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## Agricultural Knowledge and Innovation Systems in European Union policy discourse: *Quo vadis?*

'Sustainable intensification' of agricultural production, or 'producing more with less', has been widely adopted as a policy approach by national governments and international agencies, including the European Union (EU) through its Common Agricultural Policy. Sustainable intensification will be facilitated through on-farm innovation in a process that is fostered by knowledge sharing between actors with complementary forms of knowledge. These actors, their organisations, the knowledge flows between them and the so-called 'enabling environment' constitute an 'agricultural innovation system' (AIS). This paper begins by reviewing recent international theoretical development of the AIS concept and of equivalent concepts in the EU. Although the international and EU development paths are similar, there are clear differences between them. It is argued that these different perspectives can be integrated into a single 'multi-level' model, with family farming at its centre. The paper then explores current agricultural innovation policy discourse in the EU. Based on the European Innovation Partnership 'Agricultural Productivity and Sustainability' (EIP-AGRI), this may result in the adoption of a new and contestable use of the term 'Agricultural Knowledge and Innovation System' or 'AKIS' that is reminiscent of the EU's treatment of the term 'Rural Development'. The paper argues, however, that this development may in fact add clarity to the understanding of the agricultural innovation systems concept. Greater dialogue between researchers, policy makers and others in the EU and beyond offers the welcome prospect of greater coherence between future EU and international approaches to fostering agricultural innovation.

**Keywords:** family farms, enabling environment, Quadruple Helix, CAP Strategic Plans

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### Introduction

In its influential publication *Save and Grow*, the Food and Agriculture Organisation of the United Nations (FAO) proposed a new paradigm of intensive farm production, one that is both highly productive and environmentally sustainable (FAO, 2011). It stems from the recognition that, over the past half-century, agriculture based on the intensive use of inputs has increased global food production and average per capita food consumption. In the process, however, it has depleted the natural resources of many agro-ecosystems, jeopardising future productivity, and added to the greenhouse gases responsible for climate change. At the global level, it has not significantly reduced the number of chronically hungry, which FAO (2011) estimated to be 870 million people.

The subtitle of *Save and Grow* is *A policymaker's guide to the sustainable intensification of smallholder crop production*, and this reflects an emphasis on helping family farms to achieve higher productivity, profitability and resource use efficiency, while enhancing natural capital. 'Sustainable intensification' of agricultural production, or 'producing more with less', has been widely adopted as a policy approach by national governments and international agencies, with 'sustainable' including the economic (e.g. profitability of farming), environmental (e.g. minimising unfavourable environmental impacts) and social (e.g. maintaining farming communities) dimensions. In particular, sustainable intensification is consistent with the European Union's (EU) Common Agricultural Policy (CAP), which has for many years been built on the idea of a 'European Model of Agriculture', based on family farming and consisting of a competitive and diverse agricultural

sector that is environmentally responsible and addresses issues of food quality and animal welfare (Lowe *et al.*, 2002; Swain, 2013).

Sustainable intensification will be facilitated through on-farm innovation, by combining traditional knowledge with modern technologies. The term 'innovation' can be used to refer to either a process or an outcome. Through the process of innovation, individuals or organisations master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country, or the world (World Bank, 2006). The resulting innovation can be a technologically new or remarkably improved product, service, process, a new marketing or management method in the business practice, organisation or external relationship (OECD, 2005). OECD/Eurostat (2018) uses the term 'innovation activities' to refer to the process, while the term 'innovation' is limited to outcomes.

Change can involve farm products, production processes and/or farm organisation and management. In addition to facilitating sustainable intensification, innovation helps farmers to expand, change or diversify their marketable output, thereby increasing the profitability of their farms, to free up resources for use in other economic activities, or enhance the provision of important ecosystem services (FAO, 2014). But innovators rarely work in isolation and the process of innovation is fostered by knowledge sharing between actors with complementary forms of knowledge (Fieldsend *et al.*, 2020). These actors, their organisations, the knowledge flows between them and the so-called 'enabling environment' constitute an 'agricultural innovation system' (AIS).

The changes in the physical, social and economic environment for agriculture are being accompanied by increas-

ing interest in, and understanding of, innovation systems approaches. This paper begins by reviewing recent international theoretical development of the AIS concept and of equivalent concepts in the EU. Although the international and EU development paths are similar, there are clear differences between them. It is argued that these different perspectives can be integrated into a single 'multi-level' model, with family farming at its centre. The paper then explores current agricultural innovation policy discourse in the EU. Based on the European Innovation Partnership 'Agricultural Productivity and Sustainability' (EIP-AGRI), it may lead to the adoption of a new and contestable use of the term 'Agricultural Knowledge and Innovation System' that is reminiscent of the EU's treatment of the term 'Rural Development'. The paper argues, however, that such a development can in fact add clarity to the international understanding of the agricultural innovation systems concept. It concludes with some perspectives on the future.

## Evolution of the agricultural innovation systems concept

The evolution of agricultural knowledge frameworks has been succinctly reviewed by Rivera. (2006) and later by other authors (e.g. Klerkx *et al.*, 2012). Rivera *et al.* (2006) point out (p.581) that "[f]rameworks are conceptual models that structure reality. A framework identifies the elements that are considered relevant and specifies their relative importance and relations. As such, a framework represents the mental model of how reality is perceived". Rivera *et al.* (2006) examined four major frameworks, characterised by different acronyms, which have gained international importance, and sought to identify the strengths and weaknesses in each. The first two, which are now of little more than historical interest, can be described in one paragraph each, just for completeness.

The *National Agricultural Research Institute* (NARI) approach was adopted from the 1950s and 1960s onwards and focused on building public sector research departments/institutes and its extension services. Investments in 'bricks and mortar' facilities and the building of public sector human and organisational capacity were intended to drive innovation in agriculture. Such an approach was firmly grounded in the modernisation paradigm which emphasises the supremacy of modern science and technology. 'Top-down' in nature, agricultural extension was seen as a 'pipeline' for one-way channelling of information to farmers, who were often perceived as being 'backward'. Rivera *et al.* (2006) note that the NARI approach contributed greatly to promoting agriculture as an engine of economic development.

From the 1980s, international agencies began to shift their agricultural development emphasis toward system approaches that involved a wider range of organisations in technology programmes. Scientists and technicians from private sector firms, NGOs, farmer organisations and universities were more directly involved in promoting innovation and technical change. The *National Agricultural Research Systems* (NARS) approach included *National Agricultural*

*Extension Systems* (NAES) and *National Agricultural Education and Training Systems* (NAETS). This more inclusive approach led to improved linkages between organisations, helped to reduce duplication of efforts and encouraged sharing of experience and best practice.

The recognition of these three national knowledge systems gave rise to the term *Agricultural Knowledge and Information Systems* (AKIS), which developed in the 1980s and gained wide acceptance among development agencies in the 1990s. This was a more integrated concept that stressed the connections among the three knowledge systems, viewing them as part of an integrated 'triangle' that extended beyond public sector organisations to include all those involved in generating and disseminating knowledge. The concept was intended to promote linkages between organisations and with existing and potential end users of knowledge.

The AKIS framework was conceived with the recognition of the inappropriateness of the perceived unidirectional flow of knowledge from only researchers to farmers. Knowledge was envisioned as flowing not only *from* research, education and extension (and *through* extension), but also from input suppliers and credit organisations as well as markets. In other words, information flowed to farmers throughout the agricultural development process, not just within the triangle of agricultural research, extension and education. Furthermore, the triangle concept represented a change in perceptions about the role and relative importance of the different organisations. Instead of the former 'pipeline' idea, the farmers are placed at the centre of the system, with research, extension and education as equal partners. 'Participation', 'demand-driven' and 'market orientation' are elements emphasised in this approach.

Rivera *et al.* (2006) identified several major achievements of the AKIS concept, including its promotion of linkages between the different systems that support knowledge flows and the recognition of farmers as central actors in the dissemination and diffusion of innovations. Extension is viewed not just as the dissemination of agricultural information and technology, but as a non-formal education system paralleling the formal system. They considered that its main limitation is a focus on organisations, their functions and their strategic alignment, and insufficient emphasis on the importance of particular problems.

The *Agricultural Innovation System* (AIS) framework was developed in the 1990s and started to gain increasing attention in the international development community by the early 2000s. While stressing the need for linkages between actors, according to Rivera *et al.* (2006) AIS moves 'innovation' (rather than 'organisations') to the centre of attention and emphasises a wide range of stakeholders and pluralistic networking among agriculturally relevant organisations. These authors consider that what renders AIS distinct from the systems discussed above is "its emphasis on innovation related to value added commodities, integrated supply chains and market chains" (p.587). The AIS framework seeks to foster the integration of research and education systems, as well as develop public-private partnerships, develop and strengthen farmer organisations, establish technology transfer units, build decentralised regional innovation centres, and implement

new governance models for research and extension.

An important aspect of the AIS framework is its inclusion of the so-called ‘enabling environment’ (Spielman and Birner, 2008). Related enabling constraints are defined by Klein Woolthuis *et al.* (2005) as the legal (e.g. regulation and law) and customary institutions (e.g. culture and values) that together constitute the ‘rules of the game’ or the ‘codes of conduct’. This distinction between the ‘formal’ (‘hard’) and ‘informal’ (‘soft’) institutions is widely accepted. The former tend to be more tangible and include laws, regulations, contracts, standards, product specifications and property rights (Coenen and Díaz López, 2010). By contrast, informal institutions influence social and economic life in a subtle, often intangible way. Examples include trust, habits, norms and values, beliefs, conventions, traditions, routines and preferences (*ibid.*). Klein Woolthuis *et al.* (2005) emphasise the clear distinction between *institutions* and *organisations*. The former correspond to rules and the latter are players.

The term AIS is currently preferred by many international agencies, including the World Bank, FAO and the Global Forum for Rural Advisory Services (Sulaiman, 2015). World Bank (2006) identifies several distinguishing features between AKIS and AIS (Table 1). Like any ‘system’, the AIS encompasses the different stakeholders or actors as well as the linkages between them. It is seen by international agencies as the most effective and efficient instrument to reach agricultural policy goals, since it allows innovations to be developed faster, and upscaled in many more areas and farm holdings in a cost-efficient way.

Rivera *et al.* (2006) concluded that the four frameworks they examined “underscore the fact that effective knowledge systems for enabling agricultural development generally require (a) a core capacity in public sector technology institutions that (b) promote pluralistic research systems and extension services that are (c) strategically aligned in knowledge and information systems that increase coordination [their emphasis] and respond to client demands (d) to advance innovation fostered by a facilitating policy and institutional environment” (p.588).

**Table 1:** Defining features of Agricultural Knowledge and Information Systems (AKIS) and Agricultural Innovation Systems (AIS).

Defining feature	AKIS	AIS
Actors	Farmer, research, extension and education	Wide spectrum of actors
Outcome	Technology adoption and innovation	Different types of innovation
Organising principle	Accessing agricultural knowledge	New uses of knowledge for social and economic change
Mechanism for innovation	Knowledge and information exchange	Interaction and innovation among stakeholders
Role of policy	Linking research, extension and education	Enabling innovation
Nature of capacity strengthening	Strengthening communication between actors in rural areas	Strengthening interactions between all actors; creating an enabling environment

Source: World Bank (2006)

## Innovation systems in the European Union

Two separate concepts have been used in recent EU policy discourse.

### Agricultural Knowledge and Innovation Systems

The European Commission (EC) prefers to use the acronym AKIS (rather than AIS) in its policy discourse (e.g. EU SCAR, 2012). This decision was strongly influenced by the study of Dockès *et al.* (2011) which was based on the results of the EU Framework 6 research project ‘IN-SIGHT’. The authors argued that although when first introduced into EU policy discourses AKIS referred to the concept of *Agricultural Knowledge and Information Systems*, this acronym has since evolved to describe *Agricultural Knowledge and Innovation Systems*, “a concept that seeks to encompass and influence the complexity of knowledge and innovation processes in the rural sphere” (p.7). They attempted (p.8) to offer short definitions for several acronyms such as AKS, AKIS, AIS and LINSAs (*Learning and Innovation Networks for Sustainable Agriculture*).

The logic of Dockès *et al.* (2011) in opting for the term AKIS is precisely that used by Rivera *et al.* (2006), as recounted above, that it moves ‘innovation’ to the centre of attention. The emphasis is on “innovation related to value added commodities, integrated supply chains and market chains” which Rivera *et al.* (2006) ascribed to the concept of AIS. But the definition of AKIS that has been adopted by the EC, i.e. “the combined organisation and knowledge flows between persons, organisations and institutions who use and produce knowledge for agriculture and interrelated fields”<sup>4</sup> is narrower than that of AIS. The definition uses the term ‘institutions’, but not in the same clearly defined sense as Klein Woolthuis *et al.* (2005). Policy documents refer to “farm advisors, researchers, farmer organisations and other relevant stakeholders that form the Agricultural Knowledge and Innovation Systems”.<sup>5</sup> In other words, the emphasis is on the actors, organisations and knowledge flows directly relevant to agricultural innovation, which is a legacy of the Agricultural Knowledge and Information Systems definition of Röling and Engel (1991) (Table 2). The research-advisor-farmer axis remains dominant in EU AKIS-based policy discourse.

The difference in terminology between AIS and AKIS (i.e. the inclusion of the word ‘knowledge’ in the latter) is somewhat illogical, and simply historical.

In practice, policy makers in many countries actively monitor and intervene in the sector with specific policies for creating knowledge, providing R&D financing, enabling extensive and effective cooperation and networks,

<sup>4</sup> Proposal for a Regulation of the European Parliament and of the Council establishing rules on support for strategic plans to be drawn up by Member States under the Common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulation (EU) No. 1305/2013 of the European Parliament and of the Council and Regulation (EU) No. 1307/2013 of the European Parliament and of the Council. {SEC(2018)305final} - {SWD(2018)301final, p.101.

<sup>5</sup> *Ibid.*, p.45.

**Table 2:** Example definitions of Agricultural Knowledge and Information Systems (AKIS) and Agricultural Innovation Systems (AIS).

AKIS	AIS
A set of agricultural organisations and/or persons, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilisation of knowledge and information, with the purpose of working synergistically to support decision making, problem solving and innovation in agriculture.	A network of organisations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organisation into economic use, <i>together with the institutions and policies that affect the way different agents interact, share, access, exchange and use knowledge</i> [my emphasis].
– Rölöng and Engel (1991)	– Leeuwis and van der Ban (2004)

Source: own composition

improving intellectual property rights regimes, facilitating technology transfer, supporting skill formation and public procurement etc. (Edquist *et al.*, 2004). In the EU, interventions implemented under several Rural Development Programme (RDP) measures<sup>6</sup> can address ‘innovation’.<sup>7</sup> Guidelines for the evaluation of innovation in RDPs specifically identify ‘building the enabling environment for innovation’ as one of three ‘pathways’ by which RDP measures/sub-measures can support innovation (EC, 2017).<sup>8</sup> Interventions can improve various enabling conditions such as institutional (e.g. the policy/legislative environment), procedural (e.g. sources of funds), professional (e.g. access to training), organisational (e.g. possibility to interact with partners), operational (e.g. enabling transnational or cross-sector innovation) and technical (e.g. supporting new techniques and technologies).

The relevance of the enabling environment to agricultural innovation is therefore clearly acknowledged in EC programming guidelines, even if it does not form part of the EC’s AKIS model. Policy makers and funders have considerable influence in shaping the enabling environment, but it is also strongly influenced by political history and cultural context (Nemes and High, 2013). In addition to administrative competences, which can influence how guidelines are interpreted and programmes are implemented, social attitudes such as trust vary between different regions of Europe (and elsewhere) (Augustyn and Nemes, 2014).

### ‘Quadruple Helix’ innovation system

Alongside the evolution of the two compatible, but slightly differing, approaches described above, i.e. the World Bank – FAO AIS and the EU AKIS, another relevant concept that appears to have developed somewhat independently is the so-called ‘Quadruple Helix’ innovation system (QHIS, see e.g. Carayannis and Campbell, 2012). This is an extension of the ‘Triple Helix’ model of knowledge, developed

by Etzkowitz and Leydesdorff (2000), that identifies three ‘helices’ that intertwine and by this generate a national innovation system: *academia/universities, industry and state/government*. To this, Carayannis and Campbell (2012) and others add a fourth ‘helix’ that they identify as *culture and civil society*.

The QHIS concept has been integrated into the EU’s Europe 2020 flagship initiative ‘Innovation Union’ which, among other things, is the context for the EIP-AGRI which was first implemented during the 2014–2020 programming period<sup>9</sup> and which will be carried forward to the next one. Sargsyan (2016) describes (p.54) the QHIS as “where government, industry, academia and civil participants work together to co-create the future and drive structural changes far beyond the scope of what any one organisation or person could do alone”. The QHIS approach is also incorporated into the EU’s research and innovation strategies for smart specialisation (RIS3). EC (2012) sees QHIS as allowing “more direct involvement of users in various stages of the innovation process. RIS3 processes can develop environments which both support and utilise user-centred innovation activities also with the aim of securing better conditions to commercialise R&D efforts” (p.37). The smart specialisation approach is entirely applicable to agriculture and rural areas (da Rosa Pires *et al.*, 2014; Dax, 2019).

## An integrated approach to innovation systems thinking

Partnerships and networks are key features or core elements of the innovation systems concept (Fieldsend *et al.*, 2020), and the development of innovation systems theory reflects primarily the improvements in our understanding of the processes of knowledge sharing and innovation involving farmers, rather than changes in the processes themselves. In particular, whereas in the 1950s and 1960s, farmers were often perceived as being ‘backward’, the role of tacit (as opposed to formal, codified or explicit) knowledge in the process of innovation is now widely appreciated (EC, 2013). Lowe *et al.* (2019) clearly demonstrated that not only is it incorrect to believe that knowledge flows in one direction, from researchers, through advisors, to farmers, but farm advisers themselves draw extensively on the knowledge and experience of those they advise. Through these interactions, farmers contribute extensively to the process of knowledge sharing between the diversity of actors in the agricultural innovation system.

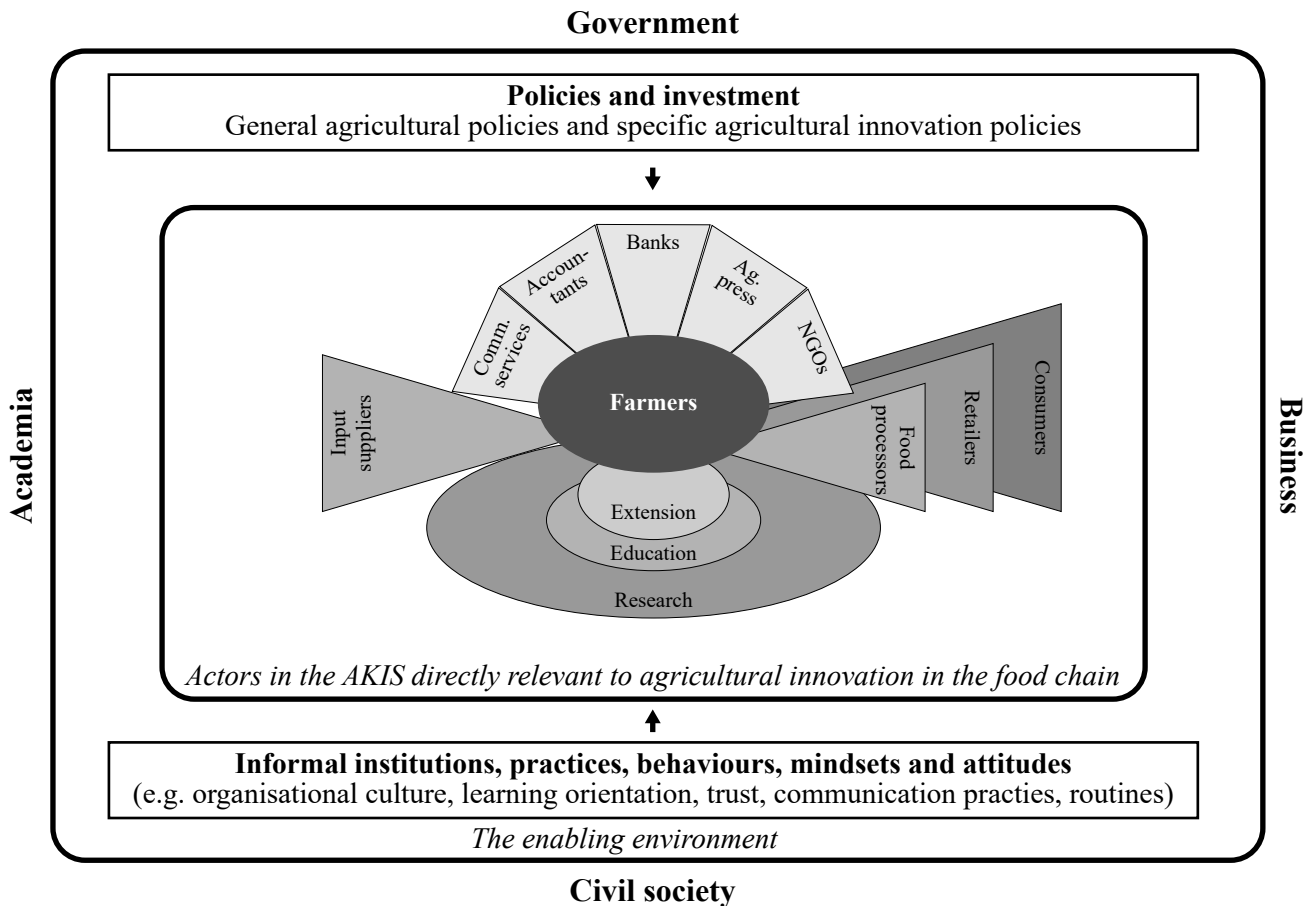
Figure 1 illustrates a model that integrates the various ideas discussed until now. In line with common practice, farmers are placed at its centre, but one useful revision would be to replace ‘Farmers’ with ‘Farm households’. Both globally and in the EU, most farms are family farms, defined by FAO as agricultural holdings which are managed and operated by a household and where farm labour is largely supplied by that household. Numerous studies have shown

<sup>6</sup> Art. 8(1)(c)(v) of Regulation (EU) No 1305/2013 and Annex I, Part 1.5(c) of Regulation (EU) no 808/2014.

<sup>7</sup> ‘Innovation’ is one of three cross-cutting rural policy objectives in the current (2014–2020) programming period. The other two are ‘environment’ and ‘climate change mitigation and adaptation’.

<sup>8</sup> The others are ‘identify and nurture potential innovative ideas’ and ‘build capacity to innovate’.

<sup>9</sup> Communication from the Commission to the European Parliament and the Council on the European Innovation Partnership ‘Agricultural Productivity and Sustainability’. COM (2012) 79 final. Brussel: European Commission.



**Figure 1:** A multi-level innovation system model that integrates the ‘Quadruple Helix’, WB/FAO Agricultural Innovation System and EU Agricultural Knowledge and Innovation System concepts.

Source: own composition including a graphic derived from EU SCAR (2012)

‘friends and family’ to be important sources of information and knowledge for family farmers (Garforth *et al.*, 2003), but the farming family is often omitted from models of the AIS/AKIS. Similarly, Koutsouris *et al.* (2017) observed that farmers tend to be most influenced by proof of successful farming methods by their peers, so-called peer-to-peer learning. Focusing on the ‘primary farmer’ may discriminate against spouses (particularly women) and younger household members who play a major role in decision-making in many farm households (Sutherland *et al.*, 2018).

Figure 1 uses the graphic from EU SCAR (2012) to depict the AKIS as recognised by the EC. There are many other depictions of the EC’s AKIS model and this one is preferred because it clearly illustrates three key features. Firstly, the (mainly public sector) education and research institutes and advisory services which have long been recognised as sources of knowledge for agricultural innovation and which continue to play an important part in this process. Secondly, the (mainly private sector) actors in the value chain,<sup>10</sup> including input suppliers and food processors. Knowledge sharing and innovation occur extensively along this axis (Swinnen and Kuijpers, 2019), although frequently outside the sphere

of formal projects and public sector funding. Thirdly, various other actors such as banks and the agricultural press (both printed and electronic) are important sources and brokers of expert knowledge in their own right. Spielman and Birner (2008), and many other authors, adopt similar approaches within their models of AISs.

A concept proposed more recently is the farm-level ‘micro-AKIS’, defined by Sutherland *et al.* (2018) as the knowledge system that farmers personally assemble, including the range of individuals and organisations from whom they seek services and exchange knowledge, the processes involved, and how they translate this into innovative activities (or not). So, within the AKIS, numerous micro-AKISs exist. Knowledge sharing in a micro-AKIS may occur through informal networks, interactions with advisory organisations or participation in partnerships such as (multi-actor) projects (Šūmane *et al.*, 2018). The diversity of sources of knowledge in the farmer’s micro-AKIS is clearly illustrated by several studies, including Varanka (2014) in Hungary and Fieldsend *et al.* (2019) in Ukraine. In both these instances, most of the different actors depicted in Figure 1 are consulted, and the research and education sectors together account for a relatively small part of many farmers’ micro-AKIS.

The enabling environment has been introduced earlier in this paper and can be denoted according to the widely shared approach used by Spielman and Birner (2008). The actors,

<sup>10</sup> A value chain can be understood as a sequence of business relationships that allow the consequent addition of value as a commodity passes from one segment in the chain to the next reaching from primary production, over various steps of transformation to the final consumer (Hartwich *et al.*, 2010).

organisations and knowledge flows in the AIS operate within this enabling environment.<sup>11</sup>

How, then, does the Quadruple Helix concept relate to the foregoing? Analogous to our emerging understanding of the nature of agricultural innovation systems, the Quadruple Helix idea is associated with the recognition that until the 1990s, the R&D community often drove research trajectories and the public played the part of passive innovation recipients. Now it is accepted that research trajectories must be legitimised among relevant publics, aim at positive public impact and be defined with the public's help (Schütz *et al.*, 2019). The expectation is that involving societal stakeholders and individual laypersons will help to re-align research trajectories with public preferences and lead to more welcome, sustainable, solutions.

The Quadruple Helix is the framework in which the innovation system, including the enabling environment, operates. The 'consensus' (tacitly) agreed between the components of the Quadruple Helix, albeit one that is constantly evolving, with the relative influences of the four helices fluctuating over time (and differing between countries and regions), regulate the operation of the AIS. In other words, the 'hard' and 'soft' rules set by the enabling environment are dictated by the prevailing consensus in the Quadruple Helix. An innovation such as, for example, genetically modified crops requires academia to develop the methodology for transformation and business to commercialise it. However, the success (or otherwise) of the innovation process depends on the legal framework put in place by government and acceptance by civil society (the latter also having an impact on the former).

This model is comparable to that outlined by Renting and Wiskerke (2010), in which the development and functioning of food systems are subjected to a 'governance triangle' of market, state and civil society. FAO (2013) defined a food system in terms of its components: "[f]ood systems encompass the entire range of activities involved in the production, processing, marketing, consumption and disposal of goods that originate from agriculture, forestry or fisheries, including the inputs needed and the outputs generated at each of these steps. Food systems also involve the people and institutions that initiate or inhibit change in the system as well as the socio-political, economic and technological environment in which these activities take place". By contrast, HLPE (2014) emphasised the objectives: "a system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised".

Using the CAP as an example, Renting and Wiskerke (2010) illustrated the initial dominance of the state during the modernisation era, the subsequent increase in the importance of the market in successive CAP reforms, to the current inclusion of 'societal demands'. Clearly, the food systems concept is fully compatible with that of AIS, and a well-functioning AIS is indeed essential for food systems development. The inclusion of 'academia' in the governance framework of the AIS is a logical extension of that adopted for food systems.

<sup>11</sup> For completeness, it should be recorded that Spielman and Birner (2008) also refer to a set of 'linkages' from the AIS (such as to other economic sectors), but these are not shown in Figure 1.

## Current agricultural innovation policy discourse in the EU

Rivera *et al.* (2006, p.588) noted that the AIS approach "does point up the over-whelming complexity of a multi-functional, institutionally pluralistic system of agricultural development in an increasingly globalised world". Innovations only can leverage substantially the national agricultural goals if an appropriate enabling environment for the generation and adoption of innovations is established. Any programme to advance a pluralistic agricultural innovation system must ascertain that there is, in the words of Rivera *et al.* (2006, p.588), "the *political will* to promote agriculture in general and AKSs more specifically, an *institutional environment* that is conducive to the flow of knowledge, to collaboration, experimentation and implementation of innovations, a *well-articulated demand for new knowledge and technology*; and the *effective supply of new knowledge and technology*, from the public research system as well as from other sources, including indigenous knowledge private sector research and transfers from abroad". The aim should be to offer a sufficiently flexible means of dealing with the varied conditions and contexts in which innovation must occur.

All four prerequisites are present in the EU. A cross-cutting objective of the EU's CAP for the 2021-2027 programming period is to modernise the sector by fostering and sharing knowledge, innovation and digitalisation in agriculture and rural areas, and encouraging their uptake.<sup>12</sup> Each EU Member State will be expected to prepare a CAP Strategic Plan which, *inter alia*, shall describe their contribution to this cross-cutting objective by describing (a) the organisational set-up of their AKIS; (b) how advisors, researchers and CAP networks will work together within the framework of the AKIS; and (c) how advice and innovation support services are provided.<sup>13</sup> A requirement is to include a system ('farm advisory services') for providing impartial farm advice to farmers and other beneficiaries of CAP support by advisors that have no conflict of interest. These advisors can be staff from NGOs, farmers' organisations or innovation support services, as well as from 'formal' advisory services. They will also offer innovation support, in particular for preparing and for implementing 'Operational Group' (OG) projects in the frame of the EIP-AGRI. OGs, which are already financed by the current CAP, are farmer-driven partnerships that are expected to develop innovative solutions based on the interactive innovation model. They shall disseminate their plans and the results of their projects, in particular through the CAP networks.

While these measures are to be welcomed, they are a necessarily limited set of interventions, owing to the constrained resources of the EU in comparison to the multiplicity of actors, organisations, partnerships, knowledge flows and enabling environments that make up the European agricultural innovation system. But they may lead to the term

<sup>12</sup> SEC(2018)305final; see earlier footnote for full reference.

<sup>13</sup> According to Article 113 of the draft Regulation, CAP networks will network organisations and administrations, advisors, researchers and other innovation actors in the field of agriculture and rural development at national level.

'AKIS' being appropriated to refer solely to the activities covered by this EU policy instrument rather than a model, as now. In line with the multi-level model proposed in this paper, many EU communications already depict the AKIS as being 'at the heart of the agricultural innovation [eco]system'. But the term has also been specifically linked with the phrase 'cross-cutting CAP support to systematically share knowledge and innovation in agriculture and rural areas'.

There is a precedent for this evolution of terminology. Schucksmith (2010) observed that the term 'rural development' carried an "essentially territorial" (p.2) meaning when first used by the EU in the early 1980s, but then acquired a new and highly contested meaning in EU parlance through the establishment of the CAP's second pillar, the Rural Development Regulation (RDR). Dwyer *et al.* (2002, p.13) described the RDR as "primarily a structural adjustment policy for agriculture". This example shows that it is not unknown for a new meaning to be applied to established terminology in CAP discourse. Quite separately, any shortcomings in the content of the new CAP, for example, in any failure to address core environmental needs, are likely to have important implications for innovation activities in those areas (Pe'er *et al.*, 2020).

But is it a problem if the term 'AKIS' acquires a new meaning in the EU?

No.

The concurrent use of two compatible but different models with similar acronyms is causing confusion. For example, Sutherland *et al.* (2018) stated that "[t]he current usage of the term AKIS more accurately represents the literature on AIS" (p.22) and observe that, according to different authors, the two approaches can be considered competing or complementary. Reflecting their assessment, they defined 'AKIS' as "the collection of agricultural information providers, the flows of information between them, and the institutions regulating these relations" (my emphasis). Such confusion is clearly unhelpful for both theory and policy development. The problem would be at least mitigated if in the next EU programming period, as seems possible, the term 'the AKIS' comes to be associated specifically with those interventions in CAP Strategic Plans that are designed to foster and share knowledge, innovation and digitalisation in agriculture and rural areas. 'The AKIS' would be an EU policy instrument which forms (a relatively small) part of the European agricultural innovation system, and the term 'AIS' would retain its internationally recognised meaning.

## Conclusions

Development of the innovation systems approach has shifted our thinking away from seeing research as the central actor in an innovation system to being one important part of the whole system. It allows a clear distinction to be made between 'invention' and 'innovation'; and 'institution' and 'organisation' and looks at the multiple conditions and

relationships that promote innovation in agriculture. This includes adopting a multi-level perspective. Such a perspective argues that transitions come about through interactions between processes at different levels (Geels and Schot, 2007). In other words, the day-to-day knowledge sharing between actors and organisations does not operate independently of the enabling environment or the 'governance rectangle' represented by the Quadruple Helix.

Undoubtedly the concept of AIS will continue to evolve and may even gain a new acronym in the future. For example, as long ago as the late 1990s, the AKIS framework was perceived as an essential contribution not just for agricultural development, but also more broadly for 'rural development', and began to be referred to as AKIS/RD (e.g. FAO/World Bank, 2000). This change reflects the fact that many farmers are multi-occupational, having both on-farm and off-farm sources of household income. In many countries in Europe, to a greater or lesser extent, the role of agriculture in the rural economy is declining. In these countries 'rural' cannot be equated to 'agriculture': the former is a much broader topic. The idea of ARKIS (Agricultural and Rural Knowledge and Information Systems) for Europe has recently been revived by the Agricultural and Rural Convention 2020, a multi-stakeholder platform of civil society networks and organisations that are pushing for reform of the CAP to encompass an integrated rural agenda (ARC2020, 2020).

Similarly, reflecting the increasing diversification of the economic role of agriculture, EU SCAR (2016) hinted (p.78) at the need for a bioeconomy knowledge and innovation system (BKIS). However, this concept is very much in its infancy and may prove to refer to a concept that is simply to broadly-based to be addressed in a meaningful way.

The features of the 'AKIS' listed in Table 1, such as 'linking research, extension and education', continue to be reflected strongly in the way the 'AKIS' is to be considered in CAP Strategic Plans. This may point up the role of path dependencies in policy making, whereby specific concepts and associated acronyms become embedded in policy discourse. Rivera *et al.* (2006, p.582) rightly noted that "there is no blue-print solution, [innovation systems] approaches need to be country specific". Even so, the risk of path dependency and the historical disconnect in the development of the AIS and AKIS demonstrate the need for even greater dialogue between researchers, policy makers and others in the EU and beyond during the future development of innovation systems theory, quite apart from any parallel debate on the most important priorities for innovation in agriculture and rural development.

As a first step, EU researchers might consult the publications of international agencies such as FAO more fully, while these agencies could publish more of their analyses in peer-reviewed academic journals. Enhanced cooperation offers the welcome prospect of greater coherence between future EU and international approaches to fostering agricultural innovation. In turn, it should lead to more progress on the mutual aspiration of sustainable intensification.

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