Policy Brief 3 – JANUARY 2026

THE ROLE OF AKIS IN DIGITAL ECOSYSTEMS

Abstract

This policy brief deals with the relations between Agricultural Knowledge and Innovation Systems (AKIS) policies and digital ecosystems. AKIS can be conceptualised as representations of the actors, relations, resources, and institutions involved in knowledge exchange in the agricultural sector. Digital ecosystems include innovation intermediaries and Living Labs supporting the process of sustainable digitalisation of agriculture in specific regional contexts and for specific purposes. It is crucial to understand the AKIS perceptions of different actors or social groups that contribute to these ecosystems. Discrepancies between the AKIS perceptions of researchers, practitioners and policy makers, for instance about the profiles of intermediaries involved, could hinder the effectiveness of AKIS policies.

We compared the perspectives of various actors engaged in digitalisation on the components and roles of intermediaries both within digital ecosystems and AKIS. More specifically, we compared 1) a "top-down" perspective on AKIS that can be found in policy documents or science and expert reports, 2) the perspective on AKIS of actors engaged in digital ecosystems through their participation to the Living Labs of the CODECS project, 3) the bottom-up perspective of the practices of actors acknowledged as innovation intermediaries. Evidence reveals discrepancies in AKIS perceptions. These differences are influenced by the regional context as well as by the specific objectives of the Living Labs (e.g., the degree to which sustainability issues are integrated). A closer examination revealed a potential distribution of roles among: 1) actors involved in co-designing and testing digital solutions, 2) actors evaluating them, and 3) actors contributing to farmers' everyday advice on the use of technologies. This pattern can be seen as a form of functional complementarity within innovation systems, but it may also be a sign of segmentation between the innovation support embedded in EU policy frameworks and the day-to-day advice available to farmers.

These findings should be interpreted with caution as they are based on a small sample, however, they point to the need for debate about how to anchor AKIS policy discussions and actions in the realities of farmers' practices, networks, and resources. A promising avenue for such debates would be to give bottom-up perspectives a stronger role in the policy arenas where the AKIS policy mix (strategies and instruments) is designed and evaluated.

Highlights

- AKIS are representations of relations, resources, and institutions involved in knowledge exchange.
- It is crucial to understand the AKIS perceptions of different actors engaged in digital ecosystems.
- Evidence reveals discrepancies in AKIS perceptions between top-down and bottom-up perspectives.
- Differences relate to regional context and to the objectives of Living Labs (e.g. in relation to sustainability).
- There is a need to anchor better AKIS policy discussions in the realities of farmers' advisory practices, networks, and resources.

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Introduction – Exploring AKIS perspectives within digital ecosystems

Agricultural Knowledge and Innovation Systems (AKIS) are an important component of public policies in Europe, including in supporting digitalisation and sustainability transitions of agriculture. AKIS are central in the Common Agricultural Policy (CAP) 2023-2027. Each Member State had to set up a National AKIS coordination mechanism as part of their CAP national strategic plan (Reg. UE 2021/211, art. 101-114). The Digital Europe Programme also supports agricultural digitalisation as part of AKIS. These policies promote multi-actor approaches, EIP-Agri operational groups and Living Labs (LLs). AKIS and LL approaches are also promoted by the Horizon Europe research and innovation programme and by the EU Soil Mission or other EU Missions, as well as by the European Green Deal and Farm to Fork Strategy.

Box 1 – Defining AKIS

In CODECS, we have opted for a definition close to the one in EU policy documents: "*AKIS is a mental construct that comprises the combined organisation and knowledge flows between persons, organisations and institutions who use and produce knowledge for agriculture and interrelated fields*".

AKIS policies play a key role in supporting various "intermediaries" that contribute to digitalisation.

Box 2 – Defining Living Labs & Digital ecosystems

Living Labs in CODECS are defined as networks of farmers, knowledge intermediaries, stakeholders, and policy makers, constituted around and related with an emerging digitalisation problem within a given application scenario, and willing to develop solutions through collaboration.

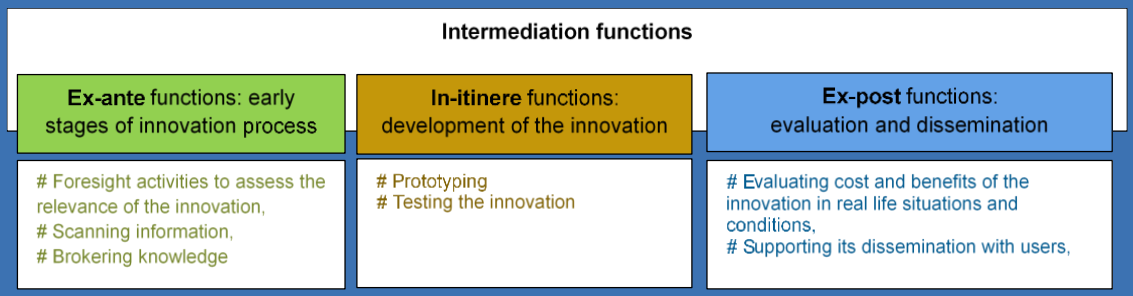
In CODECS conceptual framework, **digital ecosystems** are defined as digital, socio-economic, organisational, knowledge, and physical components that converge to support the production, storage, communication, and utilisation of digital technologies and data.

However, AKIS policies are complex, and there is a need to understand how they are perceived by actors engaged in digital ecosystems. For instance, both AKIS and LLs policy instruments supporting digital ecosystems include strong expectations about intermediary actors that bridge science and practice in the innovation process. But there is a lack of understanding about who the intermediary actors are that could actually (co)produce knowledge about digital technologies. There are extensive debates about the types of intermediary actors to which public policies should lend their support (and how), all within a context of fragmentation of AKIS, and uncertainty about the relative importance of various actors (e.g., independent advisors, brokers, industries, informal networks, etc.), especially within digital ecosystems. Some authors have even called for a re-assessment of intermediaries. This reality check is particularly important as discrepancies in how AKIS and intermediary actors are understood could lead to inefficiencies in public policies.

→ Our aim is to understand the role played by innovation intermediaries to feed debates on AKIS policies, and to compare top-down and bottom-up perceptions of AKIS within a variety of digital ecosystems.

Box 3 – Defining Innovation Intermediaries

Innovation intermediaries are key actors of the innovation process. Their activities are services that contribute to three important sets of intermediary functions.



In the agricultural sector, these functions were classically implemented by bridging actors such as advisory organisations (public extension, farmers' based organisations such as chambers of agriculture, cooperatives or private independent consultants). For the past decade there has been a growing debate about the profiles of these actors, in a context characterised by a growing pluralism of actors and fragmentation of their relations within AKIS.

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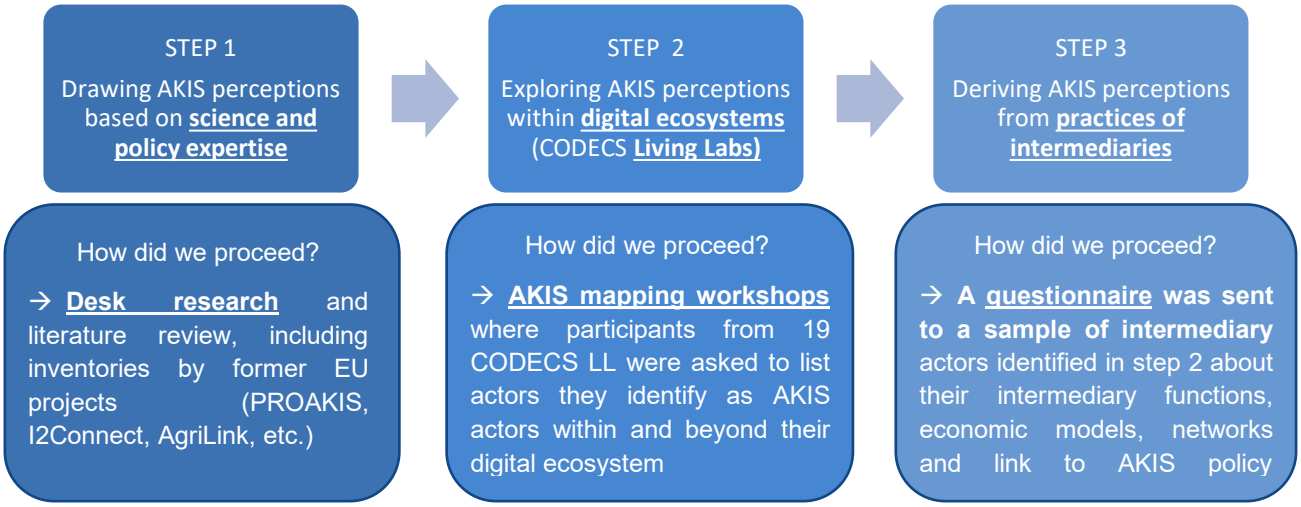
Our approach: three steps to compare various perceptions on AKIS

Our three-step approach consisted in "zooming-in" from the policies to the practices of intermediary actors through the lenses of CODECS Living Labs. We compared the perspectives of various actors engaged in digitalisation on the components and roles of AKIS: the "top-down" perspective on AKIS that can be found in policy documents or science and expert reports (step 1), 2) the perspective on AKIS of actors engaged in digital ecosystems through their participation to the LLs of the CODECS projects (step 2), the bottom-up perspective of actors acknowledged as innovation intermediaries within digital ecosystems (step 3).



Step 1: AKIS perceptions based on science and policy descriptions

For more than 10 years, the European Commission has supported the production of scientific knowledge on AKIS. Two subsequent Coordination and Support Actions projects were funded to provide inventories of AKIS: PROAKIS (Prospects for Farmers' Support: Advisory Services in European AKIS, 2012-2015) and I2Connect (Connecting advisers to boost interactive innovation in agriculture and forestry, 2019-2024). Based on expert interviews and desk research, these reports[1] have produced AKIS diagrams that propose visual representations of AKIS.

Two key elements of these representations can be highlighted.

1) They demonstrate the heterogeneity of AKIS structures (actors involved, networks, funding structures, etc.) across countries.

2) These representations are still focused on the actors classically integrated in AKIS studies, even when these studies emphasised the pluralism of AKIS. This is especially true for bridging organisations, where the actors mentioned are mostly public extension organisations, farmers'-based organisations (chambers, farmers' groups, etc.), or independent consultants that emerged after privatisation in certain contexts.

However, another stream of research, based on a bottom-up approach, on farmers' surveys about their sources of knowledge, has highlighted a different trend in the evolution of AKIS landscape, especially for bridging organisations (including the ones delivering advisory services to farmers). This is for example, the case of the AgriLink research project (Agricultural Knowledge: linking farmers, researchers and advisors to boost innovation, 2017-2021). This project showed that actors not typically included in AKIS descriptions play a key role for farmers, including informal sources of advice (peers, retired agronomists) and non-independent or "linked" advisors (companies that sell pesticides, seeds, or fertilisers to farmers, start-ups, bookkeepers, etc.). This situation holds true in the case of digital technologies, with a specific contribution of Information Technology (IT) firms and start-ups.

[1] https://i2connect-h2020.eu/resources/akis-country-reports/

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Step 2 - AKIS perceptions within digital ecosystems (CODECS LLs)

The aim of the second step was to understand the perspective on AKIS of actors engaged in digital ecosystems, through their participation in LLs. An AKIS mapping exercise was implemented in CODECS. Participants of each of the 19 LLs of the project were asked to list actors they identify as part of AKIS, and the proximity of these actors to the digital ecosystem of the LL. The mapping exercise identified the different types of actors that are recurrently mentioned both within AKIS and digital ecosystems.

a) A growing role of private firms?

In total, 330 actors were mentioned in the mapping exercise (Figure 1). Private firms were highly cited, more than the AKIS actors that are placed at the centre in academic or expert-based AKIS inventories, such as research organisations or advisory organisations.

A second key learning is to disentangle between organisations. Whereas AgTech companies and start-ups are well represented (almost as much as advisors or researchers) as one could expect (from the perspective of participants within a LL dealing with digital technologies), upstream and downstream companies of the supply chain are also very well represented. Financial organisations are also present in AKIS representations.

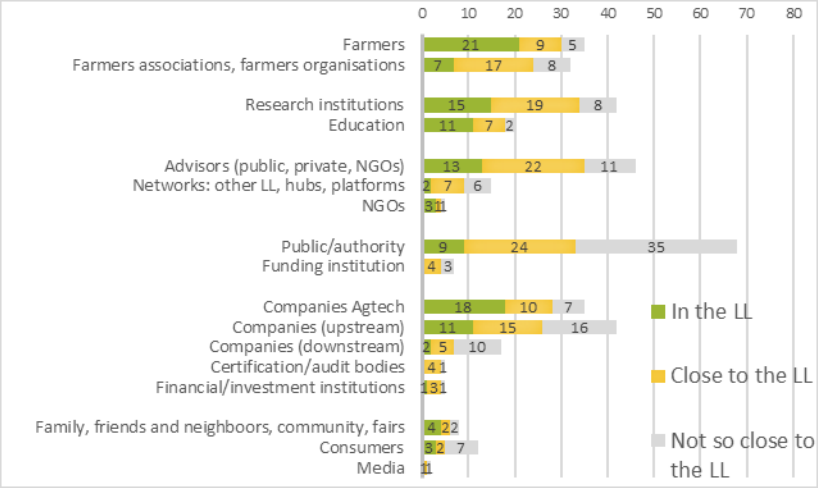

Figure 1 - Number of AKIS actors mentioned by LL participants during mapping exercises and proximity with the LL digital ecosystem

b) Three perceptions of AKIS across digital ecosystems

We could identify three types of AKIS representations across LLs.

- **Type 1 – Firm-led perceptions of AKIS** (mapping in 5 LLs of 4 countries: Belgium, Czech Republic, Italy and Spain). The main characteristic of the representation of AKIS in this group is the strong presence of firms (IT firms, upstream firms, and to a lesser extent, downstream firms). Firms are the most represented actors both in the overall AKIS and in the digital ecosystems of the LLs. This is coherent with the fact that the aim of the LLs relates directly to economic issues: productivity, efficiency, or value creation. Traditional bridging organisations of AKIS seem to be rather positioned in the second line.
- **Type 2 – Policy-Driven perceptions of AKIS** (mapping in 5 LLs of 5 countries of Eastern Europe: Estonia, Latvia, North Macedonia, Poland and Slovenia). The main characteristics of the representation of AKIS in this group is that Public Authorities are the most cited actor of AKIS. However, whereas they are noticed as actors of AKIS that could have indirect effects on digital innovation, they are hardly mentioned as close to the digital ecosystems of these 5 LLs. This might be the expression of a representation in which AKIS is primarily seen as public policy instrument supported by public authorities, whereas LL contribute more directly to digital innovation by connecting farmers and intermediaries.
- **Type 3 – Pluralistic perceptions of AKIS** (mapping in 7 LLs of 6 countries: Germany, France, Hungary, Serbia, Slovakia and Scotland). The characteristics of this group is that the representation better reflects the pluralistic perspective of AKIS that is often presented as the main characteristics of these systems in Europe, typically in countries such as Germany, France or Hungary.

In total, the mapping exercise reveals the diversity of representation of AKIS across digital ecosystems, according to contexts and aims of the LLs. An implication is that there could be discrepancies in AKIS representations between actors, which could in turn limit the uptake of AKIS measures and the willingness or ability of certain actors to participate to AKIS strategies and instruments.

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Step 3 - AKIS perceptions from innovation intermediary actor practices

The aim of the third step was to identify the representation of AKIS based on an analysis of the practices of intermediary actors identified by LLs participants. To characterise intermediaries, we combined four dimensions.

Box 4 – Four dimensions to understand intermediary actors' practices and links to AKIS

- The intermediary functions played by actors (cf. list presented in Box 1)
- The economic model of these actors, based on literature on Knowledge Intensive and Business services (KIBS), focusing on the income sources, the distribution between front-office activities (direct interactions with clients) and back-office activities (R&D, staff training, networking), on the client targeted, on the methods used to interact with clients, etc.
- Their networks (with which type of organisation do they exchange knowledge?)
- Their relations to AKIS related policies and their inclusion in digital ecosystems, including Living Labs

The questionnaire was disseminated through the EU survey tool to a subset of countries (France, Germany, Italy, Latvia, Scotland). We identified three groups in innovation intermediaries, according to their practices and relations to AKIS and digital ecosystem.

The first group is the most integrated in Living Labs digital ecosystems. Four key aspects of this group stand out. Regarding intermediary functions, it aligns with ex-ante and in itinere innovation support services, such as foresight, scanning, testing, and dissemination. In terms of KIBS features, there is substantial investment in back-office capabilities, while limited investment in front-office activities aimed at providing personalised advice for farmers. Regarding AKIS networks and instruments, knowledge exchange occurs primarily with private firms of their digital ecosystems. With respect to public policies, members of this group not only participate in Living Labs but are also well integrated into other innovation policy frameworks.

The second group of innovation intermediaries is characterised by its contribution to the evaluation of digital technologies. Its KIBS profile includes some front-office activities, even though these services are not highly personalised for farmers, and typically not charged to them. AKIS networks in this group are the most pluralistic, with strong interactions with advisory organisations, public research, and upstream and downstream industries. In policy terms, this group is more distant from Living Labs and broader innovation policy frameworks, yet it nonetheless displays some dependence on public subsidies.

The third group has a distinct profile characterised by minimal investment in intermediary functions alongside strong front-office activity. In terms of intermediary functions, this group shows little engagement with any of the five intermediary functions considered in the analysis (foresight, scanning, testing, dissemination, evaluation). Its KIBS features include the highest level of service personalisation and a high share of organisations selling services directly to farmers. In terms of AKIS network, it shows the weakest ties to other actors. Regarding public policy, it is also the most distant from Living Labs, innovation policy frameworks, and public financial support.

Summary and Policy implications

As AKIS is a mental framework combining relationships among different actors, it is crucial to understand AKIS perceptions of different actors or social groups that contribute to digitalisation. The CODECS project, including a diversity of possible AKIS actors and social groups involved in digital ecosystems, developed a reflection in this sense. Our three-step analysis reveals two forms of differences in AKIS perceptions. The first one can be seen at each level of our analysis and reveals that there are discrepancies in AKIS perceptions among researchers, policymakers and LL participants. These differences are influenced by the regional context as well as by the specific objectives of the technologies used in the Living Labs, and the degree to which sustainability issues are integrated. The second form of heterogeneity is evident between perspectives, and could reveal discrepancies a) between top-down and bottom-up representations of AKIS and b) among intermediary actors groups.

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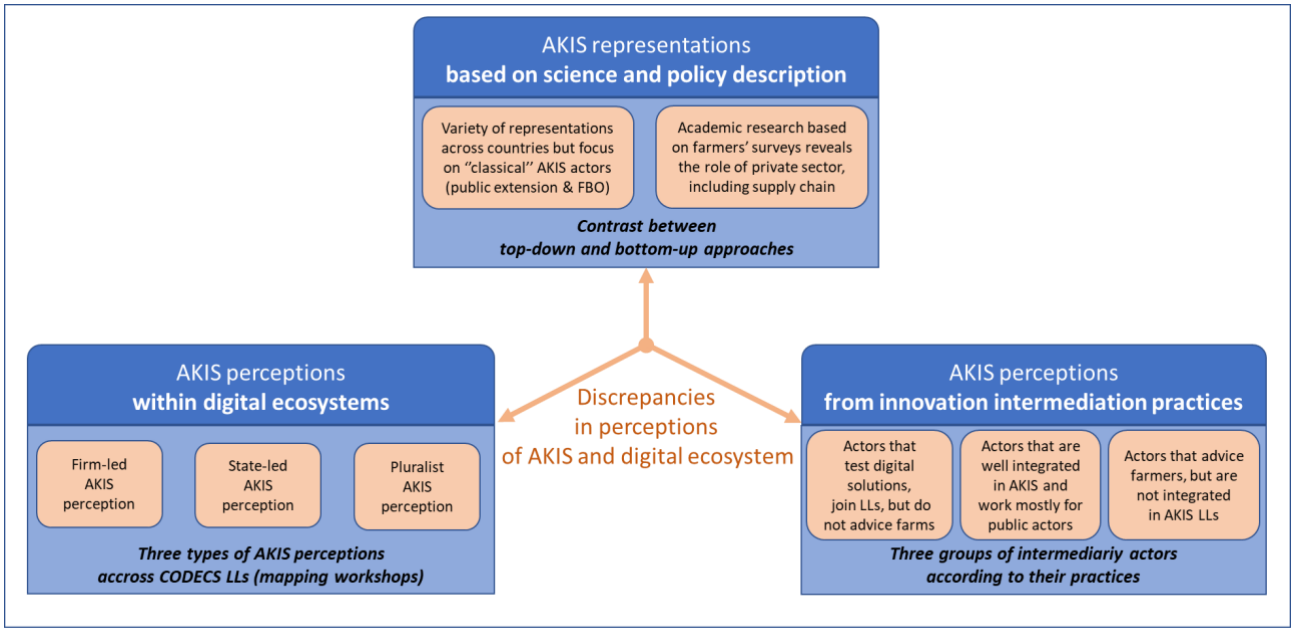

Figure 2 - Graphical abstract summarizing discrepancies in AKIS perceptions

- **Discrepancies between top-down and bottom-up representations** partly correspond to the identification of the prominent role of non-traditional AKIS actors, such as informal advice and private firms (upstream, downstream and IT) in digital ecosystems. While top-down expert representation of AKIS remains focused on traditional actors, bottom-up research starting from farmers' perspectives, as well as from the perspective of LL participants, reveals the importance of firms and private actors in digital ecosystems. While it is relevant that public money should benefit an impartial and independent source of knowledge within AKIS, we consider that the central place of firms should be better acknowledged, debated and addressed in AKIS public policies, as suggested in recent research.
- **Differences in the practices of innovation intermediaries** revealed a potential distribution of roles among: 1) actors involved in co-designing and testing digital solutions, 2) actors evaluating them, and 3) actors advising farmers on their use. The first group is well integrated both into policy frameworks and digital ecosystems, participates in Living Labs, and interacts with IT firms. The second is connected to a plurality of bridging organisations and benefits from public R&D funds. The third group, however, operates largely outside AKIS policy and digital ecosystems, but is the closest to farmers by providing them the most personalised advisory services. This pattern should be interpreted with caution as it is based on a small sample of actors. It can be seen as a form of functional complementarity within innovation systems, but it may also indicate segmentation between the innovation support embedded in EU policy frameworks and the day-to-day advice available to farmers.

The findings support the idea that complex agricultural innovations – such as digitalisation, require a collaborative approach for successful innovation and diffusion that transcends scales and the public-private good traditional representations of the distribution of roles. These findings point to the need for debate about how to anchor AKIS policy discussions in the realities of farmers' advisory practices, networks, and resources for a sustainable digitalisation. A promising avenue for such debates would be to give bottom-up perspectives a stronger role in the policy arenas where the AKIS policy mix (strategies and instruments) is designed and evaluated.

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Resources

CODECS project material - Where to find a detailed presentation of concepts and empirical evidence supporting this policy brief?

- This Policy Brief mainly builds on the section 7 of the Deliverable D6.2 of the CODECS project.

CODECS Deliverable D6.2. Hurtado A. R., Delgado-Serrano M.M., Labarthe P. (2025). Report on policy environments for digitalisation in Europe. DOI: 10.5281/zenodo.17235435

- The mapping exercise presented in step 2 derives from the Deliverable D3.1 of the CODECS project

CODECS Deliverable D3.1. Giagnocavo C., Heredia Hortigüela R.M., Olmedo Osuna L., Knierim A., Herrera B. Ferrari A., Mannari C., Manlio B. (2025) Report on Digital Ecosystems. DOI: 10.5281/zenodo.17235792

- The definitions of Living Labs and Digital Ecosystems can be found in the Policy Brief presenting the conceptual framework of the CODECS project

CODECS Policy Brief Nov. 2024. Soma K., Brunori G., Giagnocavo C., Knierim A., et al. (2024). Conceptual Basis of Sustainable Digitalisation

Further reading

- About National descriptions of AKIS

Birke F.M., Bae S., Schober A., Wolf S., Gerster-Bentaya M., Knierim A. (2022). AKIS in European countries: Cross analysis of AKIS country. Reports from the i2connect project.

Knierim, A., Boenning, K., Caggiano, M., Cristóvão, A., Dirimanova, V., Koehnen, T., ... & Prager, K. (2015). The AKIS concept and its relevance in selected EU member states. *Outlook on Agriculture*, 44(1), 29-36.

- About Farmers' sources of advisory services

Cofré-Bravo, G., Klerkx, L., Engler, A. (2019). Combinations of bonding, bridging, and linking social capital for farm innovation: How farmers configure different support networks. *Journal of Rural Studies*, 69, 53-64.

Klerkx, L., Petter Stræte, E., Kvam, G. T., Ystad, E., & Butli Hårstad, R. M. (2017). Achieving best-fit configurations through advisory subsystems in AKIS: case studies of advisory service provisioning for diverse types of farmers in Norway. *The Journal of Agricultural Education and Extension*, 23(3), 213-229.

Kvam, G. T., Hårstad, R. M. B., Stræte, E. P. (2022). The role of farmers' microAKIS at different stages of uptake of digital technology. *The Journal of Agricultural Education and Extension*, 28(5), 671-688.

Madureira, L., Labarthe, P., Marques, C. S., Santos, G. (2022). Exploring microAKIS: farmer-centric evidence on the role of advice in agricultural innovation in Europe. *The Journal of Agricultural Education and Extension*, 28(5), 549-575.

Mrnuštík Konečná, M., Sutherland, L. A. (2022). Digital innovations in the Czech Republic: developing the inner circle of the Triggering Change Model. *The Journal of Agricultural Education and Extension*, 28(5), 577-600.

Paulus, M., Herrera, B., Knierim, A. (2024). Who do German farmers trust when making decisions about digital technologies? An analysis of the trustworthiness of innovation actors. *Studies in Agricultural Economics*, 126(3).

Sutherland, L. A., Labarthe, P. (2022). Introducing 'microAKIS': a farmer-centric approach to understanding the contribution of advice to agricultural innovation. *The Journal of Agricultural Education and Extension*, 28(5), 525-547.

Sutherland, L. A., & Labarthe, P. (2022). Should 'Impartial' Advice be a Priority of European Agricultural and Rural Policies?. *EuroChoices*, 21(1), 15-22.

- Conceptual papers on intermediaries

Consoli, D., & Elche-Hortelano, D. (2010). Variety in the knowledge base of Knowledge Intensive Business Services. *Research Policy*, 39(10), 1303-1310.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research policy*, 35(5), 715-728.

Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research policy*, 48(4), 1062-1075.

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