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Innovation in Family Farming in Eastern Europe and Central Asia

Abstract: *Family farms are part of the solution for ensuring long-term global food security, rural poverty reduction and environmental sustainability. Hence, promoting innovation in family farming is becoming a priority for politicians and policy makers. However, while family farms everywhere are facing major challenges in terms of succession planning, access to finance, land, markets and education, bargaining power, administrative burden and dealing with market volatility, farms in the (Central and Eastern) European and Central Asia (EECA) region have the additional challenges of dealing with the consequences of transition and learning to operate in a market economy. This paper, firstly, summarises the current theoretical discourse about the potential of national Agricultural Innovation Systems (AIS) to contribute to sustainable agricultural development in EECA. It then, explores the following challenges: (a) the demand for transition towards inclusive, decentralised and pluralistic AISs; (b) the need for a broad involvement and participation of family farmers in knowledge sharing and innovation; (c) the role of producer organisations and, in particular, service cooperatives to promote innovation on family farms; and (d) the roles of public and private investment in agricultural R&D and extension and advisory services. Based on this analysis, a set of recommendations for fostering agricultural innovation for family farms, both for governments and other actors in the AIS, are then made.*

Keywords: *Agricultural Innovation System, knowledge sharing, enabling environment, advisory services, producer groups*

Introduction

The State of Food and Agriculture: Innovation in family farming (FAO, 2014a) report highlights that family farms should not be considered an obstacle but, instead, are part of the solution for ensuring long-term global food security, rural poverty reduction and environmental sustainability. Hence, promoting innovation in family farming is becoming a priority for politicians and policy makers around the world, including nations in the (Central and Eastern) European and Central Asia (EECA) region. This is not a simple task. While family farms everywhere are facing major challenges in terms of succession planning, access to finance, land, markets and education, bargaining power, administrative burden and dealing with market volatility, farms in EECA have the additional challenges of dealing with the consequences of transition and learning to operate in a market economy. Family farms across the region are extremely diverse in size, market and knowledge access and other characteristics, implying diversity in the policy options for agricultural innovation systems.

The paper is structured into three sections: introduction, the challenges and recommendations. The first section summarises the current theoretical discourse about the difficulties faced by agricultural innovation and national Agricultural Innovation Systems (AISs) and their potential to leverage the livelihoods of family farmers in particular, and contribute to the sustainable development of agriculture in EECA in general. Against this background, in the second section the paper, explores the following challenges:

- the demand for transition towards inclusive, decentralised and pluralistic AISs;
- the need for a broad involvement and participation of family farmers in knowledge sharing and innovation;
- the role of producer organisations and, in particular, service cooperatives to promote innovation on family farms;
- the role of public and private investment in agricultural research and development (R&D) and extension and advisory services.

Finally, a set of recommendations for fostering agricultural innovation for family farms, both for governments and other actors in the AIS, are made.

Mapping the demand for innovation by farmers: agricultural holdings¹ in EECA

In the last twenty-five years, farming in EECA has been marked by an overall shift from collective to individual land tenure, accompanied by land restitu-

¹ FAO's theoretical definition of an agricultural holding is "an economic unit of agricultural production under single management comprising all livestock kept and all land used fully or partly for agricultural production purposes, without regard to title, legal form, or size. Single management may be exercised by an individual or household, jointly by two or more individuals or households, by a clan or tribe, or by a juridical person such as a corporation, cooperative or government agency" (FAO, 2014a).

tion and privatisation. This has (a) created a large number of family farms with unequal access to knowledge, markets, conditions and opportunities for innovation, and (b) left governments with challenges regarding policies and institutional capacities to address innovation demands adequately. The great majority of the farms in EECA are family farms, and most are small or very small.

Table 1. Total number of agricultural holdings (thousands), and shares (in per cent) in the number of holdings (bold text) and agricultural area (italics) by land size class (ha) in nine EECA countries, and Italy and the UK² (various recent years as per data availability)

Country	No. holdings	<1	1-2	2-5	5-10	10-20	20-50	>50
Albania	324	60	<i>7</i>	30	<i>11</i>	10	<i>83</i>	..
Bulgaria	370	77	<i>7</i>	20	<i>8</i>	..
Croatia	450	51	<i>6</i>	16	<i>7</i>	19	<i>20</i>	9
Czech Rep.	23	29	<i>0</i>	15	<i>0</i>	17	<i>1</i>	11
Georgia	730	70	<i>24</i>	23	<i>23</i>	5	<i>12</i>	1
Hungary	967	27	<i>2</i>	13	<i>1</i>	19	<i>3</i>	11
Italy	2591	38	<i>2</i>	19	<i>4</i>	21	<i>9</i>	10
Kyrgyzstan	1131	85	<i>8</i>	7	<i>8</i>	5	<i>15</i>	2
Lithuania	611	0	<i>0</i>	8	<i>1</i>	47	<i>14</i>	23
Poland	2933	33	<i>3</i>	18	<i>5</i>	21	<i>13</i>	15
Romania	4485	50	<i>5</i>	20	<i>8</i>	23	<i>20</i>	6
U. Kingdom	233	14	<i>0</i>	9	<i>1</i>	11

Source: FAO (2014a) and Hungarian Central Statistical Office (www.ksh.hu).

Eurostat data show that in 2007 there were 4.5 million agricultural holdings of less than 2 ha in the ten countries that joined the European Union (EU) in 2004, out of 8 million farms. Data sets for Central Asia are incomplete but in Kyrgyzstan alone, 85 per cent of the estimated 1.1 million farms are believed to be smaller than 1 ha in size (table 1). The social and economic contributions of small farms differ widely between countries across EECA. In Kyrgyzstan a small number of huge agro-holding companies account for a large share of the agricultural area. By contrast, in Georgia almost 50 per cent of land is covered by farms of 2 ha or less. In Albania the number of farms bigger than 5 ha is negligible. In Poland (which did not see collectivisation) and in Romania (which did), most of the numerous farms are 2 ha or less in size. The Czech Republic is an EU Member State where the role of small farms (in terms of land area) remains minor, although almost 45 per cent of farms are no bigger than 2 ha. While this is the only country in the sample where the area accounted for by farms of 20 ha or more is comparable to the UK, in the latter country over 50 per cent of farms are larger than 20 ha.

² Italy and the UK are included for comparison as examples of major northern and southern European countries.

FAO has formulated the following definition of what constitutes family farming: ‘Family farming includes all family-based agricultural activities, and it is linked to several areas of rural development. Family farming is a means of organising agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, including both women’s and men’s’ (EC, 2013).

In 2011, FAO proposed a new paradigm of intensive farm production, one that is both highly productive and environmentally sustainable (FAO, 2011). This idea of ‘sustainable intensification’ of agricultural production (including family farms) has now been widely adopted as a policy approach by national governments and international organisations, with ‘sustainable’ including the economic (e.g. profitability of farming), environmental (e.g. minimising unfavourable environmental impacts) and social (e.g. maintaining sustainable farming communities) dimensions. Sustainable intensification means ‘producing more with less’, and can only be achieved through innovation, which can be described as ‘a new idea that proves successful in practice’³.

Farmers can innovate in different ways. 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 release resources for use in other economic activities, or enhance the provision of important ecosystem services (FAO, 2014a). On the other hand, innovations created out of immediate and urgent needs, e.g. of smallholders or family farmers without the appropriate resources to grow, usually have very limited potential to upscale and generate a development change or lead to transforming the agricultural sector. Innovations only have the potential to leverage substantially the national agricultural goals if an appropriate ‘enabling environment’ (see below), for the generation and adoption of innovations as policies, organisational structures and capacities, is established.

Hence, a systematic commitment to innovation has proven to yield greater benefits to more people over time (Bakalli, 2013). With systematic innovation, needs and opportunities are carefully understood, the search for ideas is open and transparent, and the culture nurtures the development and scaling of innovations resulting in a continuous pattern of agricultural innovation. In many EECA countries the agricultural sector is only just beginning to explore more systematic and system-based approaches.

Innovations do not occur in isolation and the innovators (farmers, business, academia, NGOs, etc.) are not the sole agents of change. The innovations are related to all kinds of changes at different levels and in different systems.

³ Numerous definitions of ‘innovation’ exist in the literature, see e.g. FAO (2012).

Hartwich (2013) suggests that three main factors (which for simplicity can be described as process, policy and people) influence the progress of innovation, namely:

- The nature of the innovation (i.e. process). Innovations can be substantial (bring radical transformations) or incremental (e.g. new product) and these require the application of different kinds of understanding, learning and resources.
- The innovation context (i.e. policy) or ‘enabling environment’ (Christy et al., 2009) that enables the innovation to occur and become part of the productive process.
- The innovation constituency (i.e. people). This refers to the type of intended users of the innovation and those who will be affected by it.

These three factors can interact with each other. For example, the AIS lies at the interface between policy and people. The former helps to determine its structure, but its parts are composed of individuals⁴. The history of our understanding of AIS is rather complex. The concept of Agricultural Knowledge and Information Systems (AKIS) first appeared in policy discourses in the 1970s and this acronym has since evolved to refer to Agricultural Knowledge and Innovation Systems (Rivera et al., 2006), a concept that seeks to encompass and influence the complexity of knowledge and innovation processes in the rural sphere. The AKIS was defined by Röling and Engel (1991) as “a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of knowledge and information, with the purpose of working synergistically to support decision-making, problem-solving and innovation in agriculture”. Traditionally, the AKIS in many countries was dominated by the public sector, its operation was characterised by a ‘linear’ (researcher-advisor-farmer) model of communicating innovation.

Reflecting changes in our understanding and expectations, FAO prefers the term Agricultural Innovation Systems instead of AKIS (table 2) and, referring to its operation, is using the term knowledge sharing in the AIS context instead of technology transfer. The former implies a multilateral interaction, while the latter implies a unidirectional flow and knowledge exchange suggests simply a bilateral relationship. Spielman and Kelemework (2009) note that “[h]idden within this [innovation] system are the essential processes that facilitate innovation – for example, the development of capacity among individuals and organizations to learn and change the ways in which they organize production and the iterative learning processes that occur among different actors through

⁴ The term ‘agricultural innovation system’ refers to the individuals, organizations and enterprises that bring new products, processes and forms of organization into use to achieve food security, economic development and sustainable natural resource management. Like any ‘system’, it encompasses the different stakeholders or actors as well as the linkages between them. It also includes the so-called ‘enabling environment’ which, as the name suggests, includes the factors making it all possible, such as political commitment and vision; policy, legal and economic framework; budget allocations and processes; governance and power structures; incentives and social norms (FAO, 2012).

different forms of interaction” (p. 2). Thus, increasingly, innovations are generated in a network setting.

Table 2. Defining features of Agricultural Knowledge and Innovation 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).

Despite the continuing debate over terminology (AIS, AKIS, etc.), the FAO’s view on the desirable features of the AIS is widely accepted. Similarly, with regard to its structure, this improved understanding implies that the scope of the traditional national knowledge system, encompassing research, advisory services and education, has to be extended in order to take into account developments in the private sector, enabling service cooperatives, financial mechanisms in agriculture, implementing information and communication technologies (ICTs) and overall policies, including interlinkages among the traditional system components (research, extension and education). SCAR (2012) has developed a new model of the AKIS, applying the AIS concept, which positions the farmer within the supply chain and includes a broader range of actors, including private sector actors (figure 1). Thus, the AIS is now promoted as a more effective and efficient instrument to reach agricultural policy goals.

The policy environment in which family farms operate varies across EECA (Davidova and Thomson, 2013). Agricultural policy in the EU has long been tailored to family farms and, following the eastern enlargement, has paid increasing attention to the needs of very small farms, including semi-subsistence farms. By contrast, in many countries of the former Soviet Union policy has often been inconsistent and progressed unevenly, with limited reforms.

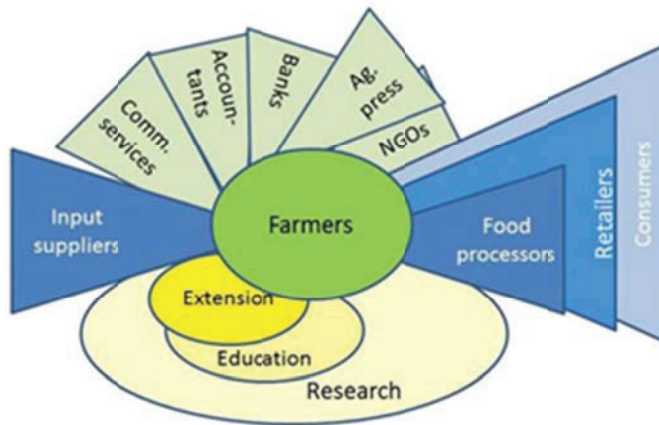


Figure 1. Actors in the AKIS directly relevant to agricultural innovation in the food chain

Source: SCAR (2012).

Christy et al. (2009) developed a framework (hierarchy) of enabling needs for agro-industrial competitiveness that is composed of ‘essential enablers’ (e.g. land tenure and property rights), ‘important enablers’ (e.g. standards and regulations) and ‘useful enablers’ (e.g. business development services). Agricultural advisory services are a form of business development service and a part of the AIS that is strongly influenced by policy.

The challenges

The demand for inclusive, decentralised and pluralistic AIS

Farmers can be differentiated according to several criteria: professional/part-time, old/young, men/women, conventional/organic, specialised/diversified as well as according to their main motivations (entrepreneurship, ethics, innovation etc.). Farmers in these different groups have different attitudes towards innovation. The AIS (and especially farm advisory services) tends to be biased towards professional, specialised, conventional and male farmers (Dockès et al., 2011). As a result, not all farmers have equal access to support, for various reasons, including:

- some farmers cannot afford to pay;
- AIS does not answer to the needs of all farmers;
- some farmers (for example: part time farmers) do not qualify for support.

Dockès et al. (2011) showed that the ‘linear’ model of communicating innovation has, in many ‘western’ countries, steadily been replaced by a ‘participatory’ network approach in which innovation is ‘co-produced’ through interactions between firms, researchers, intermediate actors (input providers, distributors, etc.) and consumers. This reflects increasing awareness of the

importance of people in the AIS, especially the (end) users of innovation such as farmers who are no longer seen as passive recipients of innovations generated by ‘experts’ but as the very drivers of innovation⁵. Coupled with this is the wider recognition of the role of tacit (as opposed to formal, codified or explicit) knowledge in innovation. Indeed, innovation often involves fresh applications of traditional knowledge (EC, 2013). The findings of Dockès et al. (2011) tell us that it is not sufficient to dwell on the organisational structure of the AIS but emphasis should be placed on mobilising the AIS actors (people), not least by improving the diversity and flows of information and knowledge between them⁶.

Unfortunately, the ‘linear’ model of communicating innovation and public sector dominance of AIS (especially research and advisory services) persist in many EECA countries, e.g. Albania (Zhlilima and Kromidha, 2013), Poland and Hungary (Floriańczyk et al., 2014), and Azerbaijan and Central Asia (FAO, 2014b). Smaller farms, those engaged in extensive farming and those below certain output thresholds (almost all of which are family farms) find it difficult to access research products and formal advisory programmes, which are largely designed for more intensive farming. Thus there is a need to develop ‘research and advice products’ that are tailored to the needs of family farmers.

This is the rationale that underpins the European Innovation Partnership ‘Agricultural Productivity and Sustainability’ (EIP-Agri) that is being implemented by the EU during the 2014-2020 programming period (EC, 2012). The EIP-Agri brings together actors from across the AIS, be they farmers, scientists, farm advisors, enterprises or others, in multi-actor partnerships or ‘Operational Groups’ (OGs) that are farmer-driven and are intended to carry out projects that test and apply innovative practices, technologies, processes and products. Topics can include environmental and social as well as economic innovation. In Central Asia and Azerbaijan, FAO programmes that coordinate contributions of various stakeholders have already been successful in introducing specific technological innovations (FAO, 2014b).

The EIP-Agri recognises the role of innovation brokers, which can be defined as “persons or organizations that, from a relatively impartial third-party position, purposefully catalyse innovation through bringing together actors and facilitating their interaction” (World Bank, 2012, p. 221), in facilitating innovation in agriculture. Similarly, FAO (2014b) found that in Central Asia and Azerbaijan “adequate facilitation ... is more successful in driving innovation processes” (pp. 22-23) and that “what is needed is personnel with advisory and facilitation skills to take on the rather new role of brokers of information and linkages” (p. 31).

⁵ Farmers would point out that they have been innovating and adapting their practices since agriculture began.

⁶ In line with this, the term ‘knowledge sharing’, which implies multilateral flows of knowledge, has tended to replace ‘knowledge transfer’, a term which is associated with the linear model of communication.

The need to promote the participation of family farmers in knowledge sharing and innovation

FAO (2014b) notes that agricultural innovation takes place in Central Asia and Azerbaijan, but not at the desired pace. Many farmers and institutions are open to progressive ways but there is a legacy of a Soviet-period mindset. In the EU, insufficient innovation is occurring in farming. For example, in Hungary, rather than deal with innovation, most farmers focus on running their farms and solving daily challenges (Biró et al., 2014). A survey of 300 farmers in the South Great Plain NUTS 2 region of Hungary found that less than 5 per cent of them have an innovating attitude. In Romania, a field study revealed that the small farmers are more traditionalist, their values are specific to the empirical knowledge transfer model (from a farmer to another) and they are rather ‘prisoners’ of the traditional view of ‘making agriculture’ (Florian (coord.), 2013). Unlike small farmers, the larger Romanian farmers are more open to innovation, as these have profit increase expectations; however, at the same time, the latter are not so willing to pay for innovation.

Earlier, this paper made reference to process, i.e. the nature of the innovation. Innovations need to be attractive and convincing for farmers; in such cases they will be ‘pulled’ by farmer demand and not ‘pushed’ by government. The AIS must support small-scale farmers in finding solutions that are relevant, most likely ones that are low-cost and unsophisticated, and at the same time market-oriented and profit-enhancing. In other words, for innovation policies to be effective they must take into consideration the needs and capacity of users. Increasing the ability of knowledge producers, innovation brokers and others to understand what constitutes an attractive innovation, and how to correctly present and promote them, will assist innovations to spread quickly from early adopters to others.

Each November, AGRYA, in partnership with several private sector companies, organises three information exchange meetings in regional towns across Hungary. Farmers aged under 40 can attend the meetings free of charge and 100-200 attendees are expected at each event. Between around 10.00 and 16.00 there is a series of formal presentations from representatives of AGRYA, the Ministry of Agriculture and agri-business companies. For example, topics include direct payments and rural development support from 2015, external sources to finance investments in agriculture, land law, weather challenges in the management of arable crops, sustainable fertilisation solutions, and agro-technological innovations on family farms. In addition, the meetings use the ‘long coffee break’ approach; throughout the day, in parallel with the formal programme and outside the conference room, attendees can meet face-to-face with representatives of the participating organisations to discuss the topics in more detail.

Box 1. Young Farmers’ Information ‘Bourse’ (Hungary).

Source: own research.

Novel approaches to encouraging the participation of family farmers in innovation should be promoted. This includes a shift from the ‘visit and train’ model of farmer education to group discussion-based approaches. If farmers are accepted as co-creators of knowledge they should be treated as such. Peer-to-peer learning in a facilitated environment allows farmers to share and discuss their own experiences and knowledge (EC, 2013). Special focus should be placed on engaging those groups (e.g. young farmers and women) with a reputation for being innovative. In Hungary, the Young Farmers’ Hungarian Association (AGRYA) is proactive in promoting knowledge sharing and, by implication, innovation in farming (box 1).

The role of producer groups in promoting innovation on family farms

One of the seven key messages of FAO (2014a) is that ‘effective and inclusive producers’ organisations can support innovation by their members’. The document cites a number of mechanisms (e.g. helping farmers to establish links to markets and value chains and integrating them into effective innovation systems) through which they can have an impact.

Numerous studies have shown that ‘friends and family’ are an important source of information and knowledge for family farmers⁷. This shows that there is a basic willingness among farmers to communicate and cooperate. Many observers with a ‘western’ perspective then see farmers’ (production) cooperatives as a logical step to farm business development, and perceive such cooperation in EECA as being held back only by the legacy of forced cooperation during the socialist period. In fact, the causes are more complex. For example, Tudor (2015) notes that attempts in Romania to establish land owners’ associations failed for two reasons. The first is a lack of institutional support to help the new organisations to become economically viable, while the second has a strong social basis. Since 1989, many small farmers have returned to their farm holdings as a consequence of labour rationalisation in urban socialist industry mainly with the intention of meeting their primary consumption needs. Furthermore, managers of agricultural associations were perceived to be performing poorly and acting in their own interests rather than in the common interest of the members.

However, a distinction can be drawn between production cooperatives (where members jointly cultivate pooled resources, as during the socialist period) and service cooperatives (that provide services to their members). The latter is the largest category and includes marketing, processing, input supply and

⁷ For example, in Hungary in 2014, 74 per cent of 1460 surveyed farmers regularly consulted ‘friends, colleagues and consultants’ for information, the highest ranked category (see http://agrostratega.blog.hu/2014/10/20/friss_kutatasi_adatok_a_mezogazdasagi_termelok_informacioszerzesi_szokasainak_valtozasairrol).

processing cooperatives. Such organisations often provide input-related technical advice as well as inputs. They may carry out product related research and training and provide product-related advice (Dockès et al., 2011). Lerman and Sedik (2014) report that the development of service cooperatives in post-socialist countries of the EECA is ‘many decades’ behind those of the northern and southern EU Member States, both in terms of numbers of cooperatives per farm and level of farmer cooperation.

Service cooperatives undoubtedly offer a way in which small-scale farmers in EECA who are producing for the market can strengthen their bargaining power, for example with large-scale input suppliers or purchasers of their produce. Through resource (equipment) sharing, they are also a way of mitigating the problem of lack of capital. At the same time, by encouraging communication and sharing of experiences they can assist innovation. Lerman and Sedik (2014) state that policies and legislation comprise the enabling environment for the development of cooperatives but they caution against trying to transplant regulations from ‘western’ countries where service cooperatives are well established to those in which the main subject is start-up cooperatives. They point to Ukraine as having perhaps the best legislation in the CIS-G⁸, having drawn on the experience of at least three donor advisory projects. Such projects should last longer than the typical two years, five years being more appropriate.

Farmer organisations (which include service cooperatives) can be drivers of demand-side knowledge sharing by (a) encouraging farmers to pro-actively search for information, (b) providing farmers with direct access to knowledge and information via ICTs and social media, and (c) facilitating networking which is a prerequisite to knowledge sharing (Blum, 2013). As well as being service providers, they can have a brokerage role, contribute to policy formulation and planning, and help to evaluate the relevance, efficiency, effectiveness and impact of knowledge sharing.

In Hungary, an example of a post-socialist EU Member State, Biró and Rác (2015) showed that it is necessary to address both people and policy to stimulate the innovation process. It is very important to promote attitude changes to cooperatives with the help of training, courses, forums for the management and the membership, with the demonstration of good examples and also with incentives that increase the membership’s trust and commitment. Alongside this, in order to strengthen cooperation and ensure contractual discipline, a legal and fiscal environment (including reorganisation of the VAT system, controlled market channels, effective supervisory bodies) that supports wider sectorial cooperation is needed.

⁸ Commonwealth of Independent States and Georgia.

The role of public and private investment in agricultural R&D and advisory services

Davidova and Thomson (2013) note that there are compelling arguments in favour of government intervention in agricultural research, development, extension and education (RDEE), both in terms of the economic rates of return to be expected from such investment and in terms of future food security and environmental protection.

However, FAO (2014a) notes that, in many countries (especially low and middle income countries), public investments in agricultural R&D remain far too low relative to the sector's economic significance and importance for poverty alleviation. The private sector has taken an increasingly big role, often focusing on advanced production technology such as new crop (including GM) cultivars and field machinery. There are conflicting views among actors in the AKS in Hungary and Romania, where several companies have established research and extension programmes, about the role of the private sector (especially multinational input manufacturers and suppliers) in RDEE. Some actors have the view that such companies “always advertise their own products”, but others believe that (a) such farm advisors (company representatives) must be seen to be giving correct advice if they are to be trusted and (b) that farmers (customers) can “see through” the “sales talk” and obtain useful advice. Without doubt, such companies are significant sources of ‘packaged’ innovation and knowledge for farmers in the two countries.

Several sources (e.g. Davidova and Thomson, 2013; FAO, 2014a) point to the risk of ‘market failure’ resulting from inadequate public sector involvement in RDEE, for at least two reasons. Firstly, the focus of agricultural RDEE has broadened from simple land productivity to societal concerns, e.g. environmental sustainability and capacity to adapt to climate change, which may not be financially attractive topics for the private sector. Secondly, the high costs of serving small, remote farms or developing cultivars or crop protection products for ‘minor’ crops is also a disincentive. Lack of access to knowledge, insufficient information flow, weak exchange of research results and too little responsiveness to the needs of farmers are major barriers to the uptake of innovation on family farms (EC, 2013).

FAO (2014a) makes several important points concerning the effectiveness of public sector RDEE. Firstly, adequate salaries and conditions of service are necessary to attract young, competent researchers and farm advisors. Secondly, women are underrepresented, meaning that the specific needs of women farmers may not be sufficiently addressed, and the level of engagement with them is likely to be inadequate. It also calls for stable institutional funding rather than a reliance on project-based funding that has higher transaction costs. FAO (2014a) also emphasises the need for partnerships. These may include public-private partnerships and collaborations between national, regional and

international organisations. However, it emphasises the benefits of partnerships between researchers and family farmers. These may be formally or farmer-led. Communication and collaboration between farmers and researchers often involves challenges, such as reaching agreement on the research agenda, but the impacts of such approaches, such as participatory plant breeding, have been shown to be positive.

Conclusions and recommendations

Family farms are part of the solution for ensuring long-term global food security, rural poverty reduction and environmental sustainability. However, in many EECA countries the state of innovation on family farms is weak and the AIS is not 'fit for purpose' in several respects. To address these issues the following recommendations, grouped according to the structure of this paper, are made.

1. Address the demand for transition towards inclusive, decentralised and pluralistic AISs:
 - Greater knowledge sharing between government, research institutions, advisors and farmers is needed. Emphasis should be placed on communicating with family farmers (male and female) running commercially viable farms who want to develop their businesses through innovation. The EIP-Agri should be recognised as an example of a policy measure that has the potential to promote farmer-focused innovation.
 - New ways of bringing innovative farmers (especially better educated and younger farmers) into farming should be supported, such as by promoting joint ventures either between farmer and land owner, or older and younger generations of a farming family.
 - The innovation capacity of small family farms should be developed through investment in education and training and creation of networks that enable different actors in the AIS to share information, experiences and good practices. Different types of personal contact, such as facilitated group learning and farmer-to-farmer communication, should be encouraged.
2. Meet the need for a broad involvement and participation of family farmers in knowledge sharing and innovation:
 - Public sector efforts to promote innovation on small, family farms which, although numerous, are not integrated into AIS (due to the low innovative capabilities and lack of incentives for innovation), should be increased. These efforts should focus on inclusive research for small farms, the consolidation of their integration on the market, providing advisory services and infrastructure development.
 - Family farmers should be involved in defining research agendas and engaged in participatory research efforts to help improve the relevance of research for them. Better integration of small family farms into AIS can be

- achieved by combining the traditional practices and direct innovations of small farms with formal research.
- To encourage innovation, both top performing farmers who develop their own innovations and middle performers who adopt existing technology and good practice to develop their businesses should be targeted. However, it should be accepted that many farmers prefer to adopt innovations and are not interested in acquiring knowledge to innovate.
3. Enhance the role of producer organisations and, in particular, service cooperatives to promote innovation on family farms:
 - Farmers and their organisations must accept that they, too, have an obligation to encourage innovation. By artificially contributing to profitability, direct subsidies to low performing farmers discourage structural change and encourage the use of outdated practices. Payments should be more strongly linked to innovation.
 - There is a high reliance among farmers on free advice. Subsidised advisory services can engage farmers who are not accustomed to paying for advice. However, to ensure confidence in the system, the advisors employed should have good professional knowledge and good communication skills.
 - Producers' organisations can assist their members in accessing markets and linking with other actors in the innovation system. Policies and regulations, tailored to local needs, to promote the development of producer organisations (including service cooperatives) should be strengthened. These organisations should be encouraged to more actively share knowledge among their members.
 4. Strengthen the role of public and private investment in agricultural R&D and extension and advisory services:
 - Research should be re-oriented towards meeting the needs of family farms, taking into consideration their agro-ecological and social diversity. In the public sector, more resources should be allocated to well targeted, near-market research and development, and its translation into practice.
 - More openness at all levels (researchers, advisors and farmers) to adopting and adapting research and innovative ideas from other countries must be encouraged, as this can be faster and cheaper than starting from basic research.
 - A variety and combinations of financial mechanisms allowing agricultural innovations for smallholder family farms should be explored.

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