond the strengthening of research systems. In: Bank W (ed) *Economic Sector Work report* Washington D.C. : The World Bank.
- Botha N, Klerkx L, Small B, et al. (2014) Lessons on transdisciplinary research in a co-innovation programme in the New Zealand agricultural sector. *Outlook on Agriculture* 43: 219-223.
- Brunori G, Barjolle D, Dockes AC, et al. (2013) CAP reform and innovation: the role of learning and innovation networks. *EuroChoices* 12: 27-33.
- Conroy C, Snapp S and Pound B. (2008) The nature of agricultural innovation. *Agricultural Systems: Agroecology and Rural Innovation for Development*: 309-323.

- Darnhofer I, Bellon S, Dedieu B, et al. (2008) Adaptive farming systems: a position paper. *8th European IFSA Symposium. Clermont-Ferrand (France)*. Citeseer, 339-351.
- Eastwood C, Klerkx L and Nettle R. (2017) Dynamics and distribution of public and private research and extension roles for technological innovation and diffusion: Case studies of the implementation and adaptation of precision farming technologies. *Journal of Rural Studies* 49: 1-12.
- ENRD. (2013) Phase 2 Report on EIP Operational Group. European Network for Rural Development Coordination Committee, Focus Group on Knowledge Transfer and Innovation
- Howells J. (2006) Intermediation and the role of intermediaries in innovation. *Research policy* 35: 715-728.
- Kanter RM. (2000) When a thousand flowers bloom: Structural, collective, and social conditions for innovation in organization. *Entrepreneurship: the social science view*: 167-210.
- Kilelu CW, Klerkx L and Leeuwis C. (2013) Unravelling the role of innovation platforms in supporting co-evolution of innovation: contributions and tensions in a smallholder dairy development programme. *Agricultural Systems* 118: 65-77.
- Kleiner A and Roth G. (1996) Field manual for a learning historian. *MIT Center for Organizational Learning and Reflection Learning Associates*.
- Klerkx L, Aarts N and Leeuwis C. (2010) Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment. *Agricultural Systems* 103: 390-400.
- Klerkx L and Gildemacher P. (2012) The role of innovation brokers in agricultural innovation systems. *World Bank. Agricultural innovation systems: an investment sourcebook, Module 3*.
- Klerkx L and Jansen J. (2010) Building knowledge systems for sustainable agriculture: supporting private advisors to adequately address sustainable farm management in regular service contacts. *International Journal of Agricultural Sustainability* 8: 148-163.
- Klerkx L and Nettle R. (2013) Achievements and challenges of innovation co-production support initiatives in the Australian and Dutch dairy sectors: a comparative study. *Food policy* 40: 74-89.
- Klerkx L, Seuneke P, de Wolf P, et al. (2017) Replication and translation of co-innovation: The influence of institutional context in large international participatory research projects. *Land Use Policy* 61: 276-292.
- Klerkx L, van Mierlo B and Leeuwis C. (2012) Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions. *Farming Systems Research into the 21st century: The new dynamic*. Springer, 457-483.
- Lambrecht E, Kühne B and Gellynck X. (2015) Success factors of innovation networks: Lessons from agriculture in Flanders. *Proceedings in Food System Dynamics*: 390-403.
- McKenzie F. (2013) Farmer-driven innovation in New South Wales, Australia. *Australian Geographer* 44: 81-95.
- Moschitz H, Roep D, Brunori G, et al. (2015) Learning and innovation networks for sustainable agriculture: processes of co-evolution, joint reflection and facilitation. Taylor & Francis.
- Neef A and Neubert D. (2011) Stakeholder participation in agricultural research projects: a conceptual framework for reflection and decision-making. *Agriculture and Human Values* 28: 179-194.
- Pretty JN. (1995) Participatory learning for sustainable agriculture. *World Development* 23: 1247-1263.
- Röling N. (2009) Pathways for impact: scientists' different perspectives on agricultural innovation. *International Journal of Agricultural Sustainability* 7: 83-94.
- SCAR. (2013) Agricultural Knowledge and Innovation Systems towards 2020—an orientation paper on linking innovation and research. *Brussels, European Commission*.
- Spielman DJ and Birner R. (2008) *How innovative is your agriculture?: Using innovation indicators and benchmarks to strengthen national agricultural innovation systems*: World bank.
- van Mierlo B, Arkesteijn M and Leeuwis C. (2010a) Enhancing the reflexivity of system innovation projects with system analyses. *American Journal of Evaluation* 31: 143-161.
- Van Mierlo B, Regeer B, Van Amstel M, et al. (2010b) Reflexive monitoring in action. A guide for monitoring system innovation projects. Communication and Innovation Studies, WUR; Athena Institute, VU.
- Vogl CR, Kummer S and Schunko C. (2016) Farmers' experiments and innovations: A debate on the role of creativity for fostering an innovative environment in farming systems.
- Wielinga. (2012) *The Learning History - tools for networkers* Available at: www.toolsfornetworkers.nl.
- Wielinga E and Vrolijk M. (2009) Language and tools for networkers. *Journal of Agricultural Education and Extension* 15: 205-217.
- Wielinga E, Zaalmink W, Bergevoet R, et al. (2008) Networks with free actors: encouraging sustainable innovations animal husbandry by using the FAN approach (Free Actors in Networks): networking is sensing opportunities! : Wageningen UR.

Wielinga H and Herens M. (2013) Monitoring Creative Processes: the Timeline and Learning History.
Wielinga HE and Geerling-Eiff F. (2009) Networks with free actors. *19th European Seminar on Extension Education*. Citeseer, 133.