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Agenda item 3

Innovation in family farming in Europe and Central Asia

Executive Summary

- Family farms are part of the solution for ensuring long-term global food security, rural poverty reduction and environmental sustainability. Therefore, promoting innovation in family farming is becoming a priority for politicians and policy makers.
- In preparation for a panel discussion during the 39th session of the European Commission of Agriculture in Budapest, Hungary in September 2015, this background paper firstly summarizes the current theoretical discourse about the potential of national Agricultural Innovation Systems (AIS) to contribute to the sustainable agricultural development in the (Central and Eastern) European and Central Asia (EECA) region.
- It focuses on the following challenges:
 - (a) the demand for transition towards inclusive, decentralized and pluralistic AISs;
 - (b) the need for a broad involvement and participation of family farmers: smallholders, women and disadvantaged or marginalised groups;
 - (c) the role of effective and inclusive producers' organizations and, in particular, service cooperatives to support innovation;
 - (d) the role of public investment in agricultural R&D and extension and advisory services and public-private partnerships; and
 - (e) the potential of information and communication technologies to foster agricultural innovations and make national AISs more efficient. A set of recommendations are then made, both for the governments and other actors, and for possible FAO action which should be endorsed by the FAO constituency and reflected in the future work planning.

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Guidance sought

- Member countries are invited to take note of, and comment on, the demand and mechanisms related to making agricultural innovation systems true enablers of family farms.
- In particular, Member countries are encouraged to take full advantage of the pluralistic, demand-driven decentralized and inclusive AIS approach in revisiting their overall agricultural policies and institutional arrangements.
- Member countries may wish to provide guidance on FAO's future work to:
 - continue efforts to assist the countries in EECA to transform their agricultural sectors and leverage the livelihoods of family farmers (men and women) to generate and adopt innovations;
 - in particular, by collecting and analysing good practices and mechanisms that have enhanced innovations in family farming, knowledge sharing, policy advice and capacity development;
 - provide a meeting ground for countries in the region and worldwide and act as neutral broker for sharing knowledge on transforming AISs in EECA towards more efficient, inclusive, decentralized and pluralistic systems.

I. Introduction

1. The *State of Food and Agriculture: Innovation in family farming* report (FAO, 2014a) 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. Therefore, 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. Despite this fact, still very little is being done in transforming their knowledge systems from linear and centralized models towards inclusive, decentralized and pluralistic Agricultural Innovation Systems (AISs)¹ that would revolutionise the sector (FAO, 2012). This is not a simple task. 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.

2. This background paper has been prepared to provide the FAO constituency in EECA with consolidated information on the current theoretical discourse surrounding the challenges faced by agricultural innovation and national AISs and their potential to leverage the livelihoods of family farmers in particular, and to contribute to sustainable agricultural development in EECA in general, if comprehensive policies are in place. Further, the paper sets out policy options for fostering agricultural innovation for family farms and invites member countries to share their views and experiences.

¹ 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 frameworks; budget allocations and processes; governance and power structures; incentives and social norms (FAO, 2012).

Mapping the demand for innovation by farmers: agricultural holdings² in EECA

3. 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 restitution and privatization. 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 adequately address innovation demands. The great majority of farms in EECA are family farms, and most are small or very small (Table 1). 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.

Theoretical background

4. 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 organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, from both women and men’ (EC, 2013).

5. In 2011, FAO proposed a new paradigm of intensive farm production, one that is both highly productive and environmentally sustainable (FAO, 2011). Sustainable intensification implies ‘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. The following key features of the nature of the agricultural innovations and AISs can help countries in EECA develop informed positions. The theory of innovations and AISs is explored in Annex 2.

6. Agricultural innovation:

(i) is a process, or product, or form of organization and management, the benefit of which has been already proven in practice.

Innovation facilitates sustainable intensification and helps farmers to expand, change or diversify their marketable output, thereby increasing the profitability of their farms, freeing up resources for use in other economic activities and enhancing the provision of important ecosystem services (FAO, 2014a).

(ii) needs a systematic commitment (e.g. AIS) from the government to upscale, including the creation of an enabling environment, for generating a development change.

Innovations only can leverage substantially national agricultural goals if an appropriate enabling environment for the generation and adoption of innovations as policies, organizational structures and capacities, is established. Yet in many EECA countries, the agricultural sector, responsible for feeding humans and animals, is only just beginning to explore more systematic and system-based approaches.

² 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).

³ Numerous definitions of ‘innovation’ exist in the literature, see e.g. FAO (2012). The theoretical nature of agricultural innovation is still not fully understood. Innovation is often used as a synonym of a new technology or product, however a new plant variety can be considered as innovative only after its economic, environmental or social benefit for the farmer has been proven in practice.

(iii) *does not occur in isolation with the innovators (farmers, business, academia, NGOs etc.) being not the sole agents of change.*

Innovations are related to all kinds of changes in different levels and systems. 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)⁴ 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.

(iv) *The AIS model is an evolved concept of the conventional knowledge system i.e. research-extension-farmers.*

In many countries, the framework of how innovation is generated and knowledge shared was dominated by the public sector; its operation was characterised by a ‘linear’ and ‘top-down’ (researcher-advisor-farmer) model of communicating innovation. AIS emphasises bottom-up, participatory approaches in generating and adopting innovations in agriculture that occur in a decentralized setting. 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, implementation of information and communication technologies (ICTs) and overall policies. Thus, the agricultural innovation system is now promoted as a more effective and efficient instrument to reach agricultural policy goals, since it allows innovations to happen faster, and upscale in much more areas and holdings in a cost-efficient way.

(v) *Increasingly, innovations are generated in a network setting.*

In innovation systems, networks of different players are transient and emerge around specific challenges and tasks at particular points in time (World Bank, 2006).

(vi) *Action is required towards AIS transformation in EECA*

A well-functioning AIS can help ensure good use of public funds, improved collaboration between public and private participants, including across national borders, and a more demand-driven system that is responsive to the needs ‘innovation consumers’ (OECD, 2014). This can be achieved mainly through: (i) adequate policy incentives, such as family farm income support coupled with innovations; ‘pull’ mechanisms for investment in agricultural research in the service of small and family farms; pluralistic advisory system and funding that is based on the demand and not on the provider, among many others, and (ii) innovation capacity development. The AIS approach requires changes in the behaviour of all innovation actors, acquisition of novel skills and alternation in their role.

AIS is strongly influenced by the overall policy environment, which varies across EECA with regard to family farms (Davidova and Thomson, 2013). Agricultural policy in the EU has long been tailored to family farms and, following the eastern enlargement, has paid increasing

⁴ 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.

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. However, despite the attempts of many EECA countries, the interplay between incentives and capacities to enhance AISs is still a grey area.

Against this theoretical background, the paper focuses on the following challenges, to which country statements are invited and recommendations will be revolving:

- The demand for transition towards inclusive, decentralized and pluralistic AISs;
- The need for a broad involvement and participation of family farmers: smallholders, women and disadvantaged or marginalised groups;
- The role of effective and inclusive producer organizations and, in particular, service cooperatives to support innovation;
- The role of public investment in agricultural R&D and extension and advisory services, its monitoring and public-private partnerships;
- The potential of information and communication technologies (ICTs) to foster agricultural innovations and make national AISs more efficient.

II. The challenges

The demand for inclusive, decentralized and pluralistic AIS

7. 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.

8. 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 themselves drivers of innovation⁵. Coupled with this is the wider recognition of the role of tacit (as opposed to formal, codified or explicit) knowledge in innovation⁶. The findings of Dockès *et al.* (2011) tell us that it is not sufficient to dwell on the organizational structure of the AIS but emphasis should be placed on mobilizing the AIS actors (*people*), not least by improving the diversity and flows of information and knowledge between them. Indeed, innovation often involves fresh applications of traditional knowledge (EU, 2013).

9. Unfortunately, the ‘linear’ model of generating and communicating innovation and public sector dominance of AIS (especially agricultural research and advisory services) persists in many EECA countries e.g. Albania (Zhillima and Kromidha, 2013), Poland and Hungary (Floriańczyk *et al.*, 2014), and Azerbaijan and Central Asia (FAO, 2014b). FAO continuously provides assistance through

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.

its programmes to member countries in moving from their linear approach. Smaller farms, those engaged in extensive farming and those below certain output thresholds (almost all of which tend to be family farms) find it difficult to access formal advisory programmes. Thus there is a need to develop tailored ‘research and advice products’ that are appropriate for the needs of family farmers.

10. This is the rationale that underpins the European Innovation Partnership ‘Agricultural Productivity and Sustainability’ (EIP-Agri), which is being implemented by the EU during the 2014-2020 programming period (EC, 2012). The EIP-Agri brings together actors from across the AIS, including farmers, scientists, farm advisors, enterprises or others, in multi-actor partnerships. These are farmer-driven and are intended to carry out projects that test and apply innovative practices, technologies, processes and products. 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 Tropical Agricultural Platform (TAP), as a G20 initiative, implemented by FAO and other partners, is an example of networking approach, applied inter-regionally (Annex 3).

11. 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).

The need to promote the participation of family farmers in innovation

12. FAO (2014b) notes that innovation in agriculture is taking place in all the countries it studied (Kyrgyzstan, Tajikistan, Uzbekistan 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, most farmers focus on running their farms and solving daily challenges. They play it safe by using proven methods (Biró *et al.*, 2014). In Romania, small farmers are ‘prisoners’ of the traditional view of ‘making agriculture’ (Florian (coord.), 2013).

13. Earlier, this paper made reference *to process*, i.e. the nature of 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. However, complex agricultural challenges, such as climate change, require increasingly complex solutions. For such situations, close attention should be paid to adequately communicating those technologies (as discussed below) in order to ensure equitable access for family farms (men and women). 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 strengthen their spread from early adopters to others.

14. 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, 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).

Box 1: Young Farmers' Information 'Bourse' (Hungary).

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 am and 4 pm there is a series of formal presentations from representatives of AGRYA, the Ministry of Agriculture and agri-business companies. 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 fertilization 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 organizations to discuss the topics in more detail.

Source: Own research

The role of producer groups in promoting innovation on family farms

15. One of the seven key messages of FAO (2014a) is that 'effective and inclusive producers' organizations 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.

16. 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 to establish land owners' associations in Romania failed for two reasons. The first is a lack of institutional support to help the new organizations 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 rationalization 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.

17. 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 processing cooperatives. Such organizations 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 the level of farmer cooperation.

18. Service cooperatives undoubtedly offer a way for small-scale farmers in EECA – which produce for the market – to strengthen their bargaining power, for example with large-scale input suppliers or purchasers of their produce. Through resource (equipment) sharing, there is also a way of

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).

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.

19. Farmers’ organizations (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 play a brokerage role, contribute to policy formulation and planning, and help to evaluate the relevance, efficiency, effectiveness and impact of knowledge sharing.

20. In Hungary, an example of a post-socialist EU Member State, Biró and Rácz (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 reorganization of the VAT system, controlled market channels, effective supervisory bodies) that supports wider sectorial cooperation is needed.

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

21. 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. Activities include research institutes, advisory services, agricultural colleges, and often state experimental stations.

22. 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 important role, often focusing on advanced production technology such as new crop (including GM and new breeding techniques; see Lusser *et al.*, 2011) varieties 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 take 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. In a systematic commitment of innovation assets, governments should find a way to involve private extension service providers in a collaborative action, e.g. in annual public and private planning process (FAO programme in Kazakhstan) or joint capacity development initiatives.

23. Private sector companies at national level, however, are usually hesitant to invest in the agricultural sector, especially in products and services for smallholders and family farmers. There are two main reasons for this: weak intellectual property rights (IPRs) protection and markets being too small and uncertain (the latter is also valid for some countries in the Western Balkans and Caucasus).

⁸ Commonwealth of Independent States and Georgia.

24. 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 varieties or crop protection products for ‘minor’ crops is also a disincentive. Lack of access to knowledge, insufficient information flows, 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).

25. FAO (2014a) makes several important points concerning the effectiveness of public sector RDEE. Firstly, adequate salaries but, most importantly, 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. As an increase of the public sector budget is not always possible, FAO (2014a) emphasises the need for partnerships. These may include public-private partnerships and collaborations between national, regional and international organizations. It emphasises the benefits of (formally or farmer-led) partnerships between researchers and family farmers. Communication and collaboration between farmers and researchers often involves challenges, such as reaching agreement on research agendas, but the impacts of such approaches, such as participatory plant breeding, have been shown to be positive. Agricultural researchers often lack the capacity to communicate their research achievements, especially more sophisticated ones that respond to a direct farmer need, to the public in general and farmers in particular. Thus, researchers’ communication capacities should be strengthened or adequately rewarded and interactive science communication programmes at national or local level should be designed; e.g. DEFRA science communication programme.

26. Adequate financial mechanisms to fund agricultural innovation by attracting the private sector should be an intrinsic part of national agriculture or innovation strategies. In addition to some commonly-used instruments such as competitive grants, consortia, matching funds, ‘pull mechanisms’, being results-based incentives designed to overcome market failures and encourage innovation, particularly for smallholders and family farms (Box 2), can be explored. Pull mechanisms reward successful innovations *ex-post*, compared with push mechanisms which fund *ex-ante* research supply that may (or may not) result in innovations. By providing assured public funding for goods that embody technologies beneficial for family farms for which private demand is inadequate (for example, irrigating technologies, non-cash crop varieties and veterinary vaccines), they aim to turn notional into effective demand, thus allowing investors to capture more fully the social value of their research and investments.

Box 2: Examples of ‘pull’ mechanisms.

Standard prizes, which reward achievements in a technology development contest. They may be designed as a winner-takes-all prize or may also reward runners-up;

Proportional prize structures, which reward innovations in proportion to their impact, offering a fixed per-unit reward proportional to the total benefits achieved, while the overall size of the award is variable;

Patent buyouts, which are a direct form of ‘pull’ mechanism under which the public sector pays private holders of an existing patent to transfer ownership to the public domain;

An *advance market commitment (AMC)* represents a legally binding contract guaranteeing a specified level of demand at a specified price for a specified period to producers that develop and bring to the marketplace a new product meeting previously agreed product specifications. While producers still bear the risk that their R&D efforts will fail to generate a product that meets those specifications, AMCs guarantee that, if they succeed, a viable market will be available for a known period.

Source: World Bank (2012)

The potential of ICTs to foster agricultural innovations and make national AISs more efficient

27. The e-Agriculture (FAO, 2015) aims to enhance agricultural and rural development through improved information and communication processes. It involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain. Technological application, facilitation, support of standards and norms, capacity building, education and extension belong to the broader concept of e-Agriculture.

28. ICTs have long been recognised as key enablers for bridging the digital divide and achieving sustainable development. ICTs can help smallholder family farmers (FAO, 2014c) coordinate their planning and monitoring of production and marketing systems by virtually aggregating data, without cooperatives having to take over the land or do the decision making for their farms. Access to credit, financial and insurance services for smallholder family farmers has been a major constraint to improving their farming and incomes. With the increasing availability of mobile phones and the internet, smallholder farmers can now access financial services much more easily. FAO has been promoting the use of ICTs in agriculture and has focused on ICT innovation in improving agricultural production and value chains. Examples show that:

- Food traceability systems using ICT as an important risk-management tool have allowed food business operators or authorities to contain food safety problems and promote trust in the value chain;
- GIS and agro-meteorological technologies have contributed to better land use planning, crop forecasting and early warning systems. Space technology is also essential to monitoring threats from the growing number of natural disasters;
- The use of mobile phone technology for information exchange such as disease surveillance and pest tracking has become routine in many EECA countries;
- In EECA, FAO has implemented projects on the establishment of a rural radio in Armenia, national online networks enhancing collaborative action among AIS actors in Albania and Armenia and has assisted national AGROWEB platforms and thematic networks for food safety, medicinal and aromatic plants, fisheries and many more in EECA.

29. However some of those initiatives – along with many others that are donor and governmental self-funded at national level – put technology alone at the core of proposed solutions. As discussed earlier, systematic commitment is needed to achieve a sustainable change in the sector. In this line FAO has recently been developing the *National e-Agriculture Strategy Guide*⁹ which aims at assisting countries at mainstreaming ICTs in agriculture and developing or revitalizing a country's e-Agriculture strategy in alignment with the agriculture goals and priorities. The existence of a comprehensive national strategy can prevent e-Agriculture projects from being implemented in isolation (resulting from duplication of efforts and resources) and develops efficiency gains from intra-sector and cross-sector synergy. FAO is ready to provide technical support and capacity development in agricultural innovation, including e-Agriculture strategy formulation and implementation.

⁹ The publishing of the Guide is expected in October 2015.

III. Conclusions and recommendations

30. Family farms are part of the solution for ensuring long-term global food security, rural poverty reduction and environmental sustainability. The following recommendations are made, both for the governments' and other actors' consideration, and for possible FAO action, to be endorsed by the FAO constituency and thus also reflected in the future work planning.

- 1) Address the demand for transition towards inclusive, decentralized and pluralistic AISs:
 - Greater knowledge sharing between government, research institutions, advisors and farmers at national, regional and international levels is needed;
 - Countries should support new ways of bringing innovative farmers (especially better educated and younger farmers) into farming, such as by promoting joint ventures either between farmer and land owner, or older and younger generations of a farming family;
 - Countries should develop the innovation capacity of small family farms through investment in education and training and creation of networks.
- 2) Meet the need for a broad involvement and participation of family farmers: smallholders, women and disadvantaged or marginalised groups:
 - Public sector efforts to promote innovation on family farms should be increased;
 - Countries should involve family farmers in defining research agendas and engage them in participatory research efforts to improve the relevance of research for them;
 - To encourage innovation, governments should target both top performing farmers who develop their own innovations and middle performers who adopt existing technology and good practice to develop their businesses.
- 3) Enhance the role of effective and inclusive producer organizations and, in particular, service cooperatives and link them better to innovation systems:
 - Countries must encourage farmers and their organizations to accept that they, too, have an obligation to encourage innovation. There is a high reliance among farmers on free advice. Countries, especially those with predominance of small agricultural holdings, should develop, at the extend proportionate, subsidised advisory services as these can engage farmers who are not accustomed/in a position to paying for advice;
 - Governments should strengthen policies and regulations, tailored to local needs, to promote the development of producer organizations (including service cooperatives). These organizations should be encouraged to more actively share knowledge among their members.
- 4) Strengthen the role of public investment in agricultural R&D and extension and advisory services, and public-private partnerships with a focus on family farms:
 - Research should be re-oriented towards meeting the needs of family farms, taking into consideration their agro-ecological and social diversity;
 - Countries must encourage more openness at all levels (researchers, advisors and farmers) in adopting and adapting research and innovative ideas from other countries;
 - Countries are encouraged to explore a variety and combinations of financial mechanisms allowing agricultural innovations for smallholder family farms.
- 5) Recognise the potential of ICTs to foster agricultural innovations and make national AISs more efficient:
 - Countries are advised to consider developing national e-Agriculture strategies that would leverage the agricultural sector, enhance family farms' access to information to innovate, and assist in achieving countries' agricultural goals for sustainable development and food security.

IV. The Role for FAO

31. One of the main priorities of FAO in this region is policy advice to governments in support of sustainable intensification of production for small and family farms through its EECA Region's is the Regional Initiative 1 "Empowering Smallholders and Family Farms for Improved Rural Livelihoods and Poverty Reduction". In particular, more efforts should be dedicated to investigating the "ecosystem" of innovation in family farming horizontally, across the sectors – food, crop production, livestock, fisheries and forestry and also vertically, by exploring gender, agribusiness etc. aspects.

32. FAO can harness its established technical and advisory expertise in assisting the countries in EECA to transform their agricultural sectors and leverage the livelihoods of the family farmers (men and women) to generate and adopt innovations. In particular,

- FAO should focus on collecting and analysing good practices, and successful operational mechanisms as PPPs and pull financial mechanisms that have enhanced innovations in family farming, horizontally and vertically. Further, a compendium of adequate policy options with focus on transition economies shall be prepared;
- FAO should continue assisting countries to revise their agricultural policies and institutional arrangements along the concept of AIS towards participatory, pluralistic and decentralized knowledge system with the aim to increase the AI system effectiveness and focus on enabling family farms, including rural advisory services and e-Agriculture strategies;
- FAO can help countries develop new capacities, required by the AIS actors, e.g. facilitation, brokerage, communication skills and governance of innovation;
- FAO is in a position to provide a meeting ground for countries in the region and worldwide and act as neutral broker for knowledge sharing on transforming the AISs in EECA towards more efficient, inclusive, decentralized and pluralistic systems.

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Annex 1

Data on agricultural holdings in EECA

Table 1: The total number of agricultural holdings (thousands), and shares (in percent) in the number of holdings (red text) and agricultural area (blue text) by land size class (ha) in nine EECA countries, and Italy and the UK¹⁰ (various recent years according to data availability).

Country	No. holdings	<1	1-2	2-5	5-10	10-20	20-50	>50
Albania	324	60	7	30	11	10	83	..
Bulgaria	370	77	7	20	8	..
Croatia	450	51	6	16	7	19	20	9
Czech Rep.	23	29	0	15	0	17	1	11
Georgia	730	70	24	23	23	5	12	1
Hungary	967	27	2	13	1	19	3	11
Italy	2591	38	2	19	4	21	9	10
Kyrgyzstan	1131	85	8	7	8	5	15	2
Lithuania	611	0	0	8	1	47	14	23
Poland	2933	33	3	18	5	21	13	15
Romania	4485	50	5	20	8	23	20	6
U. Kingdom	233	14	0	9	1	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 was not see collectivization) 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.

¹⁰ Italy and the UK are included for comparison as examples of major northern and southern European countries.

Annex 2

Theoretical analysis of the agricultural innovations and AISs

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 organizations. Sustainable intensification means ‘producing more with less’, and can only be achieved through innovation¹¹.

Farmers can innovate in different ways. Change can involve farm products, production processes and/or farm organization and management. In addition to facilitating sustainable intensification, innovations help 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, 2014a).

Therefore, 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 business sector has made some bold commitments to systematic innovation; yet the agricultural sector, responsible for feeding the world of humans and animals, is only just beginning to explore more systematic and system-based approaches.

Innovations do not occur in isolation with the innovators (farmers, business, academia, NGOs etc.) being not the sole agents of change. The innovations are related to all kinds of changes in different levels and systems. As set out above, Hartwich (2013) suggests that three main factors (*process, policy and people*) influence the progress of innovation. 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 individuals.

The history of our understanding of AIS is rather complex. Driven by the imperatives of world’s economy after the Second World War, the development of new agricultural innovations was the prime responsibility of the public sector research and agriculture extension service, in a top-down approach, considering agricultural research as provider, extension services as mediator and farmers only as recipient of knowledge. In the 1980s, during the “perestroika”, this model was enriched by recognizing other actors taking part of the agricultural knowledge system as private sector and assigning new roles of the traditional players, thus transforming the linear knowledge flow into a more decentralized model. A further stage of knowledge systems evolution was Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) (FAO and WB, 2000), which integrated education, research and extension having equal contribution for agricultural development. Farmers are seen already as partners, not only recipients of knowledge (Alexandrova, 2011). 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

¹¹ Numerous definitions of ‘innovation’ exist in the literature, see e.g. FAO (2012). The theoretical nature of agricultural innovation is still not fully understood. Innovation is often used as a synonym of a new technology or product, however a new plant variety can be considered as innovative only after its economic, environmental or social benefit for the farmer has been proven in practice.

was dominated by the public sector and characterised by a ‘linear’ 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 different forms of interaction” (p.2). Thus, increasingly, innovations are generated in a network setting. To support network building, social learning and conflict management, the traditional communication and knowledge-sharing strategies should be expanded to include network brokerage, demand articulation, visioning, facilitation, and others, hence the need that all actors adopt new skills, outside of their professional specialization, e.g. expertise in communication, facilitation, management, including of natural resources and climate change adaptation (Alexandrova, 2011).

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
Organizing 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 of 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 agricultural innovation system (AIS) is now promoted as a more effective and efficient instrument to reach agricultural policy goals. Applying the AIS concept in practice involves a paradigm shift. For example, several countries in EECA are currently engaged in improving their rural advisory services. Many of them concentrate on organizational changes or capacity building activities

but a problem-solving approach would involve a holistic assessment of, and reforms in, agricultural research and education policies, legislation regime for cooperatives, enabling mechanisms for public-private partnerships, financial schemes etc.

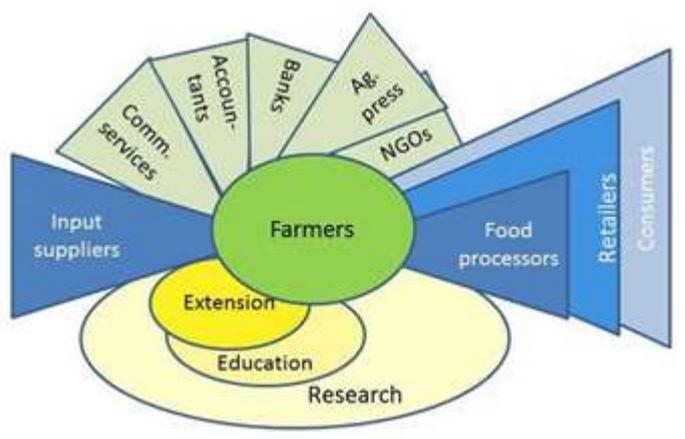


Figure 1: Actors in the AKIS directly relevant to agricultural innovation in the food chain.

Source: SCAR (2012).

Annex 3

Tropical Agricultural Platform on agricultural innovations

Innovation has a high potential for increasing productivity and farmers' income, and consequently reducing poverty and improving food security. However several tropical countries lack the resources and capacities to suitably develop their agricultural innovation systems. To address this gap, the G20 established the Tropical Agriculture Platform (TAP), a multilateral dynamic facilitation mechanism, which fosters better coherence and greater impact of capacity development for agricultural innovation systems in tropical countries. To date, TAP has over 40 Partners, including agricultural research institutions, regional and global fora and donor organizations.

The strategic goal of TAP is to contribute to the development of national capacities in agricultural innovation in the tropics. TAP's activities enhance the integration of regional and international capacity development programmes, encouraging interventions to be aligned with national plans and policies. The platform will strengthen existing partnerships and broker new ones between actors of all types, facilitating the emergence of agricultural innovation systems that increase farmers' income, food security, nutrition and environmental sustainability. Ultimately, small and medium-scale producers will benefit from TAP's activities.

Based on three regional assessments, TAP partners agreed on an Action Plan with global and country-level activities. A Common Framework on capacity development for agricultural innovation systems is developed, including tools for the assessment of capacity development needs at policy, organizational and individual levels, as well as tools for design, M&E and impact assessment of capacity development interventions. The Framework is validated through country-led multi-stakeholder processes and its adoption is advocated through global and national policy dialogues. This should result in better defined capacity development needs of the various stakeholders along value chains and increase the coherence of capacity development interventions. TAP supports countries to apply the Common Framework, to build partnerships and capacity development programmes that lead to demand-driven, efficient and sustainable agricultural innovation systems.

The TAP operates through:

- Policy-dialogue space – Allowing for greater dialogue and interaction among stakeholders to enhance clarity and coherence of national policies for capacity development in agricultural innovation.
- Marketplace – Promoting and brokering existing demands and offers in capacity development for agricultural innovation.
- TAPipedia – Offering a global information system for innovation outputs, success stories, , lessons learned, and analyses of impacts.