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Using systems diagrams to support multi actor collaboration in Agricultural Knowledge and Innovation Systems

Abstract

European agricultural policies increasingly acknowledge the tension between the economics of food production and the common good, a collaborative imperative for agriculture to be sustainable, and adaptation to the exigencies of climate change and biodiversity loss. To address this tension, significant emphasis has been put on understanding and describing the Agricultural Knowledge and Innovation Systems (AKIS) that operate at different levels within different countries and doing so through graphical representations of these systems. Strong support also exists for multi-actor approaches to foster dialogue between organisations and groups within these AKIS. However, a key problem is that abstract macro-AKIS diagrams can contain assumptions and emphasise forms of knowledge and practices that do not readily support dialogue between different actors within a micro-AKIS attempting to determine innovations for more sustainable agriculture. This paper reports on diagramming techniques often used in systems practice that can enable multiple actors in a micro-AKIS to co-create mutual representations of the complex situations and choices they face as they attempt to work together more effectively and efficiently. Our findings from six Living Labs convened for the H2020 funded AgriLink project showed diagrams could be an essential tool for collaboration and collective understanding and action within a micro-AKIS. We conclude with implications for policy-making at the macro-AKIS level.

Keywords: Systems diagrams, collaboration, multi actor, Agricultural Knowledge and Innovation Systems

Introduction

The need to both provide for a resilient agricultural sector in order to deliver food security and to ensure that that those working within agricultural systems mitigate

their impacts upon climate change and biodiversity loss has long been addressed in European agriculture through Agri-Environment Schemes (Cullen et al, 2018; Pe'Er et al. 2019). Indeed, the two concepts of public goods and ecosystems services have been investigated over the years and directly linked through an approach known as Socio-Ecological Systems (Berkes et al., 2003), that has been used to enhance sustainable farming. While agricultural policies across Europe have these same aims due to the influence of the Common Agricultural Policy (Ackrill, 2000), there is variation in how the many policies within the major principles of the CAP framework are understood and enacted by the various actors involved and also what should be the consequent actions taken at all levels – national, regional, local.

Visualising Agricultural Knowledge and Innovation Systems

This linking of public goods and ecosystem services drives attention to the multiple perspectives on the changing dynamics of interactions between human and ecological processes over time. These interactions have also been visualised using many schematic diagrams to represent the authors' understanding of the main factors and inter-relationships involved in a socio-ecological system framework. The exemplar in Figure 1 is recognisably a form of systems diagram that includes components and relationships, and some form of feedback, within a given boundary, with several elements existing in the system environment. However, while this schematic diagram provides a description of a socio-ecological framework it does not provide any prescriptions as to what might be done in a particular situation of interest.

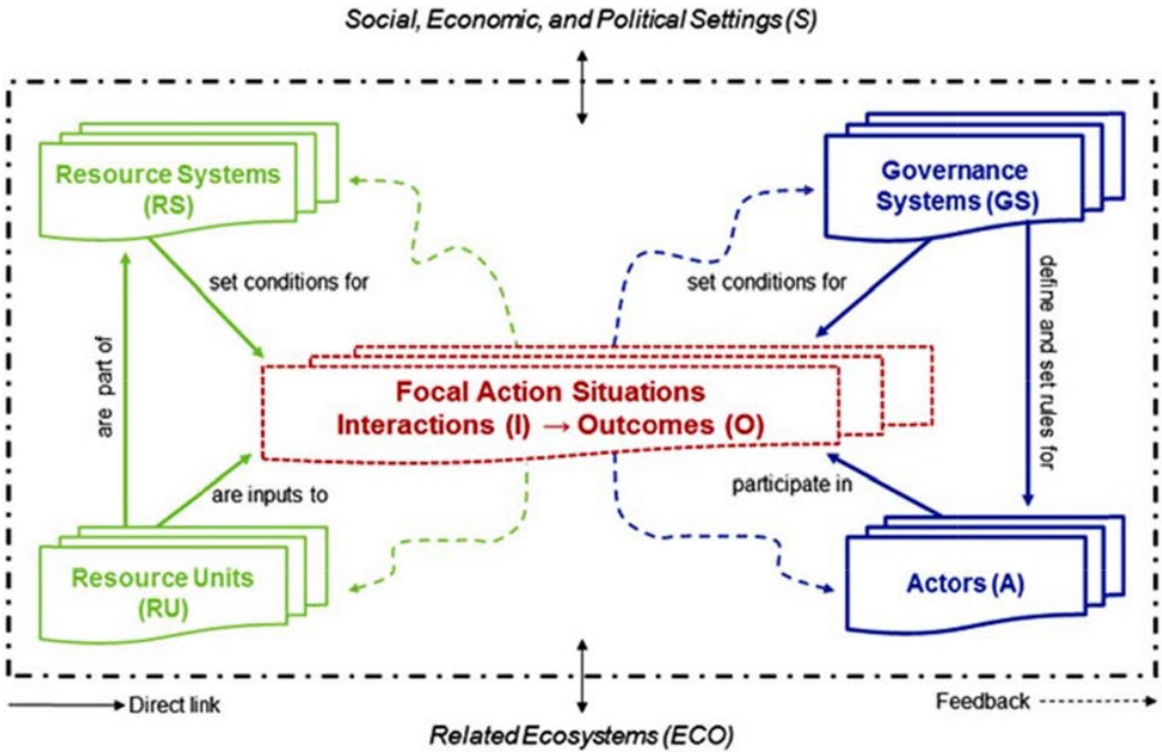

Figure 1 An exemplar of a socio-ecological system framework from Dwyer et al, 2018

In parallel, there has also been interest in and investigations of what have been called Agricultural Knowledge and Innovation Systems (AKIS). Designed to enable co-development and exchange of information and innovation, they operate at different levels within different countries (Moreddu and Poppe, 2013). These too have been visualised through schematic diagrams such as the one shown in Figure 2 detailing who might be the main actors involved in helping farmers through innovations and advisory support services. Such use of the term 'system' in this domain is more than the everyday use of the term but is not always linked to the wider systems literature, including that relating to systems diagramming (Lane, 2013; Oreszczyn and Lane, 2017). Moreover, this schematic diagram is more notable for its very abstract nature, devised by researchers, and for its aesthetics and simple 'listing' of actors than its depiction of explicit relationships between them. As with Figure 1 it also offers a difficult transition from using such a diagram or model of a situation to developing an appropriate systems design, implementation, or improvement for a particular situation.

These visualisations have their value to researchers and/or policy makers in setting out high level, abstract depictions of complex and/or complicated situations. They

can be included in articles and reports and be discussed in meetings and conferences. However, their abstract nature and conceptualisation means they are not so useful for individual actors, such as farmers and advisors, or the multiple other actors involved in more local contexts, to both understand or apply to their work.

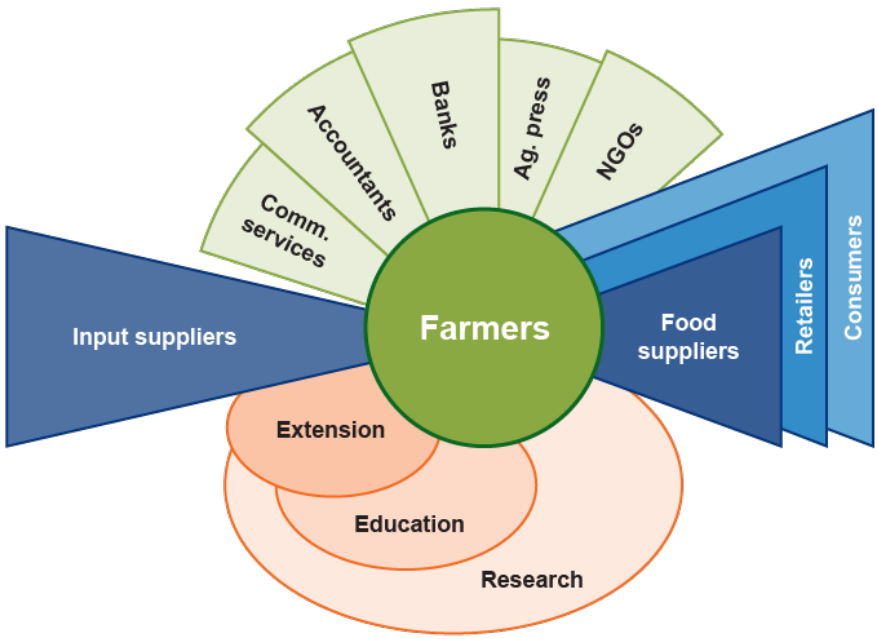

Figure 2 Actors involved in a contemporary AKIS (Source: EU SCAR 2012)

The differing conditions and circumstances in European countries also means that more detail and richness is required in such visualisations. The PROAKIS project (PROAKIS, 2015) attempted to do this by creating diagrams to describe and understand the macro-AKIS for different countries, noting more specific actors, the relationships between them and the logic behind the colour coding. Figure 3 provides one such country specific AKIS visualisation.

Despite more detail, a key problem is that macro-AKIS diagrams for a whole country such as that shown in Figure 3 are still at an abstract level and developed by researchers who have not necessarily had direct or sustained stakeholder input. They can contain assumptions and emphasise forms of knowledge and practices that do not readily recognise or support dialogue between different actors within a micro-AKIS operating at a local geographical scale – an essential element of successful change processes in agriculture (Sutherland & Labarthe, 2022). Even at more local scales, such actors also probably have a limited view of all the elements in their micro-AKIS 'system'. They may see themselves as operating within a local

or regional geographical context at different times, and when attempting to determine innovations for more sustainable agriculture some may be more interested in economic returns and productive agriculture rather than their contributions to sustainability, however defined. There is therefore a need for a more specific and more collaborative approach to visualising a micro-AKIS and the innovations needed for more sustainable agriculture.

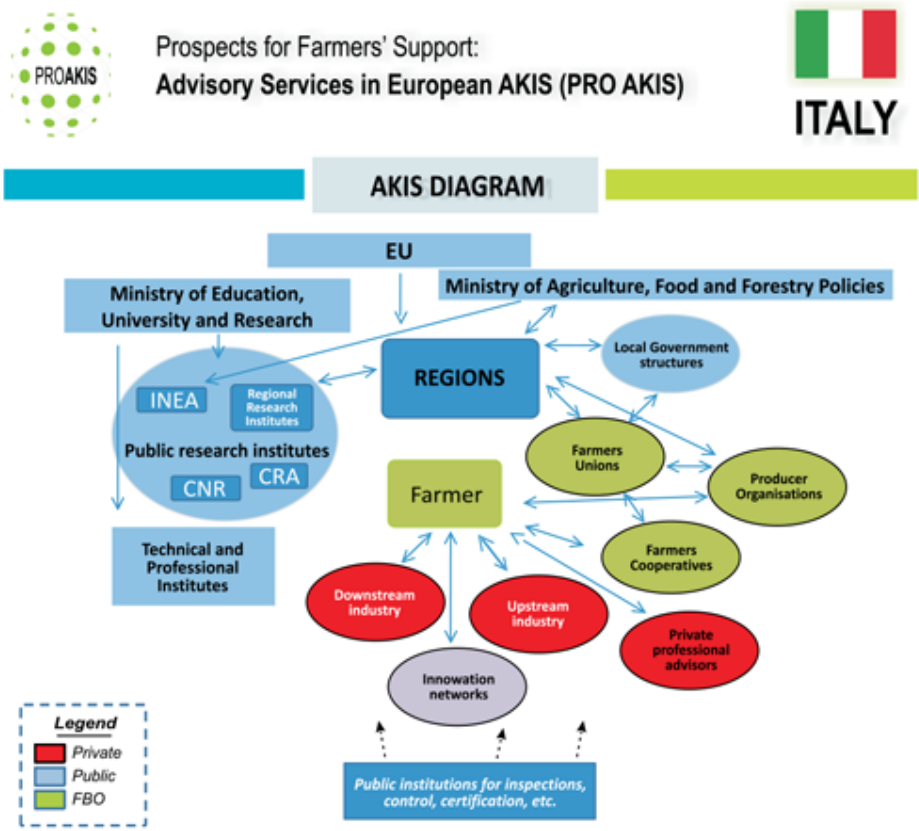

Figure 3 Example of a national AKIS for Italy as determined by the PRO AKIS project (Source: Prager et al, n.d).

Agricultural Knowledge: Linking farmers, advisors and researchers to boost innovation (AgriLink)

To exemplify a more collaborative approach to visualising a micro-AKIS, the authors report on diagramming techniques that enabled multiple actors to co-create mutual representations of the complex situations and choices they faced as they

attempted to work together more effectively and efficiently in a Living Lab as part of the Horizon 2020 funded AgriLink project (the full post project website is at https://www.agrilink2020.eu/, with the Living Labs being part of Work Package 3). The AgriLink project involved the establishment and operation of six Living Labs – defined as open innovation processes for situation improvement over a period of three years (Potters et al, 2022). These Living Labs used the five characteristics identified by the European Network on Living Labs (EnoLL 2021) as a starting point: real life setting; co-creation; end user involvement; multi tool and multi stakeholder participation; and the application of principles of 'design thinking' (Buchanan, 1992), 'systems thinking' (Checkland et al, 1990) and 'reflexive monitoring' (Ison and Blackmore, 2014). Fuller details on how the Living Labs were run are described in Potter et al (2022), this article is focussing on one aspect, the use of diagrams by Living Lab participants to understand their micro-AKIS and to design novel interventions in their situations.

Diagrams as techniques to support co-inquiry

Diagrams or other visualisations can be used in many ways, either as part of a defined method or methodology or as a technique that can be used by individuals and groups alike. There is a lengthy tradition of using them within participatory action research or community-based investigations based on system thinking in practice within a wide range of environmental sustainability settings (Oreszczyn and Lane, 2017; Ison et al., 2021). Diagrams, especially in combination, have been particularly used with multiple actors or stakeholders to (i) share multiple perspectives on a complex and messy situation of interest and then (ii) help understand the connections between the elements and boundaries of a perceived system of interest (a structured representation of the complex and messy situation). If properly facilitated and following agreed rules within a carefully designed set of processes, conversations that are mediated through the co-production of diagrammatic representations of a situation or system of interest can surface assumptions and framings, stimulate creativity and lead to more consensus on what to do next. It cannot be assumed that co-producing diagrams of situations or systems of interest will lead to a definite or pre-defined outcome within a given timeframe, but it does mean that all involved should be better informed and appreciate what other actors are trying to do and have opportunities to seek ways forward that are more agreeable to all parties. Nevertheless, there can be cognitive overload when using many different diagrams without suitable design guidelines (Kim et al, 2000).

Using systems diagrams with actors in Living Labs

Each of the six AgriLink Living Labs focussed on sustainability challenges for farmers that required the development of innovative advisory services to help address those challenges. The operation of each of these Living Labs was supported by a facilitator and monitor who could help organise and review the conversations and deliberations of multiple actors in their individual contexts as they tried to create these innovative agricultural advisory services. In turn this group of facilitators and monitors was supported by a small team of experts in process concepts (design thinking, systems thinking, monitoring and evaluation) and participatory practices (diagramming, peer to peer mentoring, storyboarding).

The main diagramming techniques used with the facilitators and monitors that they, in turn, could use with their Living Lab actors were spray diagrams, systems maps, rich pictures and conversation maps (Figures 4, 5 and 6 show examples of three types). These diagrams were used to visualize and understand contexts, inter-relationships and to reflect on boundary judgements. They could be a diagram produced by one or more participants in a particular Living Lab for others involved in the Living Lab to comment on, but more often these diagrams were produced collectively on large sheets of paper by groups of participants working together, including farmers and their advisers in some cases. Thus, the diagrams helped frame and focus the discussion and drew out assumptions behind any statements or contributions. All involved found that the co-creation of visual representations of their situations and systems of interest was helpful to their work in shaping their understanding of the Living Lab processes, supporting actors to determine their aims and activities for the Living Labs, and evaluating their own practices.

However, it is also the case that co-creating diagrams does require people to follow rules and ensure all involved can contribute to the discussions and that all perspectives are properly represented in the diagram. In our experience, it is also true that the association between diagrams and drawing can be off-putting for some participants unused to the creative freedom and rigour required. Roles such as a facilitator and a monitor can help guide the process. Participants may need a short training session on how to use a chosen diagramming technique to best effect – this can usually be achieved as part of the conversation (some guidance on both diagramming techniques and facilitating participatory sessions is provided in an online course developed as part of the AgriLink project - Creating innovative

agricultural advisory services through a Living Lab[1] – that in turn draws upon existing educational resources and expertise on these topics).

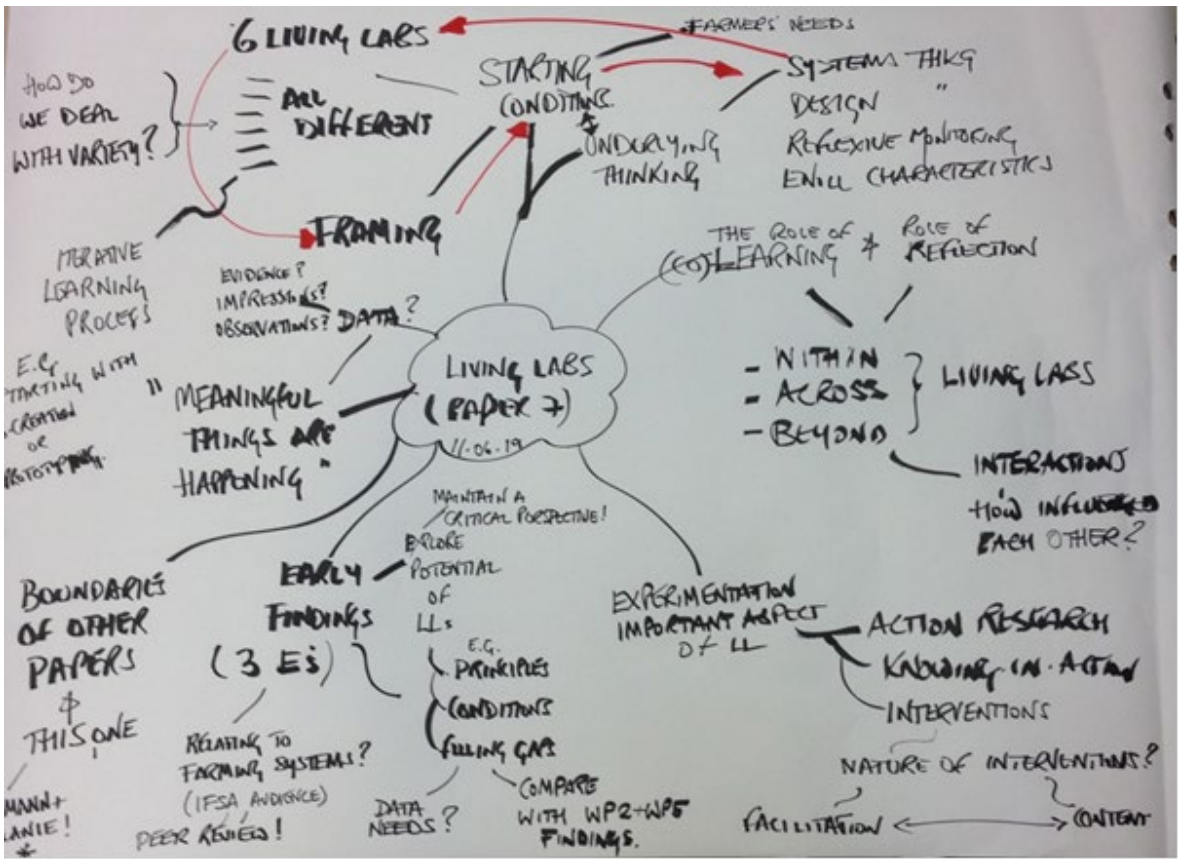

Figure 4 An example of a spray diagram produced by AgriLink members as they explored the role and nature of Living Labs

[1] OLCreate: AgriLink Living Labs Creating innovative agricultural advisory services through a Living Lab (open.edu)

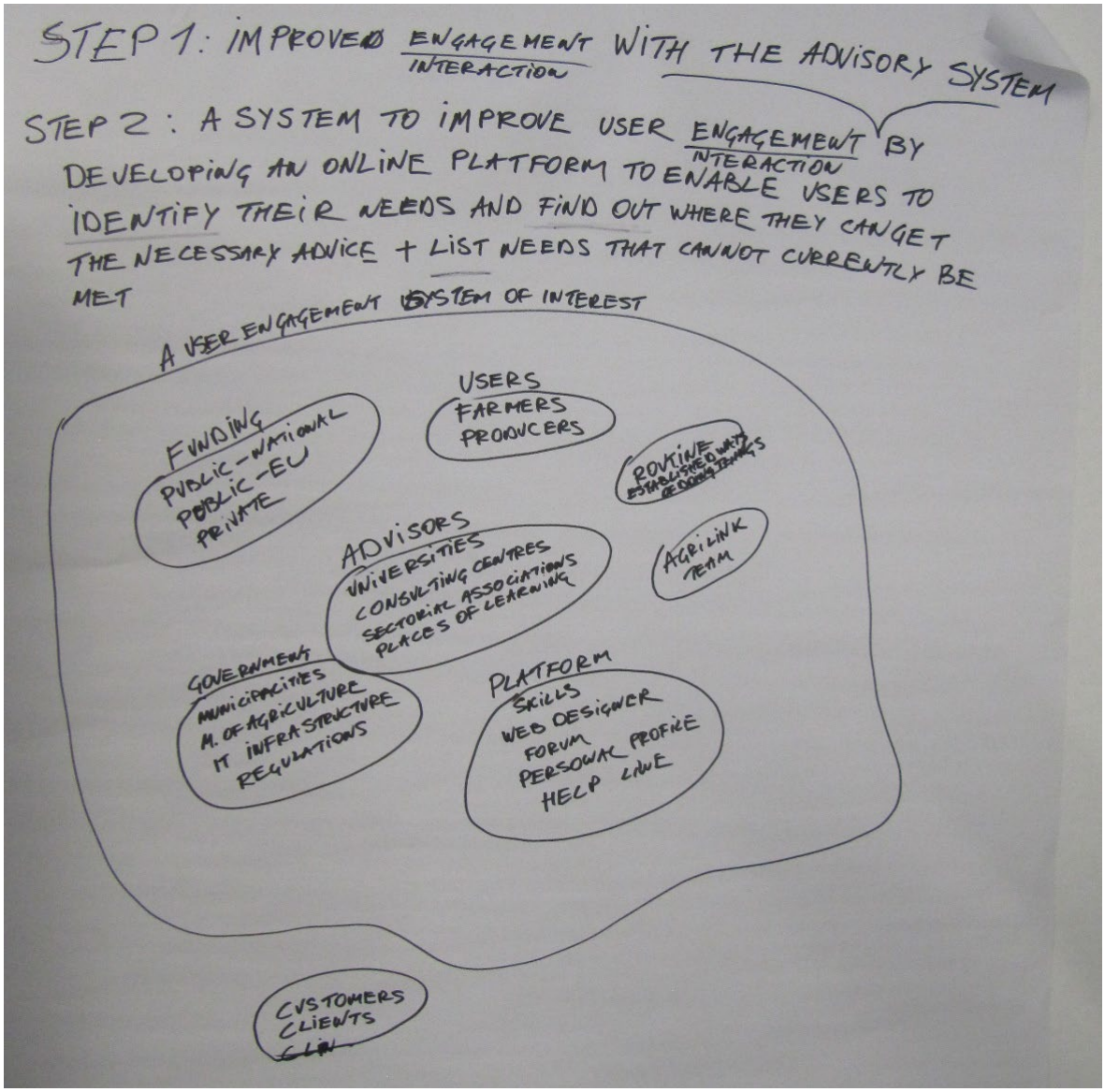

Figure 5 An example of a systems map for the Living Lab in Latvia

Figure 6 AgriLink Living Lab monitors and facilitators reviewing their co-created conversation map

Such co-created diagrams can look rough and confusing to those not involved in their creation. They are also not a means to capture a definitive, absolute and final representation of the situation since this is dependent on who is involved in the diagram's creation. Where necessary, the diagram can be re-drawn and 'tidied' to make it more suitable as a communication device to others not involved in the conversation for inclusion in formal reports and articles. However, in many cases the principal value of the diagram is not in communicating information to others, but in *mediating the conversation* between the actors involved to improve their mutual understanding and sense of interdependencies as a first step in determining more concerted actions. In very complex situations several diagrams co-created over weeks or months might be needed to fully explore that situation and determine ways forward. Whether used in one-off or extended processes, diagrams and the act of diagramming can enable a social learning process. It is the learning and insights gained from diagramming that provides the foundation for shifting from a diagram to rethinking systems design, implementation, or improvement.

In other cases, while diagrams are useful techniques in themselves, their success will often depend upon the structures and processes in which they are embedded,

which in this case were the Living Labs. Potters et al (2022) highlighted four conditions that are pivotal in developing a successful functioning Living Lab and which have implications for policy-makers dealing with AKIS. These conditions are the complexity of the challenge, the enabling setting, the proficiency of the facilitation and the energy to move. While systems diagrams were not explicitly one of these conditions, they helped shed light on their dynamics and were an important element in how the Living Labs were run. In enabling a more collaborative approach to visualising a micro-AKIS and the innovations needed for more sustainable agriculture, the diagramming techniques offer considerable scope for use in AKIS policy-making.

Conclusions

AgriLink was a large project that drew upon many concepts and traditions. Systems thinking was part of the mix but was not a defining feature of the project. However, experiences in AgriLink and other contexts confirm that systems diagrams are useful tools to support multi-actor collaboration in agriculture to help improve practices in complex situations, without the need to employ an in-depth systems approach. This has certainly been the case at a micro-AKIS level where most of the actors (farmers, advisors, agricultural suppliers etc) are aware of each other to some degree and/or have long term ongoing relationships. The challenge now is to use systems diagramming at the macro-AKIS level to co-create representations of situations and systems of interest between the multiple actors working on policies and practices at regional, national, or even international arenas to ensure that assumptions and framings are shared and/or representative of the thinking of all the actors involved. This will require policy-makers to recognise and invest in diagrams and diagramming as additional tools in their lexicon to aid integration of policy and practitioner aims and practices.

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