



Food and Agriculture Organization
of the United Nations



APPROACHES TO STRENGTHENING AGRICULTURAL INNOVATION SYSTEMS (AIS) IN CENTRAL ASIA, SOUTH CAUCASUS AND TURKEY

INSIGHTS BASED ON ASSESSMENTS OF STRENGTHS AND
WEAKNESSES OF THE AIS IN KYRGYZSTAN, TAJIKISTAN,
UZBEKISTAN, AZERBAIJAN AND TURKEY

OCCASIONAL PAPERS ON **INNOVATION IN FAMILY FARMING**

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Prepared by

E. Katz Riaz, J. De Meyer, B. Dosov and K. Nichterlein

In cooperation with and with contributions by:

S. Karimov (Tajikistan); S. Karasartov, P. Jooshov and the teams of the Rural Advisory Services in Talas and Naryn (Kyrgyzstan); I. Gürbüz and U. Kirmizi (Turkey); and R. Balaev and R. Huseyn (Azerbaijan)

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CONTENTS

Acknowledgements	v
Abbreviations and acronyms	vi
CHAPTER 1	
INTRODUCTION	1
1.1 PROJECT BACKGROUND	1
1.2 BRIEF ABOUT THE PROJECT	2
1.3 PROJECT IMPLEMENTATION.....	3
1.3.1 Steps for country studies.....	3
1.3.2 Sub-regional synthesis	4
1.4 CHARACTERISTICS OF STAKEHOLDER ORGANIZATIONS INTERVIEWED.....	5
1.4.1 Organizations interviewed per country	5
1.4.2 Main functions of organizations interviewed	5
1.5 CASE STUDIES.....	5
CHAPTER 2	
AGRICULTURAL INNOVATION SYSTEMS – CROSS-CUTTING INSIGHTS FROM THE PARTICIPATING COUNTRIES.....	7
2.1 INSTITUTIONAL AIS LANDSCAPE.....	7
2.1.1 Agricultural research.....	7
2.1.2 Commercial stakeholders.....	8
2.1.3 Advisory service system.....	10
2.1.4 Farmers, value chains and agricultural professional organizations.....	12
2.2 INNOVATION PATTERNS	13
2.2.1 Areas with strong innovation patterns	14
2.2.2 Areas where [further] innovation is essential	15
2.3 INNOVATION PROCESSES	18
2.3.1 Triggers and drivers of innovations.....	18
2.3.2 Facilitation and coordination functions in innovation processes	20
2.3.3 Typical obstacles to innovation	23
2.4 FINANCING OF AIS.....	24
2.4.1 Research system.....	24
2.4.2 Advisory services.....	25
2.5 STATUS OF INFORMATION AND COMMUNICATION TECHNOLOGY IN THE AIS	26
2.5.1 ICT access and competences	26
2.5.2 Use of ICTs for communication in AIS.....	27
2.5.3 Conventional means for information dissemination to agricultural producers	28
2.5.4 Gaps in availability of information	28
2.5.5 Information means that need strengthening.....	30

CHAPTER 3	
WAYS TO ADDRESS KEY CONSTRAINTS IN AIS.....	31
3.1 POLICY ISSUES	31
3.1.1 Public investments in Advisory Services	31
3.1.2 Innovation policies and strategies	33
3.1.3 Smart and efficient financial incentives for innovation	34
3.1.4 Innovation funds – unified funding mechanism for innovation	34
3.1.5 Measures to enhance effectiveness of research.....	35
3.2 INNOVATION MANAGEMENT ISSUES	36
3.2.1 Access to agricultural innovation information	36
3.2.2 Capacity development for innovation	37
3.2.3 Innovation fairs	38
3.2.4 Innovation facilitation and coordination functions.....	38
3.2.5 Changing mind-sets towards innovations in agriculture.....	40
3.2.6 Facilitate complementary use of ICT and other communication means	41
3.3 OTHER ASPECTS	42
3.3.1 Strengthen awareness about agriculture as a sector with perspectives and importance.....	42
3.3.2 Innovation in agricultural market systems	42
References cited	45
ANNEX 1	
SHORT DESCRIPTIONS OF THE CASE STUDIES.....	46
ANNEX 2	
TRIGGERS AND DRIVERS OF INNOVATIONIN CASE STUDIES	48

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ABBREVIATIONS AND ACRONYMS

AIS	Agricultural Innovation System
AGRIDEA	Swiss Centre for Agricultural Extension and Rural Development
AS	Advisory Services
CA	Central Asia
CA&AZ	Central Asia and Azerbaijan, namely the study countries of Azerbaijan, Kyrgyzstan, Tajikistan and Uzbekistan
CAC	Countries of Central Asia and South Caucasus
CACAARI	Central Asia and the Caucasus Association of Agricultural Research Institutes
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAO/SEC	FAO Sub-regional Office for Central Asia
FTPP	FAO/Turkey Partnership Programme
GAP	Good Agricultural Practice
GDAR	General Directorate of Agricultural Research and Policy [Turkey]
GDP	Gross Domestic Product
GFAR	Global Forum for Agricultural Research
GFRAS	Global Forum for Rural Advisory Services
ICARDA	International Center for Agricultural Research in the Dry Areas
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IWMI	International Water Management Institute
KRASS	Khorezm Rural Advisory Support Services [Uzbekistan]
M&E	Monitoring and Evaluation
MAWR	Ministry of Agriculture and Water Resources [Uzbekistan]
MFAL	Ministry of Food, Agriculture and Livestock [Turkey]
MOAM	Ministry of Agriculture and Melioration [Kyrgyzstan]
NARES	National Agricultural Research and Extension System
NGO	Non-governmental Organization
PF	Public Foundation [legal form of non-governmental organizations in Kyrgyzstan]
R&D	Research and Development
RAS	Rural Advisory Services [Kyrgyzstan]
ROI	Return on Investment
SMS	Short Message Services
TAIC	Training Advisory and Innovation Centre [Kyrgyzstan]
TES Centre	Training and Extension System Centre [Kyrgyzstan]
USB	Universal Serial Bus
USD	United States of America Dollar
WTO	World Trade Organisation
WUA	Water User Association
WUASU	Water User Association Support Unit [Kyrgyzstan]

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

During an Expert Consultation for a regional research needs assessment in 2007 in Tashkent (Uzbekistan), it became obvious that the research managers put more emphasis on technology generation in crop production for scientific advance, rather than focusing on solving development problems and assisting farmers in their efforts to adjust to a market economy. The critical gap between technology generation and meeting farmers and market needs was identified as a major issue to be addressed, and research on the cross-cutting issues “extension and technology transfer” and “re-orientation of agricultural innovation systems” was recommended. In response, FAO commissioned a pilot study from the International Center for Agricultural Research in the Dry Areas (ICARDA) in 2008, to assess the agricultural information and communication priority needs of major stakeholders of the National Agricultural Research and Extension System (NARES) in Kyrgyzstan.

In April 2009, a sub-regional workshop on “Enabling the Agricultural Innovation System for Agricultural Development in Central Asia” was organized in Kyrgyzstan, led by FAO and Global Forum for Agricultural Research (GFAR), with participation of representatives of agricultural research organizations, public and private advisory services, farmer organizations, NGOs and ministries in charge of agriculture in Central Asian countries. The objectives of the workshop were to:

- > share the new agricultural innovation systems (AIS) concept, and discuss the role of modern Information and Communication Technologies (ICTs) in agricultural innovation;
- > discuss the results of the pilot study;
- > identify strengths, weaknesses, opportunities and threats associated with AIS in the sub-region, and to identify gaps and opportunities for the improvement of ICT systems through sub-regional cooperation;
- > share best practices on innovation systems and ICT applications for linking agricultural research, extension, policy-makers and farmers in the sub-region, and to create awareness of new challenges and trends in agricultural innovation for development; and
- > identify potential partners and promoters for sub-regional collaboration, and to formulate an outline of a framework for future sub-regional collaboration.

The participating stakeholders recommended addressing the issue of Agricultural Innovation Systems (AIS) as a priority in a future collaboration scheme. It was agreed that an in-depth analysis of the national AIS of all participating countries was needed in order to develop a sub-regional strategy for improving AIS in the countries. In consequence, the project “Capacity Development for Analysis and Strengthening of Agricultural Innovation Systems (AIS) in Central Asia and Turkey” was designed, and realized in 2011–2013.

1.2 BRIEF ABOUT THE PROJECT

The main purpose of the project “Capacity Development for Analysis and Strengthening of Agricultural Innovation Systems (AIS) in Central Asia and Turkey” was to assess the strengths and weaknesses of the current AIS in each participating country, to identify gaps and opportunities for improvement, and recommend follow-up actions for the improvement of innovation systems for farmers and rural people, thereby facilitating market orientation, income diversification, environmental protection and adaptation to climate change.

The expected outcome of the project was an increased capacity at national and sub-regional level to analyse existing AIS, in order to identify gaps and recommend interventions to strengthen AIS. As a result of the project, the following outputs were produced:

1. In-depth country studies on the AIS in each participating country, including at least three case studies per country with examples of successful innovation processes that benefit small-scale farmers.
2. An inter-country comparison and sub-regional synthesis of the AIS analysis, including suggestions on how to develop the AIS in the participating countries further and address constraints to innovation.
3. Three trained national resource persons per participating country (15 altogether) for analysis and strengthening of AIS, connected in a sub-regional network of trained resource persons.
4. A sub-regional project document for actions to strengthen AIS, based on the weaknesses and ways for improvement identified in the course of the project.

This present document represents Output 2 of the project.

1.3 PROJECT IMPLEMENTATION

1.3.1 STEPS FOR COUNTRY STUDIES

In each of the participating countries, the process to develop the country studies included the steps given in Box 1, although in Kyrgyzstan, where in 2008/9 a pilot study was carried out (Mirzabaev et al. 2009), the process was adapted. Instead of the complete study steps, only case studies were conducted, and those aspects of the pilot study where substantial changes took place were updated. No extensive interviews were carried out, but stakeholders contributed their experiences, views and knowledge about those aspects through a national workshop. The country studies were conducted between spring 2011 and spring 2012 in most of the participating countries. In Azerbaijan, the project was carried out between February and May 2012.

Box 1

STEPS FOR COUNTRY AIS STUDIES

1. Identification of main stakeholders in the national AIS.
2. Pre-study workshop to introduce the AIS concept to stakeholders, to inform them about the project, and to identify three suitable case studies on innovations that took place in the country's agricultural sector.
3. Structured interviews with stakeholder organizations based on a common questionnaire, and study of secondary documents.
4. Elaborate three case studies of successful innovations benefiting small farms through key informant interviews and desk research, in order to identify success factors and triggers for innovations.
5. Data analysis to determine strengths and weaknesses of the AIS, as well as opportunities for improvement.
6. Validation of study results with national stakeholders in a post-study workshop.
7. Preparation of final study document based on interviews, case studies, other contributions by stakeholders, and secondary information sources.

1.3.2 SUB-REGIONAL SYNTHESIS

After completion of the country studies, a sub-regional workshop was held in May 2012 with representatives of all participating countries, as well as representatives of key regional and global innovation system stakeholders (CACAARI, GFAR, GFRAS, ICARDA, FAO), with the following objectives:

- Presentation of the results of the AIS studies in participating countries, and of the sub-regional synthesis.
- Discuss the reports and the inter-country comparison of the agricultural innovations system studies with stakeholders from the sub-region.
- Identification of common issues, gaps and opportunities for regional cooperation.
- Formulation of conclusions and recommendations for sub-regional action to strengthen AIS.

The current publication provides a synthesis based on the five country reports, and the inter-country comparison and discussions from the sub-regional workshop, namely:

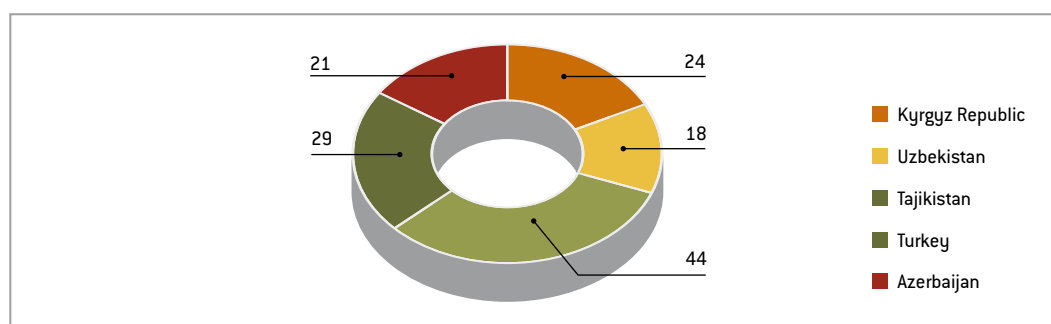
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- Shaibek Karasartov, Payazidin Jooshev, Bakyt Balbaev, Joomart Jumabekov & Elisabeth Katz Riaz. 2012. Assessment of Agricultural Innovation Systems in the Kyrgyz Republic. Country Report, prepared for FAO project GCP/RER/029/TUR.
- Rasul Balaev & Ramil Huseyn. 2013. Assessment of Agricultural Innovation System and related Information and Communication System in Azerbaijan. Country Report, prepared for FAO project GCP/RER/029/TUR.
- Sadi Karimov & Sherali Safarov. 2012. Assessment of Agricultural Innovation Systems and Information and Communication Technology in Tajikistan. Country Report, prepared for FAO project GCP/RER/029/TUR.
- FAO & Ministry of Food, Agriculture and Livestock [Turkey]. 2012. Sub-regional Workshop “Assessing and strengthening of agricultural innovation systems in Azerbaijan, Kyrgyzstan, Tajikistan, Turkey and Uzbekistan”, GCP/RER/029/TUR, 22-25 May 2012, Menemen, Izmir, Turkey.

1.4 CHARACTERISTICS OF STAKEHOLDER ORGANIZATIONS INTERVIEWED

1.4.1 ORGANIZATIONS INTERVIEWED PER COUNTRY

In each of the countries participating, between 18 and 44 organizations were interviewed (see Figure 1), 136 in all. A range of additional organizations participated in the national workshops conducted within the frame of the project, and contributed their views and ideas in this way.

Figure 1. Number of organizations interviewed per country



1.4.2 MAIN FUNCTIONS OF ORGANIZATIONS INTERVIEWED

As Figure 2 shows, the diversity of AIS stakeholder organizations that were included in the study is high. The main function or purpose of the organizations ranged from policy-making and administration (mostly departments of ministries), across research (mainly governmental research institutions) and advisory services (governmental and NGOs with advisory services as main functions, and rural development agencies whose functions include advisory services), to all kinds of private sector stakeholders along agricultural value chains: producers, processors, farmer and professional associations, etc.

1.5 CASE STUDIES

The AIS country studies included two to four case studies each of successful innovations that benefited small-scale farmers, and could serve as examples of how AISs function. Table 1 provides an overview of the case studies conducted, and Annex 1 gives a brief description of each of the case studies.

Figure 2. Main functions of organizations interviewed

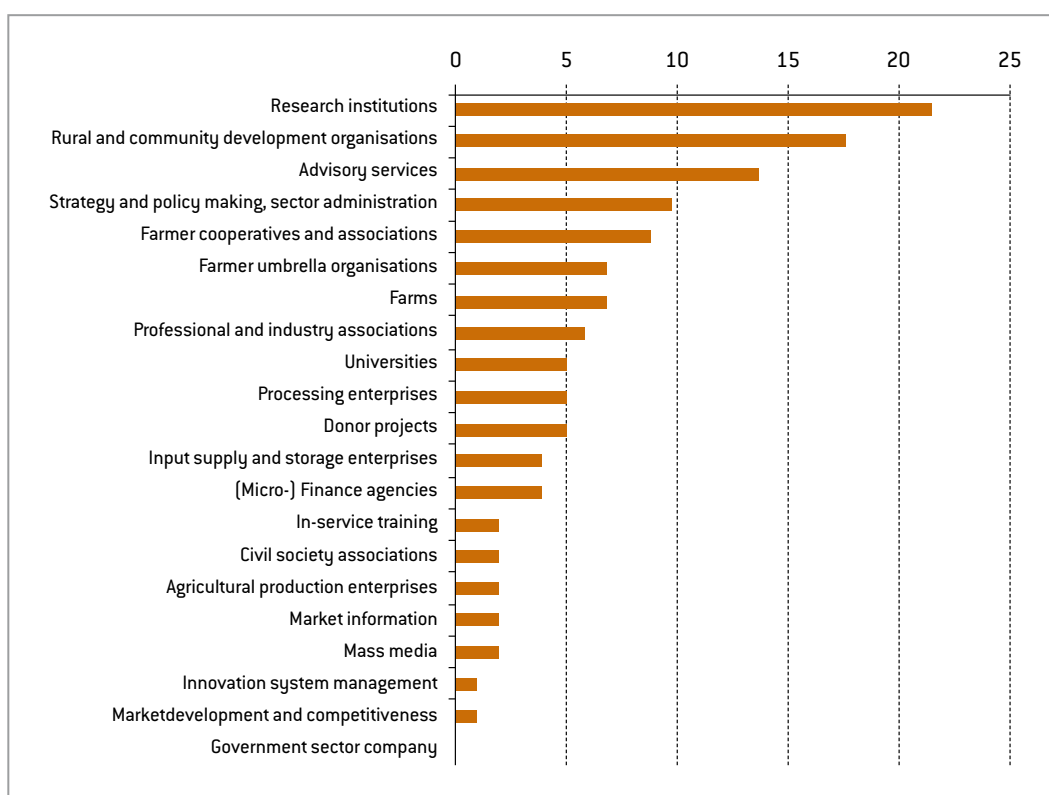


Table 1. Case studies in the five countries

COUNTRY	INNOVATION
AZERBAIJAN	System for quality wheat seed production and dissemination Sugar beet value chain in Aran economic region Development of organic agriculture in Azerbaijan
KYRGYZSTAN	Water Users Associations (WUAs) Bean value chain in Talas region Crop rotation in Naryn region
TAJIKISTAN	Beekeeping Poultry production Animal health – Brucellosis control Access of rural women to land
TURKEY	Tire Dairy Cooperative Cherries in Kemalpassa
UZBEKISTAN	Wheat production Fruit and vegetable processing company Poultry in Samarkand region

CHAPTER 2

AGRICULTURAL INNOVATION SYSTEMS – CROSS-CUTTING INSIGHTS FROM THE PARTICIPATING COUNTRIES

2.1 INSTITUTIONAL AIS LANDSCAPE

The set-up of stakeholders that form the AIS in the countries participating in the project shows some commonalities and some diverging aspects. The Central Asian countries and Azerbaijan (CA&AZ) present many similarities, as is to be expected. Turkey, which benefits from a more established innovation system, has a strong private sector and more responsive government services, differs in many aspects in comparison with CA&AZ.

2.1.2 AGRICULTURAL RESEARCH

In all the countries covered in this study, scientific research is a government domain. All governments maintain a more or less extensive set of research institutions and stations. Kyrgyzstan has four research institutes with a very small number of sub-stations, while Turkey has 60 research institutes and stations. Obviously the numbers are to some extent correlated with the size - both geographically and economically - of the country.

In all of the countries, cooperation of research with advisory services, producers and the private sector were mentioned as not entirely satisfactory. In Kyrgyzstan, Tajikistan and Azerbaijan there are no mechanisms for involving advisory services, farmers and private sector actors in defining research priorities and projects. Mechanisms for feedback about the applicability and use of research outputs and the outcome of research processes in the field are equally unsatisfactory. Moreover, in all the countries, finance allocation to agricultural research is largely not based on competitive, participatory, output-oriented planning and priority setting processes, but on an annual input-based budget. In the majority of the study countries, the interface between research and extension services is also assessed as not functioning effectively. In Uzbekistan, the Ministry of Agriculture and Water Resources (MAWR) plays a strong role in coordinating interaction between research and other AIS stakeholders, and therefore the stakeholders are more satisfied with the cooperation among the AIS actors.

In Kyrgyzstan and Tajikistan (and to a lesser extent in Uzbekistan and Azerbaijan), the agricultural research systems face an acute problem of ageing scientists. A substantial proportion of researchers has reached or will soon reach retirement age. The research institutions fail to attract young people, as incentives are weak and agricultural sciences have lost the prestige they had in the past.

In Turkey, a new policy to foster innovation and to increase partnership between the private and the public sector has been adopted, which opens public research infrastructure and facilities to the private sector free of charge. Currently 100 research projects of private companies are using the infrastructure of the Turkish General Directorate of Agriculture Research and Policy (GDAR). The directorate has also introduced a new competitive grant system open to all actors working in agricultural innovation, including farmer's organizations. The Director General of GDAR recommends that similar systems be adopted in countries in the sub-region to foster innovative partnerships and strengthen the AIS.

Generally in CA&AZ, the research scientists are not familiar with modern research methodology, on neither the technical side nor the procedural side. Insufficient exposure of scientists to modern research methodologies, and therefore reliance mainly on outdated and cumbersome methodologies, is an obstacle to effectiveness of research. Truly participatory research on-farm is still rare. Further, laboratories and other research facilities are often in a bad shape, and need to be upgraded and renovated to enable effective research work.

2.1.2 COMMERCIAL STAKEHOLDERS

Private commercial stakeholders play an important role in the AIS of all the participating countries. Private companies frequently trigger and drive innovation. Government actors tend to underestimate the private sector's role in the innovation system, as is evident in many AIS-related documents, and from the fact that very few private sector players are invited to AIS-related discussions.

Private commercial stakeholders typically include seed production and supply entities, input supply, machinery and equipment supply, financial institutions, processing units and traders. In Uzbekistan, a government-owned commercial company plays an important role in the grain value chain. Although farmers in principle are also private commercial actors, they and their organizations are presented in a separate section.

In Turkey the private sector, primarily processing and traders (both as private companies or cooperatives), is the main driving force for innovation. Turkey has a large and fast developing domestic consumer market, with the European markets, with their high purchasing power, on its doorstep. Demand and opportunities for innovation come from these markets. The other AIS stakeholders, including advisory services, research, and government policy-makers, support private sector innovation with a broad range of knowledge and skill services, financial incentives and other policies, e.g. regulatory systems to satisfy EU and WTO regulations.

The conditions for private companies in the agricultural sector in CA&AZ are not fully conducive to them assuming a stronger role in innovation processes. Frequent changes in regulatory frameworks, inappropriate or non-transparent taxation systems and governance issues affect agribusiness actors negatively, in particular local ones. For international companies, the volume of business and inadequate logistics are often not attractive enough. In contrast, in some countries, notably Uzbekistan, the government supports private companies in the agricultural sector with subsidies, preferential taxation, and protection from competing imports, as well as encourages joint ventures with foreign companies for domestic production (e.g. Lohmann-Parranda in the Samarkand poultry sector case study).

In Turkey, many cooperatives are operating like private commercial companies and have developed into substantial agri-businesses, while in CA&AZ very few cooperatives and farmer associations have developed their business to such levels. The cooperative Mol Tushum in Batken in Southern Kyrgyzstan and the farmer holding Sughd Agro Service in Khudjand in Northern Tajikistan are two examples of fairly advanced farmer-owned agri-businesses in CA&AZ.

In CA&AZ, agricultural market players and trading companies in the private sector are inadequately developed. Also, the agro-processing sector is rather weak, although all the governments have its promotion as a policy priority. Consequently, access to markets is a significant problem for the majority of farmers in these countries. This is reflected in the fact that the AIS stakeholders involved in the study in all these countries consider innovations in the marketing system as high on the list of priorities of innovations required (see Tables 2 and 6).

The number of joint ventures of foreign and domestic companies, and foreign companies with factories in CA&AZ is increasing. In Azerbaijan there are many joint ventures with Turkish companies. In Uzbekistan, the Lohmann-Parranda poultry factory in Samarkand is an example. Uzbekistan also promotes joint ventures to produce agricultural machinery and equipment in the country. In Kyrgyzstan, some Russian dairy companies are operating such joint endeavours.

2.1.3 ADVISORY SERVICE SYSTEM

The advisory service systems in the various countries that participated in the study show large differences.

In Turkey, agricultural advisory services are an integral part of the structures of the Ministry of Food, Agriculture and Livestock (MFAL), i.e. government-funded and -provided. The government advisory structures operate at all levels. They are supported by well developed informational and learning materials. Recently, agricultural web TV was initiated through which a large number of learning video films have become accessible to farmers through the internet.

In recent years the Turkish government took the initiative to move to a more pluralistic extension system, and promotes and strengthens private advisory service provision, as government advisory services are not sufficiently effective. Towards this, the government organizes or financially supports training of agricultural specialists as advisers, provides subsidies to farmers for using the services of private advisers, and has established an official certification and monitoring system for private advisers.

In Uzbekistan, advisory services are part of the tasks of agricultural departments, in close cooperation with the research system, although there are no institutions with an explicit mandate for advisory services. The Uzbek stakeholders agreed that the advisory services provided in this way do not satisfy the advisory service requirements of the innovation system. Firstly, they do not cover all farm branches; secondly, they are not available to an adequate number of farms; and thirdly, advisory services are provided in a technology transfer mode, because the personnel providing this technical support have no training in interactive advisory and training methodology. Many outputs of the research systems are not put into practice on farms. The Association of Farmers of Uzbekistan established a few years ago an innovation centre, whose task is to provide advisory services to its members, who comprise around two-thirds of all farms in the country. Once further developed, this centre, through its local branches, can be expected to become a core element of a pluralistic advisory service system. Some other explicit advisory service providers were established with donor support, e.g. Khorezm Rural Advisory Support Services (KRASS), based at the University of Urgench. Under an IWMI water productivity improvement project (with financial support by the Swiss Agency for Development and Cooperation), the capacity of the Basin Irrigation Systems Authorities to provide advisory services on irrigation management, but also crop production, was built up in some locations. The Uzbek stakeholders engaged in this project all consider the further development of advisory services as a high priority, because the current system does not offer access to effective services to the majority of farmers.

Kyrgyzstan has probably the best-developed advisory service system of all countries in Central Asia and South Caucasus. Based on diverse experiences in the second half of the 1990s, in 1999 the government of Kyrgyzstan, with support from World Bank/IFAD and the Government of Switzerland, established the Rural Advisory Service (RAS), a country-wide, semi-governmental, decentralized advisory services system, with farmer councils as governing bodies. Later the RAS was first transformed into a membership-based farmer association structure, and subsequently into a set of regional, independent, non-governmental not-for-profit organizations. At the same time, with German support, a private non-profit advisory organization, the TES Centre, was established in the south of the country. Currently, RAS operates in all *Raions* of the country and forms the core of the advisory service system. In addition, TES Centre and a range of other non-profit advisory services providers are operating in selected locations (as a rough estimate, more than one provider is operating in about half of the *Raions* of the country). Advisory service provision by private commercial stakeholders is currently very rare.

In Kyrgyzstan a separate governmental body with structures at *Raion*, *Oblast* and country level, the Water User Association Support Unit (WUASU) is responsible for specific advisory services to WUAs. It was established with World Bank support and became a permanent government feature through presidential decree. Currently, the government provides staff salaries and donors provide operational funds.

Tajikistan's advisory service system is unstructured and patchy. The government does not really recognize the importance of formal advisory services for agricultural innovation and development. The regional and local bodies of the Ministry of Agriculture provide some advice to farmers. A broad range of donor-supported non-governmental rural development organizations and advisory services are operating in many locations, but far from everywhere. Most of these were established within the framework of international programmes and evolved into independent local organizations. Various international programmes in recent years worked on establishing coordination and cooperation among the diverse advisory service providers, as well as between them and the government. Within the framework of such a programme, Agrodonish, an association of advisory service providers, was established; it has currently around ten members. Sughd Agro Services is a farmer-owned holding providing input and equipment, as well as advisory services. Advisory services are also provided within the framework of the Association of Dekhan Farmers and other farmer organizations.

In Azerbaijan, an advisory service system with regional advisory centres was set up with World Bank support, but did not survive post-completion of the project. Donor projects and a range of local advisory services organizations provide advisory services within the framework of their programmes. The Government of Azerbaijan is now planning and discussing a publicly

supported advisory service system. It is not yet clear what role the existing local Azerbaijani organizations will play in such a system.

2.1.4 FARMERS, VALUE CHAINS AND AGRICULTURAL PROFESSIONAL ORGANIZATIONS

The spread and the strength of organizations of farmers; value chain and sector actors; and of agricultural professional organizations and associations, are very variable between the countries.

In Turkey, many cooperatives and organizations of agricultural professionals are operating. Producer organizations include three major categories, agricultural producer unions or associations, chambers of agriculture and cooperatives. The agricultural producer associations often have been established in support of a specific product, mainly in livestock breeding, and in fruit and vegetable production (examples from the study are cattle, honey, sheep and goat breeding). The Turkish Chambers of Agriculture are highly developed, with a broad mandate that includes vocational training for farmers, representing farmers' interests at all levels and providing assistance to government for formulation and implementation of policies. Producer cooperatives provide a range of commercial services to producers. There is a great diversity regarding their financial resources, number of members and success. Some farmer cooperatives have evolved into agri-businesses of substantial scale. One outstanding example is Tire Dairy Cooperative (which is included in the innovation case studies), located in the well-developed Mediterranean coastal region. It is a sizable dairy processor; has recently started building up a meat branch; operates a livestock feed mill; and provides other services to its members. The country intends to promote and strengthen agricultural organizations further. While much progress has been made in developing producer organizations, through favourable agricultural policies, such as the Agricultural Producer Unions Law that came into effect in 2004 with the objective of improving farmer organizations, the capacities of these organizations need further strengthening, so that they can provide better services to their members. Specifically, in the poorest rural regions in the North-East and East-Central areas, challenges are huge to build farmers' capacity to modernize their production by adopting and using modern technologies (OECD, 2011).

Uzbekistan and Tajikistan have national farmers' associations (Association of Farmers of Uzbekistan; National Association of Dekhan Farmers in Tajikistan), which are promoted and supported by the government and have close links to authorities. In Uzbekistan there is also a Business Women's Association of Uzbekistan. In Uzbekistan at the local level there

are not many farmer organizations. In Tajikistan, there are some sector organizations (e.g. beekeepers' association) and professional associations (association of veterinarians; association of advisory service organizations). At the local level, there are the Dekhan Farmer Associations, and many groups and organizations, often established within the framework of international projects.

In Kyrgyzstan, there is no overarching producer organization at national level. A range of sector associations operate in the country (e.g. sheep breeders, beekeepers, cattle breeders, cooperatives, community seed funds) of diverse strength, as well as a range of professional and industry associations (seed sector, fruit and vegetable processing companies, agricultural input suppliers, veterinarian chamber, cooperatives, credit unions, and a fledgling association of advisory service providers). Further, there are numerous local organizations of varying size and purpose (cooperatives, territorial farmer unions, self-help groups, credit unions, entrepreneurial groups, pasture user unions, and many more). Most of these were established within the framework of international projects. The government sees it as important to promote cooperatives and other forms of cooperation between farms, as farms are considered to be inefficiently small. However, there is so far no clear strategy on how to go about this promotion.

In Azerbaijan, no national-level producer organization exists. At the local level, the degree of organization of the rural population is not very strong. Through internationally supported programmes, some associations have been established, e.g. an association of agricultural input enterprises.

2.2 INNOVATION PATTERNS

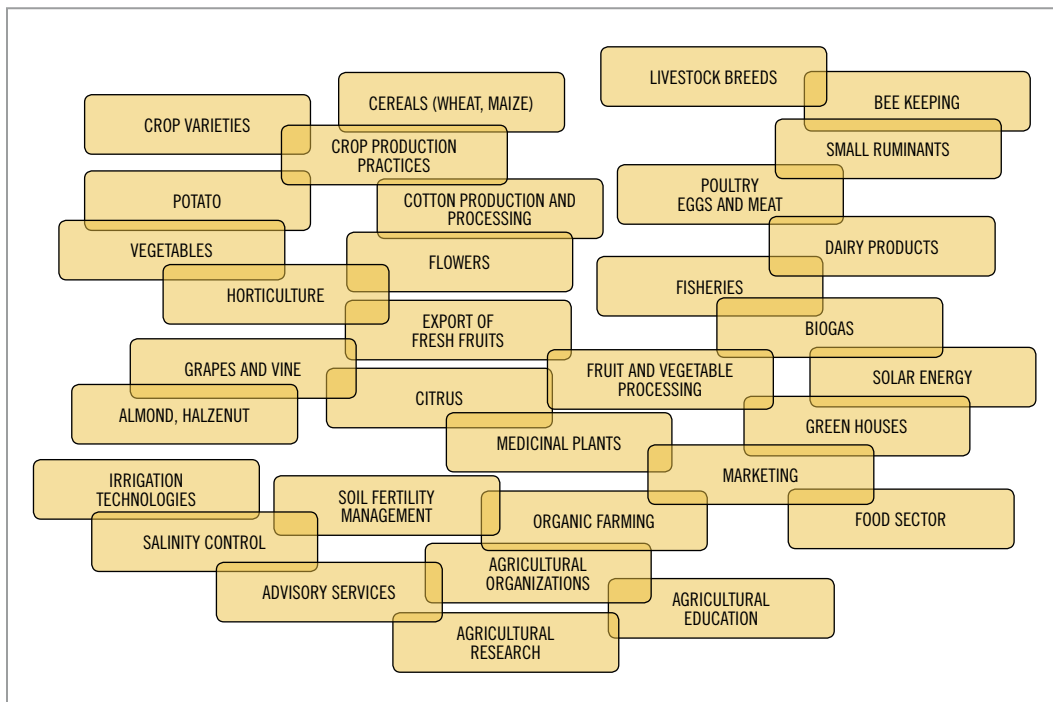
This section looks at sub-sectors, products and aspects where innovation has been and is taking place, and currently where at the time of this study, innovation is considered essential to advance productivity and profitability of agriculture and livelihoods of farmers. Interestingly, the areas identified as requiring innovation were in many cases the same as those mentioned as showing strong innovation patterns. This probably indicates that in dynamic areas, where much innovation happens, there is also high potential for further strengthening the system to realize the full potential of innovation.

2.2.1 AREAS WITH STRONG INNOVATION PATTERNS

In all participating countries, a range of products and activities were identified where in recent years innovation took place and was currently taking place. These innovations were in virtually all sub-sectors. Most of these innovations are thought to result in economic benefits for producers. The Turkish stakeholders mentioned substantially more innovative sectors than those from CA&AZ, reflecting the dynamism of the agricultural sector in Turkey.

Figure 3 summarizes the diversity of activities with strong innovation patterns in the study countries.

Figure 3. Areas with strong innovation patterns (CA&AZ and Turkey)



2.2.2 AREAS WHERE (FURTHER) INNOVATION IS ESSENTIAL

The AIS stakeholders involved in the study in all countries were of the view that there were sectors and aspects where currently innovation was required. In most cases, such innovation could build on innovations already achieved.

Table 2 shows the main areas and aspects where there are opportunities to further strengthen agricultural innovation as identified in explicit or implicit form in the country studies, or discussed at the national post-study workshops and the sub-regional workshop.

The areas with (further) innovation opportunities fall into three types:

1. innovations concerning the functioning of the AIS;
2. innovations concerning specific technical or economic aspects within the agricultural sector; and
3. innovations concerning relevant policies for AIS.

The diversity of issues where innovation is required reflects the notion that innovation is a continuous and iterative process that is never completed, since agriculture is taking place in an ever-changing environment.

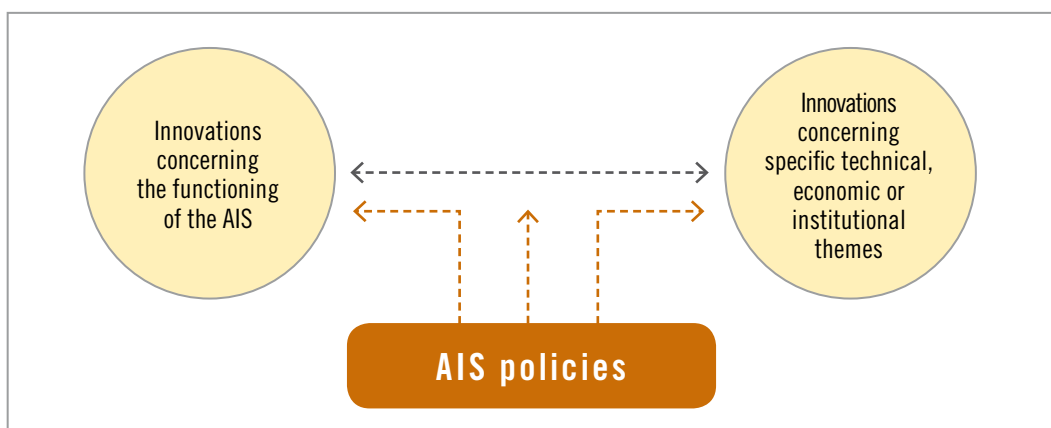


Table 2. Areas where innovation provides opportunity for advancing agriculture

A. INNOVATIONS CONCERNING AIS FUNCTIONING
<p>1. FOSTERING THEMATIC INNOVATIONS</p> <ul style="list-style-type: none"> > Monitoring and assessment system for potential innovations¹ (to identify and evaluate demand and opportunities for thematic innovation, as well as good practices with potential for wider dissemination) > Enhancing research effectiveness and relevance (interactive and practical research methodology; multi-stakeholder determination of research topics; feedback mechanisms; competitive financing; upgrading and renovation of laboratories and other research facilities; etc.) > Linkages among national research scientists and their peers in other countries, both in the region and globally
<p>2. ENHANCED COOPERATION AND PARTNERSHIP IN THE AIS</p> <ul style="list-style-type: none"> > Effective linkages and ways of working together of research and advisory services > Public-private partnerships and other ways for agricultural institutions and private commercial sector to work effectively together > Creation of interaction platforms at country level and sub-regional level for agricultural sector stakeholders and experts > Implementation of joint projects among scientists, advisory services and other AIS stakeholders to adapt and disseminate innovations > Effective mechanisms of facilitation and coordination in the AIS
<p>3. ADVISORY SERVICE SYSTEMS</p> <ul style="list-style-type: none"> > Advanced, effective and sustainable systems for dissemination of thematic innovations (advisory service systems) among farmers > Documentation of successful innovations and good practices > System of access to information about innovations, and agriculture in general, for agricultural professionals and for farmers > Field training and demonstration centres based on advanced, innovative farms > Annual regional (or national) agricultural innovation fairs > More information and learning materials adapted to different target audiences and using local languages > Better internet access and ICT competence in rural areas (for agricultural professionals as well as farmers)
<p>4. FINANCING INNOVATION PROCESSES</p> <ul style="list-style-type: none"> > Creating an innovation fund with competitive selection mechanism for innovation projects > Mechanisms of complementary funding for research (in addition to government funding) > Options for a sustainable mix of financing sources for advisory services > Mechanisms for government to support a pluralistic advisory service system > Attraction of international partners and finance
B. THEMATIC INNOVATIONS IN THE AGRICULTURAL SECTOR
<p>5. PRODUCTION TECHNOLOGY AND PRACTICES</p> <ul style="list-style-type: none"> > Innovative technologies for livestock (housing, feeding, breeds, milking) > Horticulture > Advanced technologies in vegetable cultivation > Greenhouse technology > Dairy production > Beekeeping > New varieties and breeds for specific crops and livestock types > New production technologies for specific crops and livestock types > Seedling production for vegetables > Sustainable irrigation practices (e.g. preventing erosion) > Environmentally sound production practices > Minimal and zero tillage





<p>6. ECONOMIC, MARKET AND QUALITY ISSUES</p> <ul style="list-style-type: none"> > Agricultural value chain and market systems development > Farm economic analysis, monitoring and planning > Establishment of joint enterprises > Establishing GAP standards and systems > New approaches to farm management > Certification system for organic production > Food safety and quality management system
<p>7. INFRASTRUCTURE, EQUIPMENT AND MACHINERY</p> <ul style="list-style-type: none"> > Mini-processing facilities (dairy, fruits, vegetables) > Agricultural machinery for small farms > Drip irrigation (zones where drip irrigation is feasible; economic viability; technical recommendations on its use in different crops and zones; feasibility of different types of drip equipment under different conditions; market mechanisms for their introduction) > Mechanization > Development of innovative infrastructure > Storage technologies (e.g. for fruits)
<p>8. SPECIFIC APPROACHES IN THE AGRICULTURAL SECTOR</p> <ul style="list-style-type: none"> > Expanding organic farming > Science-based resource-conserving and ecologically clean production > Cultivation of rainfed lands > Green economy > Resource recycling
<p>9. INSTITUTIONAL ISSUES</p> <ul style="list-style-type: none"> > Effective system for testing and releasing new varieties > Appropriate role and functions of Ministry of Agriculture > Organization and promotion of cooperatives and other forms of cooperation among farms
<p>10. INCENTIVES AND FAVOURABLE CONDITIONS FOR INNOVATION</p> <ul style="list-style-type: none"> > Appropriate credit products and access to them for a wide range of farmers and other value chain actors > Mechanism for farmers and other value chain actors to reduce risk when introducing innovations > Subsidies, other governmental incentive mechanisms and favourable tax regimes for promotion of innovations
<p>11. HUMAN RESOURCES FOR AIS</p> <ul style="list-style-type: none"> > Measures to attract young people to agricultural professions > Competences for innovation management > Modern systems of capacity development for scientists and other agricultural sector professionals, including farmers > Capacity in economic, market and policy research > Collaboration between agricultural education and other AIS stakeholders (research, advisory services and others)
<p>C. INNOVATION POLICY</p> <ul style="list-style-type: none"> > Elaboration of innovation policies and strategies (national and maybe regional) > Participation of all stakeholders in developing policies in the agricultural sector > Ensure information about policies and reforms in the agricultural sector is accessible for all stakeholders > Documentation, discussion and dissemination of concrete evidence of the crucial role of research and advisory services in promoting innovation in the agricultural sector

¹ The topics in bold text were mentioned as priorities by at least one of the project countries

Source: Synthesis of information from country studies, national workshops and sub-regional workshop (see 1.3.2)

2.3 INNOVATION PROCESSES

Farmers have been innovating and adapting their practices since agriculture began. In recent times, value chain actors and agricultural institutions have started playing a role in innovation processes. Innovation processes take place in many different ways. They are complex and context-specific. Few innovations just appear. Mostly, innovations are evolving in iterative and longer-term processes, over several, sometimes many, years. Many innovation processes appear never completed. They consist in fact of a complex of many smaller and larger innovations, reflecting a sequence of change here and change there.

In order to understand how innovation processes can be strengthened, it is helpful to look at and analyse past and on-going innovation processes. This study tried to identify typical features of innovation processes in the participating countries, and looked at a number of questions: How do innovation processes typically evolve? Which factors trigger or kick off an innovation? Which factors and actors drive them ahead once an innovation process is initiated? Is there any facilitator or coordinator of the innovation process? What is the role of the government in the innovation process? What role do the other main stakeholders have? The innovation case studies, as well as the experiences of the diverse country stakeholders, provide insights into these questions. They also provide answers concerning factors that are obstructing innovation.

2.3.1 TRIGGERS AND DRIVERS OF INNOVATIONS

The 14 innovation case studies undertaken within the framework of the project provide insights into typical triggers and drivers of innovations in the project countries. Table 3 shows the most important triggers and driving factors observed in the case studies, with the number of case studies and the countries in which they play a key role. In Annex 2, the triggers and driving factors for each case study are listed.

Table 3. Innovation triggers and driving factors identified through case studies and stakeholder workshops

TYPICAL INNOVATION TRIGGERS AND DRIVING FACTORS ⁽¹⁾	No. OF CASE STUDIES	COUNTRIES ⁽²⁾
Financial incentives (subsidies, preferential taxation) for producers or private companies by government	7	AZ, UZ, TR
Government programme to realize a particular policy	6	AZ, TJ, UZ
Initiative and support by international development actors	5	AZ, TJ, KG, UZ
Domestic market opportunity and increased prices for particular farm products	5	AZ, TJ, UZ, TR
Initiative by private commercial companies (production, processing and trade)	4	AZ, UZ, KR
Export market opportunity and increased prices for particular farm products	3	KR, TJ, TR
Specific government policy (self-sufficiency, food security)	3	AZ, UZ
Severe problem threatening livelihoods or economy, or both	3	KG, TJ
Keen interest by farmers as a result of benefits and suitable approaches to problem solving	2	KR, TR
Campaign by professional association or advisory service	2	TJ, KG
Initiative by advisory services, know-how provided by advisory services in general	1	KG, TR, UZ
New variety from research institution, research results, know-how of research scientists	1	TR, UZ, AZ
Initiative by cooperative (new professional management in existing cooperatives), rural and farmer organizations in general	1	TR
Access to adequate credit products	–	TR
Changes in management structure (e.g. of Water User Associations)	–	TJ
Land consolidation	–	TR
Government procurement, processing, storage and supply system	–	UZ
Regulation of input and produce prices	–	UZ
Information and Communication Technologies	–	TR

Notes:

[1] It proved to be not possible to clearly differentiate initial triggers and subsequent driving factors. Often the differentiation is a chicken and egg question. Therefore they are combined in the table. Obvious initial triggers are in bold.

[2] Country codes are AZ = Azerbaijan; KG = Kyrgyzstan; TJ = Tajikistan; TR = Turkey; and UZ = Uzbekistan.

When analysing the cases in detail it becomes evident that there are three types of key triggers, which stand at the very beginning of the innovation process and without them the respective innovation would not have happened:

- A problem that severely threatens livelihoods and economy (and some organization engaging in identifying and introducing a solution)
- Government policy decision (and a corresponding comprehensive government programme to implement the policy)
- Domestic or foreign market opportunity (and entrepreneurs, whether private, commercial or cooperative, capturing the opportunity)

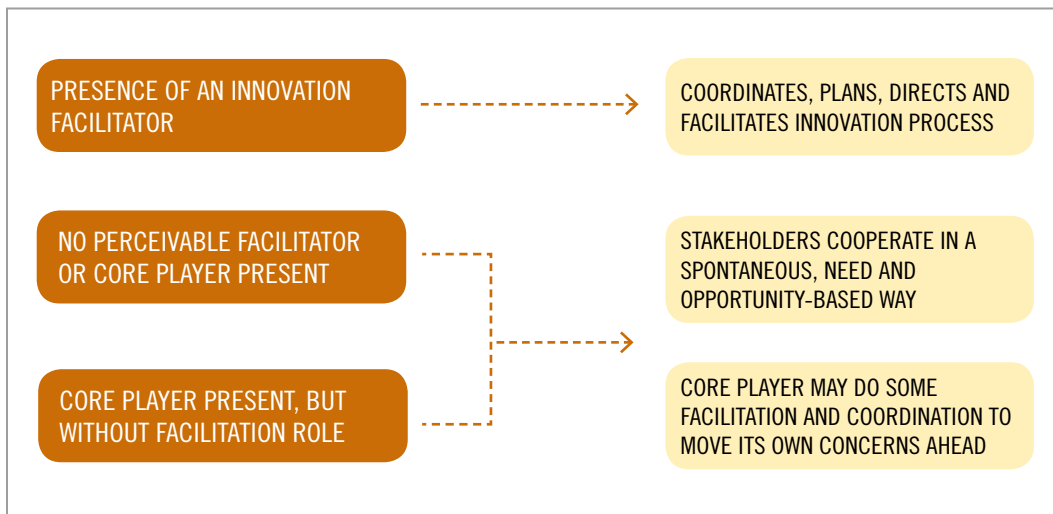
Concerning driving factors and actors in the course of the innovation process, the following insights appear:

- In about half of the innovations, some forms of financial incentives from the government were an important driving factor, either for farmers or for private enterprises. In another third, international financial support was essential, which often also implied financial incentives of some type.
- Farmer organizations, government, private commercial companies, an advisory service organization, and a professional association appear as leaders of innovation processes in the case studies. Note that the leader function should be viewed as constant main driving actor, but is not the same as a facilitator or coordinator (see next section for more explanation).
- Access to knowledge and skills development through some form of advisory services (training, consultations, accompanying farmers in innovation processes on their farms, linking between farmers and other actors) consistently appear as an indispensable driving element (with the possible exception of the bean value chain in Talas). These advisory services are, however, not always provided by explicit extension organizations, but also by diverse other institutions, including research.
- Research institutions are producers of knowledge and service providers in many of the case studies. They do not appear as leaders and facilitators of innovation processes, but their work plays often an important role, e.g. in seed sector development (Azerbaijan), or variety development and transfer of innovative know-how (Uzbekistan). In a case study of cherry in Kemalpaşa (Turkey), a research result, namely breeding of Europe's earliest cherry variety, was a key innovation trigger. It also should be noted that agricultural research institutions in the region play a role mainly in technical innovations on the production side, but rarely in innovations concerning marketing and organizational innovations.
- Interestingly, none of the case studies mentions business development services for commercial stakeholders as playing any role. It may be that the investigators overlooked this factor, or it reflects the fact that business development service markets are very little developed in Central Asia and Azerbaijan. But even in Turkey, business development services do not appear as a factor in the innovation system.

2.3.2 FACILITATION AND COORDINATION FUNCTIONS IN INNOVATION PROCESSES

Facilitation and coordination in the case studies

Also interesting is to look at the function of innovation facilitators or coordinators in the case studies. This shows that there are cases with and without facilitator or coordinator. In around half of the case studies, there is a clear and more or less formal facilitator or coordinator of the innovation process; in the other half this function is absent. Three models concerning innovation facilitation can be distinguished.



Model 1. Comprehensive government programmes (e.g. wheat in Uzbekistan), international projects (e.g. WUAs in Kyrgyzstan), a professional association (e.g. veterinary association in Tajikistan) or an advisory service (e.g. crop rotation in Kyrgyzstan) acted as facilitators or coordinators, leading, coordinating, planning, directing and facilitating the innovation process.

Models 2 and 3. In the other cases, there is no perceivable facilitator or coordinator. In some of these there is no core player at all (e.g. bean value chain in Talas); in others there is a core player, but without an explicit facilitation or coordination function (e.g. Tire dairy cooperative in Turkey; fruit and vegetable processing enterprise in Uzbekistan; Azersun sugar company in Azerbaijan). Here stakeholders cooperate in the innovation process in a spontaneous, need- and opportunity-based way. Uncoordinated collective action takes place. The core players without explicit facilitation and coordination function are all commercial entities, which aim at making their business successful and profitable, and may engage in facilitation and coordination in the innovation process as much as it serves their business interests.

Overall innovation facilitation and coordination function in AIS

The study countries have different situations concerning innovation facilitation and coordination functions.

In Uzbekistan, the government is in the driver's seat concerning innovation processes. The government coordinates innovation at the overall system level, as well as at the local level. Uzbekistan is alone among the study countries in having a government body with an explicit

mandate to promote, facilitate and coordinate innovation in the agricultural sector, namely the Scientific Innovation Centre in the Ministry of Agriculture and Water Resources. Its main goal is to promote innovations resulting in economic growth and competitiveness in the agricultural sector, e.g. through identification and assessment of innovative equipment and technologies, and elaborating programmes to introduce promising innovations, establishing a portfolio of contract research projects, supporting introduction of research results into the practice of agricultural enterprises, monitoring of research and innovation activities of research institutions and universities, assessing number and economic effects of innovation projects in departments of the Ministry of Agriculture and Water Resources, and supporting capacity building for the creation and dissemination of innovations in the sector.

In Turkey, the government also takes a strong role in innovation processes, but much more through a governing, supporting and facilitating function than as an overall coordinator. All stakeholders play their designated roles in innovation processes, but no institution has a mandate for overall coordination, and such a mandate does not appear to be felt as obviously lacking in the system.

In Azerbaijan and Tajikistan, the government takes innovation-relevant policy decisions and implements government programmes to drive the adoption of specific technological innovation. However, there is no body with an explicit innovation coordination or facilitation function at the system level. At local level, advisory service and farmer organizations sometimes act as innovation facilitators.

In Kyrgyzstan, the government has no explicit approach for promoting, facilitating and coordinating the process of innovation, neither at the system nor at the local level. Under the Ministry of Agriculture and Melioration there is a unit for innovation and science. However, the mandate of this unit is not well defined and it deals mainly with the research system. The Training Advisory and Innovation Centre (TAIC) has assumed the function of an innovation facilitator at the system level, and of a liaising body between research and advisory services. However, until now, TAIC is still exploring how to put this function into practice, and it is uncertain whether it will be able to continue to develop this function in the coming years, as it is expected that there will no longer be donor support for this function. At the local level, the diverse advisory service organizations act sometimes as innovation facilitators.

Some of the case studies show that innovation also happens spontaneously without any facilitation, coordination or direction. Nevertheless, the experiences in CA&AZ show that adequate facilitation and coordination, combined with other measures to promote innovation, is

more successful in driving innovation processes. Governments should ensure that facilitation and coordination take place; this, however, does not mean that a government institution has to perform the function itself, as it can as well mandate appropriate AIS stakeholder organizations with this role. However, it is essential that the institution and the personnel entrusted with facilitation of innovation have the necessary technical and social competences.

2.3.3 TYPICAL OBSTACLES TO INNOVATION

A range of barriers to innovation were mentioned by the stakeholders (Table 4). Knowledge deficiencies at all levels and scarcity of financial means for investments and to carry out innovation tasks are widely considered to be the most important barriers. Only in Turkey were financial means not among the most important barriers. If Turkey is excluded from the ranking, financial means become the first and most important obstacle.

Table 4. Barriers to innovation and their importance

BARRIER	IMPORTANCE	REMARKS
Knowledge deficiencies (at all levels)	Of highest importance	Highly important in all countries
Insufficient financial means		In top position in CA&AZ; less important in Turkey
Inadequate collaboration with other stakeholders		Highly important in all countries
Scarcity of qualified personnel	Very important	Important in CA&AZ; not an issue in Turkey
Low wages and revenue in agriculture		
Poor linkages between knowledge generators and users		Tajikistan, Kyrgyzstan
Insufficient government ownership and engagement to enable innovation		
Unattractive for investment due to high risks	Also important	Not important in Turkey
Insufficient government incentives		
Weak collaboration with private companies		High ranking in Turkey; less important in CA&AZ
Traditions		Not an issue in Turkey
Inadequate ICTs		Not so important in Turkey
Difficult access to profitable markets		

Source: Synthesis of information from country studies and national workshops

2.4 FINANCING OF AIS

2.4.1 RESEARCH SYSTEM

The country studies indicate that research in all the countries is largely government financed, although some private sector funding might be present, but was not specifically mentioned during the interviews. International donors provide occasional support, but so far no large-scale support to reform and strengthen research institutions has been provided in CA&AZ. Contract research is very rare.

The public research institutions are severely underfunded in CA&AZ. Based on information from IFPRI, a developing country should use at least 0.5 percent and ideally up to 1 percent of its agricultural GDP for financing research and development. Public spending on agricultural research is 0.01 percent in Kyrgyzstan, 0.04 percent in Azerbaijan and 0.13 percent in Uzbekistan (these figures do not include private sector and donor financing). In Turkey, the annual budget of the governmental research institutions makes up 0.21 percent of agricultural GDP (excluding donor funding). In Turkey, unlike in CA&AZ, substantial private sector research, which complements public research, takes place. For Tajikistan, no separate figures for research financing are available, but they are estimated to be similar to the other CA&AZ countries. To put these figures into context: in 2008, high-income countries spent on average 3.07 percent and developing countries 0.54 percent of their agricultural GDP on public agricultural research (Beintema et al. 2012). For Kazakhstan, as another Central Asian country, this figure amounts to 0.37 percent. China spends around 0.5 percent in 2008 (Chen et al 2012) and India 0.4 percent in 2009 (Stads and Rahija 2012). CA&AZ research spending is thus far below that of other comparable countries. And it is also important to note that although the difference between Kyrgyzstan, Azerbaijan and Uzbekistan does not appear large, Azerbaijan spends 4 times more in percentage terms and Uzbekistan 13 times higher in percentage terms on agricultural research than Kyrgyzstan. These differences are substantial.

In Turkey, research facilities and personnel are made available free of cost for research projects by private sector stakeholders, while in CA&AZ research institutions are looking for ways of attracting funding and contract research projects, in order to top up their meagre budgets.

In Kyrgyzstan, the agricultural research system is neglected so much that only very few relevant research results have emerged from it after independence. The scientists, who are often highly competent in their areas of specialization, are contracted by advisory service organizations and projects as technical experts, but the institutions as such get very little external support.

2.4.2 ADVISORY SERVICES

In Uzbekistan, advisory services are government financed, complemented with minor financing from international partners. Similarly in Turkey, the government finances a substantial part of advisory services through its governmental advisory service system. Here also, associations and private companies increasingly provide advisory services. The government wants to promote more private advisory service provision and subsidizes these.

In Azerbaijan, Tajikistan and Kyrgyzstan, advisory services are to a large extent donor-financed, complemented by some farmer payments and private sector financing.

Although in Kyrgyzstan the government originally established the RAS, it so far does not actively contribute to financing the RAS system. From 1999–2006, RAS was financed through a World Bank loan, which in effect was government financing. Since 2006 there have been no government investments in advisory services, although in 2010 the Ministry of Agriculture and Melioration concluded a service contract with RAS to be co-financed by the Governments of Kyrgyzstan and Switzerland (however, in 2010 in Kyrgyzstan the government changed with associated civil unrest, which resulted in non-payment of the promised government contribution).

As a result, advisory services in Kyrgyzstan currently are strongly donor-dependent (an estimated 80–90 percent of the total financing comes from donors), despite substantial and to some extent successful efforts to mobilize private sector resources, such as processing companies, micro-finance agencies, input and seed suppliers, trading companies, and to increase payment from farmer clients. Some of the advisory service providers have established associated micro-finance agencies, input supply or agricultural trading enterprises, whose revenue can cross-finance advisory services and at the same time enable the respective providers to offer a more complete service package to clients (advice combined with access to inputs, finance and markets). The government recognizes the importance of advisory services for agricultural and rural development; nevertheless it is still not ready to invest financial resources, but is looking for donor support.

In Azerbaijan, the World Bank-established advisory service centres stopped functioning after project funding ended in early 2011. Very recently the government started discussions about investing public finance in advisory services.

2.5 STATUS OF INFORMATION AND COMMUNICATION TECHNOLOGY IN THE AIS

ICTs play an increasingly important role in AIS. In fact, partnership and knowledge exchange are important conditions to foster innovation, and ICTs provide easier and varied means to connect the various actors in the AIS. Unfortunately, and although ICTs are increasingly accessible to people also in developing countries, their power is not (yet) adequately utilized in communication with and among farmers. What is the status of ICT in the AIS of the participating countries? And what options are there for making more use of ICTs in promoting innovation in the agricultural sector in these countries?

2.5.1 ICT ACCESS AND COMPETENCES

In all the participating countries, mobile phones are widely available and used, also in remote areas and by most of the people.

Concerning computers and the Internet—the most essential ICTs apart from phones—as is to be expected, the situation in Turkey is very different from in the other four participating countries. In Turkey, computer and internet access have become commonly available and are fairly widely used also by farmers, at least in the more advanced Aegean and Mediterranean regions, although there is still a clear divide between urban and rural households in internet use, at 49 percent and 24 percent respectively. In some remote regions, connectivity is there, but not all farmers have the capacities and means for utilizing these technologies.

In the Central Asian countries there are still substantial gaps in ICT access and competences, in particular in decentralized offices of AIS institutions, i.e. in rural areas, as Table 5 documents.

Table 5. Availability of computers and internet access, and competences to use these (percentage of interviewed organizations in CA)

		HEAD OFFICES (mostly in capital, some in rural towns)		DECENTRALIZED OFFICES (in rural towns and villages)	
		COMPUTERS	INTERNET	COMPUTERS	INTERNET
AVAILABILITY	No	0–2	5–10	7–25	20–35
	Insufficient	10–25	20–55	25–75	25–50
	Sufficient	75–90	35–70	0–70	25–50
COMPETENCES	Not skilled	5–20		25–60	
	Skilled	75–95		40–75	
RELIABILITY		Only rarely viewed as an issue		Reliability is clearly viewed as less important than in head offices	

Notes: Although the figures appear to show significant variation between countries, these differences in fact originate in differences between types of organizations (i.e. proportion of government institutions)

Source: Synthesis of data from AIS surveys in Uzbekistan, Tajikistan and Kyrgyzstan

Generally government structures are less well equipped and connected than non-governmental organizations (NGOs). Also, their ICT competences are less developed. Research institutions and universities are in a somewhat better position, both concerning equipment and competences. The reason for the better ICT status of many NGOs is to a large extent support from international donors. In Tajikistan and Kyrgyzstan, much of the advisory services are provided by NGOs with external support in terms of finance and capacity development, with the result that advisory services are the best-equipped and most skilled stakeholders in these AIS. In some cases, these organizations, however, find it difficult to maintain their ICT infrastructure, once international support is completed.

In the CA&AZ countries, in principle, internet access is widely possible through USB modems and smartphones, even in many remote rural areas. However, these opportunities are not much used, due to high costs of the services, and more often due to the absence of the required computers and smartphones.

2.5.2 USE OF ICTS FOR COMMUNICATION IN AIS

In general, conventional communication means today still play a much more important role in the AIS in the sub-region than modern ICTs. For personal communication, phone calls (mobile) are still far more important than e-mail. Typical voice-over-IP and other internet-based communication platforms were barely mentioned in the surveys. Government agencies communicate still a lot through common letters and fax. For information exchange and learning, booklets, leaflets, newspapers and direct interaction in training events, seminars, round-tables and meetings are more important than internet-based mechanisms.

However, there are also examples of innovative (for the respective region) use of ICTs:

- Turkey established Agriculture Web TV, through which learning videos on a wide range of agricultural topics are accessible to anybody with a reasonably fast internet access.
- In Kyrgyzstan, video training courses and videos with technical information are also being produced. Video display events with an entry fee failed, as rural people were not willing to pay.
- Market price information is made available through several websites in Kyrgyzstan and Tajikistan. In Kyrgyzstan, this information can also be obtained by telephone. Earlier efforts to make available market price information through using short messaging services (SMS) were discontinued due to low demand.
- In Kyrgyzstan a number of other efforts to use ICTs to disseminate agricultural information are being offered on a small scale:
 - thematic digests that can be downloaded to mobile phones (against payment);
 - local weather forecasts by SMS (against payment); and
 - a micro-finance agency is building up a web-based information market place, which clients will be able to access in the branch offices and get in printed form.

2.5.3 CONVENTIONAL MEANS FOR INFORMATION DISSEMINATION TO AGRICULTURAL PRODUCERS

In Azerbaijan, Tajikistan and Uzbekistan, use of printed materials (booklets, leaflets, manuals) and mass media (newspapers, TV, radio) to disseminate information to farmers are grossly inadequate.

Turkey's extension department has a broad range of information and learning materials for farmers, which are distributed partly free of cost. They identified an innovative approach to financing such materials: some large agricultural sector companies (e.g. a tractor company and a bank) contribute finance for print materials as part of their promotion activities. The department also publishes an agricultural magazine.

In Kyrgyzstan, printed materials (booklets and leaflets) in Kyrgyz and Russian are available on virtually all agricultural topics. New ones are regularly produced and many old ones are updated. The majority of these have been and are being produced with international donor support. However, awareness about the availability of these materials is not sufficiently widespread among farmers, nor among agricultural professionals. As a result of competition, the information materials are not made available through the internet. Some producers of materials do not even maintain a publications list on their sites.

In Kyrgyzstan, several local and national agricultural newspapers are published, often partly financed by international donors, with the result that some of them disappear or become irregular once donor support is phased out. Some of these agricultural newspapers are distributed free of cost to farmers, while others cost between USD 0.1 and 0.3. Also, there are more or less regular TV and radio transmissions on agricultural topics; these are however not systematic and not sufficiently frequent.

2.5.4 GAPS IN AVAILABILITY OF INFORMATION

Professionals in all participating countries face language barriers in access to relevant information from more advanced countries. A key reason is that many of them do not have sufficient command of the English language. In the case of access to international scientific information, in addition to language, costs for subscriptions and individual articles are a constraining factor.

Stakeholders in some countries also mentioned insufficient information and experience sharing between professional AIS actors within the country and in the region. This could be due to perceived competition for funding or scientific recognition between organizations, or more simply due to inadequate opportunities for exchange between professionals within countries, in neighbouring countries, in the sub-region and globally.

Table 6 shows concrete topics about which insufficient information is available in the countries included in the study. They are ranked roughly in accordance with the number of countries in which they were mentioned. Most notable is that information concerning marketing and markets is sorely missed in all countries. In many cases market prices are available, but more important market intelligence information is missing.

Table 6. Topics on which information is insufficiently available (importance ranked based on the number of countries in which the topic was mentioned)

TOPIC	IMPORTANCE
Marketing and markets	Insufficient in all five countries
Financing and credit Research projects and results Agricultural contact and event information Advisory services and advisory service approaches New varieties	Insufficient in three to four countries
Government policies, laws and regulations Agro-processing technologies Input supply and prices Statistical and analytical information about the agricultural sector	Insufficient in at least two countries
Farm planning and economic analysis Irrigation technology Horticulture Livestock Agricultural options for mountain areas Innovative production practices Biological plant protection Potential international partners Project preparation techniques Monitoring and evaluation systems New ways of organizing production Scientific information in Russian Experiences from leading countries Organic certification systems and legislation	Insufficient in at least one country

2.5.5 INFORMATION MEANS THAT NEED STRENGTHENING

The stakeholders suggested that face-to-face as well as technological information means need to be strengthened. Among the face-to-face means to be strengthened are training events, workshops, round-tables and experience exchange events at all levels, as well as fairs, demonstrations and field days, so innovations can be seen in practice and discussed. It was emphasized that it is not sufficient to have more such events, but that to be useful, they need to be responsive to demands and methodologically well designed.

Further, internet-based information and experience sharing mechanisms among professionals should be strengthened, and specialized newspapers and journals be made accessible.

In those countries where they are lacking, printed information materials for farmers, as well as agricultural professionals, should be elaborated.

TV and video are viewed as having high potential for disseminating information to rural communities, and should therefore be used more and developed further.

Although ICTs are considered to have potential, the stakeholders generally are of the view that face-to-face information and learning means continue to be essential for promoting innovation, and need to be further strengthened.

CHAPTER 3

WAYS TO ADDRESS KEY CONSTRAINTS IN AIS

3.1 POLICY ISSUES

3.1.1 PUBLIC INVESTMENTS IN ADVISORY SERVICES

The CA&AZ governments do not yet recognize sufficiently the crucial role of advisory services, and the methodological competences necessary to support innovation at the level of farmers and other rural value chain players. It is not sufficient to have Ministry personnel telling farmers what to do; what is needed is personnel with advisory and facilitation skills to take on the rather new role of brokers of information and linkages. Demonstrations, practical training events, adaptive experimentation and regular interaction between farmers and advisory personnel are required. Advisers need also to assist farmers in economic questions and for more profitable marketing.

It is unsustainable, and actually a big risk for the system, to rely in the longer term on external funding, such as donor funds, to finance the necessary advisory services. Dependence on donor funds results, as the example of Kyrgyzstan shows, in orientation of advisory service providers to donor demands instead of farmer demands, and discontinuous advisory programmes, which come and go with donor programmes.

In principle it does not matter whether advisory services are part of government structures or non-governmental, as long as they are managed professionally, have competent advisory personnel and sufficient resources for operations in the field (and not only to pay salaries). Experience, however, shows that pluralistic, flexible advisory service systems with diverse providers and financing sources, both governmental and non-governmental, are more effective in producing results in farmers' fields and in their pockets, and reduce the financial engagement required from the government, in comparison with fixed, cost-intensive, governmental systems. Public financing is better used only for a part of the services, while other services are financed from other sources, such as farmers, private sector and international organizations. Public funds for advisory services should be used according to demand-led priorities.

In Kyrgyzstan, Tajikistan and Azerbaijan, the governments should allocate budgetary resources to advisory services on a regular basis, as they do also for research. Public finance for advisory services does not mean establishing a governmental advisory service structure. As explained above, it is more cost-effective to build a mechanism for public-private partnerships working through the existing non-governmental structures and combining this with existing governmental advisory services where they exist. Such a system would be in the spirit of a pluralistic advisory service system. The availability of partial government funding will reduce dependence of the system on donors, but will not discourage the non-governmental advisory service providers from intensively striving to develop other financing sources.

In Uzbekistan, it would be useful if the government facilitates complement and expand the current provision of advice through governmental structures. It may do this by supporting the expansion of non-governmental advisory services such as the innovation centre of the Farmers Union of Uzbekistan, or university-based ones such as KRASS, or by investing in strengthening the capacity (methodology!) and broadening the mandate of its own governmental field personnel.

The rationale for public investments in advisory services is that up-to-date knowledge among farmers is an indispensable element of innovation in the agricultural sector, and therefore it is in the interest of the whole society to ensure that farmers have access to the required expertise. The provision of such expertise is not sufficiently profitable to encourage the private sector to provide it adequately through commercial services. International experiences also show that investments in advisory services have a high Return on Investment (ROI) (although no comparisons with ROIs of alternative investments in the agricultural sector are available). A large proportion of countries around the world, including the majority of high-income and upper-middle-income countries, continue to provide public funding for advisory services to farmers.

There are various mechanisms for channelling public finance to non-governmental advisory service providers, for example direct contracting of advisory service providers by government through tender, competitive grant mechanisms for the supply side (service providers) or for the demand-side (farmers and private sector actors), voucher systems, subsidies to service providers for services provided, and core contribution to selected advisory service providers. The governments concerned have to select the most suitable mechanism for them. An innovation fund (discussed below), a form of competitive grant mechanism, which is being tested in various countries, is an option with high potential for results.

Turkey with its strong and largely successful governmental advisory service structures is now moving to a more pluralistic system, and the government is supporting this process with considerable financial support. It finances capacity development of non-governmental advisers, has established a certification system, and subsidizes service provision with substantial amounts. The CA&AZ countries can learn from the Turkish model of governmental support to non-governmental advisory services. In particular their capacity development and certification system is unique, and could be considered and adopted also by CA&AZ countries.

3.1.2 INNOVATION POLICIES AND STRATEGIES

Innovation in the agricultural sector takes place in all the study countries, although apart from Turkey, not at the desired pace. As is to be expected, the agricultural sector in Turkey is far more dynamic and innovative than in the other participating countries. Given the long list of innovations that are perceived to be required in all the participating countries (see Table 2), the challenge is to identify those intervention options with the best leverage to increase the pace of innovation, and to identify and address the constraints to innovation, not only on the technical side but also concerning AIS processes.

Despite the countries having numerous policies and strategies, none has an explicit policy or strategy for innovation. Policy-makers and authorities do not give much thought to how innovation systems function and how they can be made more effective. There seems to be the assumption that if each stakeholder category is performing its functions correctly, innovation happens automatically. Some of the countries promote innovation in particular sectors through specific policies, government programmes and incentives. Sub-sector development strategies concentrate often on technical issues and give little attention to the processes by which stakeholders are able to adopt the proposed technical innovations. Only Uzbekistan has given a mandate to a specific stakeholder to promote innovation in general.

It is not essential, and may often not be sensible, for a country to have separate innovation policies and strategies. But as a minimum, any policies and strategies relevant for the agricultural sector, as well as development programmes, should be screened from an AIS viewpoint for opportunities to build-in mechanisms that foster innovation, and to be aware of shortcomings that might hinder innovation processes. In short, the policy framework in the country should provide an enabling environment for innovation. Alternatively, countries might integrate AIS-relevant policies and strategies into comprehensive agricultural innovation policies or strategies.

The essential element, as in all policy and strategy development processes, is that a broad range of stakeholders must be consulted in the policy development process and their views actually integrated in the policy document.

3.1.3 SMART AND EFFICIENT FINANCIAL INCENTIVES FOR INNOVATION

Subsidies and financial incentives are being criticised by many economists for being inefficient and unsustainable, and for distorting market signals. Critical views on subsidies in agriculture in developed as well as in developing countries are reflected in many publications. A brief overview of discussions is available in an article by Sumner (no date). Nowadays, the trend is not to totally dismiss subsidies, but to look for smart ways of subsidies, which actually achieve the desired effects (e.g. SDC, 2008).

Nevertheless, Turkey, Uzbekistan and Kazakhstan are successfully using various types of subsidies and other financial incentives for farmers and processing enterprises. The stakeholders in these countries all agree that state financial incentives are key success factors in the innovation system. The question is which are the smartest and most efficient forms of financial incentives, and how governments with scarce revenue such as Kyrgyzstan and Tajikistan can afford such incentives.

3.1.4 INNOVATION FUNDS – UNIFIED FUNDING MECHANISM FOR INNOVATION

Innovation funds are a financing mechanism to promote innovation, which is becoming increasingly popular. Many different models exist (e.g. World Bank, 2010, 2011). In some cases innovation funds are traditional competitive research grant funds, which are exclusively addressed to research institutions. Others are accessible for researchers as well as advisory services. There is also a range of examples providing farmers with direct access to innovation funds. However, as an essential feature, real innovation funds should explicitly promote joint projects among agri-business, farmers, researchers and advisory services, and should not be exclusively targeting one specific set of actors (such as only researchers). General experience indicates that true innovation funds are not yet widespread. In some cases innovation funds were established within projects, which stopped operating when the respective projects were over. Real innovation funds exist or existed for example in Bolivia, Canada, Chile, China, Colombia, Indonesia, Kenya, Peru, Senegal, Uganda, United States of America, Viet Nam and Zambia.

The advantage of real innovation funds is that they provide finance to support an innovation process to address well-defined constraints, on which concerned stakeholders work together.

If the selection process for projects is on a competitive and transparent basis, such funds also help direct public investments to initiatives and stakeholders with promising ideas, vision and desire to achieve positive change, that bring benefits to the farming communities as well as to the agricultural sector as a whole. This allows pooling of resources from different sources (government, donors, private sector, and farmers) for innovation processes, which contributes to better coordination among actors.

An innovation fund does not necessarily require additional government financial resources. It is possible to channel part of the core budgetary funding that would have been dedicated to research and advisory services into an innovation fund. Such a fund could then also attract additional investments from the private sector and donors.

Innovation funds at national level or possibly at sub-regional level would be a highly useful instrument to enhance innovation processes in participating countries. Such funds, however, need to be carefully designed and transparently managed with a clear governance structure to provide an enabling environment for innovation for all. Also it will require learning how to design and implement innovation projects, such as through pilot innovation projects. The criteria for funding as well as the priority themes should be decided in an inclusive manner.

3.1.5 MEASURES TO ENHANCE EFFECTIVENESS OF RESEARCH

In all CA&AZ countries, measures to enhance effectiveness of research will contribute to strengthening innovation processes. Effectiveness here means research results that are used by farmers, and thus relevant, applicable in the targeted environment and respond to key demands or constraints. Relevance of the research is at the heart of the issue. During the sub-regional workshop organized within the frame of this project, the Director General of GDAR, in his opening address, stated:

“Scientific study is valuable, but the role of agricultural researchers is to fulfil the needs of the farmers: research needs to be put into action.”

For research to be put into action, it needs to be relevant for farmers. In CA&AZ and Turkey, the effectiveness and relevance of the research system varies, and therefore each country might need some measures to varying degrees. In general, the following measures are suggested:

- Capacity development for research and university teaching personnel in modern, practical research approaches and methods. This should also include practical and applied participatory experimentation methods with farmers and advisory service personnel.

- Establish participatory, multi-stakeholder, competitive process for defining the research agenda, as well as feedback mechanisms from farmer to research on practical utility of research outputs. There are many successful examples of how this can be organized. This is a measure recommended for all countries.
- In CA&AZ countries it is necessary to invest in modernizing research infrastructure.
- Strengthen capacity for research in economics, markets and agricultural policy, in particular in the countries in which this is weak, such as Kyrgyzstan and Tajikistan.
- In Kyrgyzstan, Tajikistan and Azerbaijan, and to a lesser extent in Uzbekistan, it is necessary to increase research funding to enable the research system to contribute effectively to innovation. It has to be noted, though, that an increase in funding will only be effective if the above measures are also realized. Kyrgyzstan and Tajikistan need to attract international donor support, while in Azerbaijan government resources should be made available to invest in strengthening and modernizing agricultural research systems.

3.2 INNOVATION MANAGEMENT ISSUES

3.2.1 ACCESS TO AGRICULTURAL INNOVATION INFORMATION

In all CA&AZ countries, stakeholders find it difficult to access knowledge that is relevant for agricultural innovation. This concerns technical aspects, as well as other aspects such as economics, markets, farm management, government policies and international experience.

The establishment of unified agricultural information platforms in the countries of the sub-region is therefore high on the agenda of the stakeholders. The following principles should be observed when realizing these:

- Whereas an internet-based platform provides the core of such a mechanism, this should be complemented by face-to-face experience exchange and learning opportunities.
- Build up on what is available. Avoid duplication of information. Link with existing Web sites through a gateway, and with existing content through links. Add new only what is not otherwise available and accessible.
- Develop incentives for organizations to share their knowledge, and sensitize donors to making it obligatory that information products they finance through projects with government and non-governmental organizations be accessible in electronic format.
- A core part of the platform should be a collection of “Good Practices” (in technical, economic, institutional, process and other aspects). Contact information of AIS stakeholders, an event calendar, information about on-going and planned projects, and training opportunities are also required.
- Devise sustainable operation and financing mechanisms (think of multi-stakeholder models).
- Ensure appropriateness and friendliness for different user groups. Farmers, researchers, market players, field advisers and agricultural students all have different information requirements and user habits.

- Link the national platforms in an agricultural innovation gateway at regional level. For its sustainability, all countries should manage and finance this jointly, possibly through annual rotation of responsibility or another suitable mechanism.
- Ensure that other international platforms focusing on the sub-region are not duplicated, but complemented. Notable among such platforms are Technologies and Practices for Small Agricultural Producers (TECA), Central Asia Water Info, World Overview of Conservation Approaches and Technologies (WOCAT) and to some extent Environment and Sustainable Development in Central Asia and Russia (CARNET). All these platforms, apart from TECA, have Russian content. The Central Asia Water Info covers agricultural water use, while the last two are on natural resource management, and include agricultural issues to some extent.

3.2.2 CAPACITY DEVELOPMENT FOR INNOVATION

Realizing the potential for innovation in each country will be very context specific; as such it is not possible to provide a blueprint for capacity development activities. This section intends to provide some guiding thoughts. Earlier, Table 2 listed a substantial number of areas where innovation system processes and thematic innovations need strengthening. Those areas can be used to guide capacity development activities in a country. Some innovation system processes and thematic areas (for example, public financing of private advisory services or dairy production) are on an advanced level in one country (in Turkey in many cases), but not yet in other countries. Countries with an advanced level in a particular issue have practical expertise on procedures required, which could be exchanged with other countries in the sub-region. One could imagine a system where a country needing to acquire the knowledge for particular innovations could request assistance and mentoring from another country to develop and test the procedures in its specific national conditions. Each of the innovations will need an individual, specific acquisition approach, which takes into consideration the following aspects:

- What knowledge exactly needs to be acquired? Which elements make up the innovation?
- Which stakeholders are concerned with the specific process of innovation? Who needs exactly what knowledge and skills?
- Where is the relevant expertise and experience available? In-country (project, pilot region), in the CAC region, in Turkey, or elsewhere? Can it be obtained from one country or is it necessary to look at solutions and options from different countries, and combine these to provide a local approach?
- What is the best combination of mechanisms to get the knowledge to the country? Learning visits to countries where the knowledge is successfully being applied? Visits of specialists from those countries to the acquiring country? Contracting international experts with relevant experience from diverse locations? Training courses? Joint adaptive experimentation? Action research and pilot implementation? Other? Which stakeholders need to participate and in what way?
- Once the country has acquired the knowledge concerning an innovation, through what mechanisms can the innovation be scaled up most effectively? At which levels and by whom are actions needed to scale up the innovation (from field to policy level)?

Such innovation acquisition approaches could be elaborated by a working group involving key stakeholders, or by an institution with competences and mandate for innovation facilitation or coordination (ideally with participation of or consultation with stakeholders).

3.2.3 INNOVATION FAIRS

Uzbekistan has organized an annual agricultural innovation fair, which attracts a broad range of agricultural sector stakeholders. Such fairs would be a useful tool for other countries in the region to bring together stakeholders interested in agricultural innovation, and enable sharing and exchange of knowledge. Similar fairs at sub-regional level every 3 to 4 years could complement the fairs at country level.

3.2.4 INNOVATION FACILITATION AND COORDINATION FUNCTIONS

Generally speaking, innovation processes can happen also without facilitation and coordination; however, competent facilitation and coordination can guide and advance innovation, bring stakeholders to a better coordinated and directed collective action, reduce trial-and-error-based detours in the journey to innovation, and allow for a transparent and honest discussion of what works and what does not. Overall, facilitation and coordination would help to realize the full potential of agricultural innovation and would increase the effectiveness of innovation processes.

As shown by the case studies, government programmes in CA&AZ that unite and coordinate contributions of various stakeholders have been successful in introducing specific technological innovations. Experiences from other regions around the world show that strategic alliances of stakeholders are an alternative option to promote and put into practice specific innovations. For examples see SDC (2007). Such a strategic alliance is a group of representatives from different concerned stakeholder organizations and groups working together for as long as necessary to realize a particular development initiative. The alliances may be more or less formal. Often, there is a lead stakeholder, who may or may not be a government institution or representative, which facilitates and coordinates the innovation process.

Switzerland has a special model of an innovation facilitator – the Swiss Centre for Agricultural Extension and Rural Development (AGRIDEA). AGRIDEA is owned by an association of a broad range of public, farmer and private sector agricultural stakeholders, and facilitation and coordination of innovation constitutes part of its mandate. For this it maintains close links with all relevant agricultural stakeholders, both private and public, monitors developments in

the sector, and ensures it always has up-to-date knowledge about agricultural sector issues. It facilitates, for example, annual meetings of stakeholders of particular sub-sectors to discuss research results, innovation needs and political aspects. The Training Advisory and Innovation Centre (TAIC) in Kyrgyzstan was established on the basis of the AGRIDEA model. However, unlike AGRIDEA, government in Kyrgyzstan does not recognise TAIC's role as an innovation facilitator, and many non-governmental stakeholders view it as competitor, which is incompatible with the facilitator role.

The fairly new Scientific Innovation Centre in Uzbekistan may liaise with AGRIDEA and so get the opportunity to better understand how it can put its mandate into practice and complement the mandate with new ideas and options.

It is desirable for the other CA&AZ countries to build some form of innovation facilitation and coordination function into their AIS. Also for Turkey, in its position of leader in AIS for the region, more formal innovation facilitation and coordination in a decentralised form might be a useful new element.

There are various options to put the innovation facilitation and coordination function into practice. As indicated by the above examples, it is possible to have one organization responsible for the facilitation and coordination role on a broad scale. Alternatively, a central coordinator with a lighter role might support and oversee the establishment of strategic alliances, which themselves then facilitate and coordinate specific innovation processes or projects.

An important task of the coordinator is the establishment and operation of an "innovation monitoring and evaluation (M&E) system" as proposed by the stakeholders involved in the project. Such an M&E function will need to be focused towards the learning aspect of monitoring rather than the accountability.

As the example of Switzerland shows, facilitation and coordination is not necessarily a government function. Any organization within a particular innovation system may act as facilitator, provided it is recognized by the relevant stakeholders and has the necessary competences.

Whatever model of innovation facilitation and coordination a country envisages, it is essential to acknowledge that these functions require specific know-how, and therefore adequate capacity building for innovation facilitators and coordinators is indispensable.

3.2.5 CHANGING MIND-SETS TOWARDS INNOVATIONS IN AGRICULTURE

As insights from the project indicate, many farmers in CA&AZ countries are keen on technical and technological innovations; however, the majority of them still practice traditional forms of agriculture. It is important for the knowledge producers to ensure that what they propose is beneficial and acceptable for the farmers, if they want that their outputs to become true innovation being used by farmers. It is also essential to enable farmers, especially small-scale farmers, to gain confidence that innovative practices can serve them better than their traditional ones. For this they need the possibility to choose and test innovative practices, so that they are in a position to adopt practices that suit them.

CA&AZ countries all have a legacy of a Soviet-period mind set, but nevertheless many farmers and public institutions are open to progressive ways, and the introduction of new technologies and approaches. However, scientists and agronomists in this sub-region still tend to follow the policy of promoting high-cost but proven and time-tested technologies, and thus sometimes resist innovative approaches. At the same time, external factors such as negative impacts of climate change and population growth, as well as complex domestic and regional markets, are creating new challenges for agriculture, and traditional farming is no longer able to cope with these. New, especially participatory, approaches need to be employed to change the mind-set of all AIS actors, from policy-makers to individual small-scale farmers, to foster the understanding that innovation is the only way in which the agricultural sector can overcome the challenges it currently faces. Considering that most of agricultural production in CA&AZ is produced by small-scale farmers, the AIS system should support them in finding solutions that are low-cost and unsophisticated, and at the same time market-oriented and profit-enhancing. In short, for policies designed to address agriculture innovation to be effective, they need to take into consideration the capacity of users.

In summary, to strengthen the pace of change, innovations need to be attractive and convincing for farmers. In such cases innovations will be “pulled” by farmer demand and not “pushed” by government and projects. The respective knowledge will spread quickly from early adopters to others. Strengthening the capacity of knowledge producers, innovation facilitators and disseminators in understanding what makes up an attractive innovation, and in how to present and promote innovations in an attractive way, will strengthen spread of innovations. At the same time, near-automatic spread of innovative practices happens only with practices that are simple to adopt and do not require expensive investments. More complex practices and change processes will always need to be accompanied by rural advisory services support.

AIS stakeholders should be pro-active and not wait until difficulties and constraints become so serious that they force innovation to happen, but rather generate and disseminate relevant and useful know-how that offers agricultural producers opportunities to innovate and so continuously enhance their farming success.

3.2.6 **FACILITATE COMPLEMENTARY USE OF ICT AND OTHER COMMUNICATION MEANS**

Modern ICT, as well as more traditional ICT such as video, TV and radio, has potential in promoting innovation, but currently cannot replace face-to-face information and communication means, which will continue to be the most crucial instruments for supporting knowledge dissemination in the sub-region; inter-farmer exchange and exchange among professionals will remain key linkages in the innovation system. ICT can be used to complement those interactions. It is important to note that ICT provides tools to share knowledge and exchange, but in themselves ICTs do not drive innovation on their own.

In CA&AZ, video and TV could be used more systematically in communication with rural people. The know-how available in Turkey, e.g. agricultural Web TV, could be used to strengthen capacity in CA&AZ countries.

There is a broad range of successful efforts globally to enable rural people to access agricultural knowledge through the Internet, both in terms of enabling internet access (infrastructure and capacity) and in terms of providing appropriate content. It would certainly be possible to find among them models that could be piloted and/or introduced in the CA&AZ countries.

Concerning printed information and learning materials, an inventory of what is available in CAC with links to where they can be obtained would be a useful first step to develop materials required in those countries where they are lacking. An additional contribution would be to screen materials from Turkey for relevance in CA&AZ countries, translate those that are relevant to Russian, and make them accessible through the innovation platform. Ideally, the stakeholders in CA&AZ countries would agree to make their information and learning materials available freely on the Internet; however, this is currently unrealistic due to competition among NGOs (see also the need for incentives and awareness for sharing information products explained in Section 3.2).

Use of face-to-face communication means are integrated in the section on advisory services, with ICT use for agricultural professionals in the one on agricultural information platforms.

ICT with or without connection to the internet are now very commonly used for communication and exchange of brief information. But this is not enough, considering the huge potential of ICT in AIS. Tools such as e-learning, e-markets and e-information are largely undeveloped in rural areas of CA&AZ, and not available in local languages. Thus, it would be very important for AIS development to work more on ways to utilize the full potential of ICT for current agricultural development.

3.3 OTHER ASPECTS

3.3.1 STRENGTHEN AWARENESS ABOUT AGRICULTURE AS A SECTOR WITH PERSPECTIVES AND IMPORTANCE

Diverse measures are required to counteract the issue of aging agricultural professionals and the interest of young people in becoming or remaining farmers. Among such measures might be:

- A campaign to advertise agriculture as an attractive profession in schools and universities.
- Sensitize the public using mass media with the message that agriculture (including fisheries and forestry where appropriate) is responsible for producing everybody's food in adequate quantity and quality.
- Undertake concrete measures (capacity development and incentives) to attract young professionals to research, advisory services and ministries.
- Modernize curricula in agricultural education institutions.
- Build in or revive advisory services as subjects in curricula at agricultural universities and colleges.
- Include farming as a subject in high-school curricula or extra-curricular activities in rural areas. In Kyrgyzstan, this has been realized on a pilot scale, and currently efforts to institutionalize it are on-going.

3.3.2 INNOVATION IN AGRICULTURAL MARKET SYSTEMS

As explained earlier in Table 3, markets are one of the most important triggers and drivers for innovation. As such, inefficient market systems and insufficient understanding of market mechanisms are a constraint on agricultural innovation; investments under such conditions are highly risky for farmers and for other value chain actors. In CA&AZ (in particular in Kyrgyzstan, Tajikistan and Azerbaijan) all stakeholders agree that one of the focus areas for enabling

innovation is to promote transparent, efficient and inclusive market systems. The majority of farmers face immense difficulties in marketing their farm produce profitably, and they do not know what they could produce that sells better and yet still fits into their farming system. The more remote and less specialized the farms are, the more serious is the problem. The reasons for the difficulties in the market systems are diverse:

- Agricultural trade is fragmented. Individuals and very small businesses do much of it, and often agricultural products are only a part of their business, i.e. they are not specializing in agriculture and therefore also do not have in-depth understanding of the agricultural sector.
- Farmers' understanding and knowledge about markets is very limited. Most domestic market players also do not have sufficiently broad understanding of the market systems, as they are small, not specialized and operate in limited parts of value chains.
- Access to export markets is often organized by buyers from these markets, and domestic players have little information on the characteristics of these export markets.
- Production is scattered and farmers are insufficiently cooperating or organizing themselves to achieve economies of scale.
- Markets are volatile and influenced by all kinds of external factors, e.g. border closures, customs union, climatic factors in target markets and international competitors (imports into domestic markets and competition in potential export markets).
- Farmers are unable to base their production decisions on a reliable market analysis, and they are unable to produce specialized products for particular markets, as they are not adequately organized and do not have the appropriate production system.
- In some sectors there is strong competition from imports.
- Processing enterprises cannot absorb much raw material supply as they are few, and the countries import much of their processed food requirements. Some processors even import their raw materials.
- Uncertainty about the impact of the customs union of Russia, Kazakhstan and Belorussia on export opportunities to these countries and on imports from there.
- Agricultural professionals and policy-makers have insufficient understanding of market systems (e.g. demand and supply patterns and developments in potential export markets, competitiveness of local production in order to substitute imports, innovative products with market potential, functioning of particular value chains, quality requirements). This prevents evidence-based policy-making, as well as poor advice to farmers in market-led production decisions.
- In some countries, government procurement companies have been set up to resolve problems of market access and fluctuating prices. Their effectiveness is however often doubtful – for various reasons.

In summary, there are many market system issues where action is needed and innovative processes have to be established to enable and enhance profitable market access for agricultural producers. However, there are probably no simple and ready-made solutions that

can solve the issue as a whole. At the same time, in all the countries there are examples of private companies (processing and trading) contributing to make sales of farm produce by farmers easier, and there are numerous initiatives in value chain development aiming at linking small-scale farmers with profitable markets. These all contribute incrementally to market system development. The following actions would be useful steps to enhancing the functioning of market systems:

- Strengthen understanding of functioning of markets at all stakeholder levels (ensure complementary efforts and do not duplicate other efforts).
- Establish or enhance market information systems. Market price information is not sufficient. More analytical information and market intelligence is required, and the capacity to use these needs to be developed.
- Conduct research on competitiveness, comparative advantages, demand in external markets, opportunities for innovative products, etc.
- Assess the effectiveness and sustainability potential of public procurement companies in comparison with other approaches to solve the market problems these companies are expected to address.
- For all efforts that aim at agricultural innovation, use a value chain perspective, and build capacity of value chain facilitators in the respective organizations.

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ANNEX 1

SHORT DESCRIPTIONS OF THE CASE STUDIES

	INNOVATION CASE	BRIEF DESCRIPTION
AZERBAIJAN	System for production of high quality wheat seeds	The Government set the policy to achieve food security through self-sufficiency in grain production. However, for many years increases in wheat production were achieved by an expansion of the wheat cultivation area. In recent years a state programme to increase wheat yields has been implemented. A cornerstone of this programme is the development of a comprehensive seed system for the production and multiplication of original, super-elite and elite seed by research centres and private companies, with financial support at all levels of grain seed system.
	Sugar beet value chain in Aran economic region	In line with the food-security policy of the government of Azerbaijan, the private company Azersun established a modern sugar mill in 2003. It also set up an enterprise responsible for ensuring the supply of sugar beet to the mill. The enterprise provides all necessary inputs, training and consultations to farmers and concludes delivery contracts. As a result, sugar beet production increased, and Azerbaijan increased its degree of self-sufficiency in sugar.
	Development of organic agriculture in Azerbaijan	The promotion of organic production in Azerbaijan was initiated around 10 years ago with international support. Ganja Agri-Business Association (GABA) acts as key driver in this movement. Now Azerbaijan has its own certification agency, a law on organic farming, and more than 500 farmers engaging in organic production. Noteworthy is that Azersun, a large Turkish-Azeri agri-business holding, has established an organic production company.
KYRGYZSTAN	Water User Associations (WUAs)	After independence, state and collective farms were dissolved and the land distributed among the population. Numerous small individual farms emerged and the irrigation water management system collapsed, and the infrastructure fell into disrepair. As a way out of the disaster, Water User Associations started to be established, and later a Water User Association Support Unit was established as part of the Water Resources Department. Nowadays, around 70% of the irrigated area is covered by WUAs, many of which have achieved a high degree of organizational development.
	Bean value chain in Talas region	Soon after independence of the Kyrgyz Republic in 1991, Turkish businessmen came to Talas, brought bean seeds and encouraged farmers to grow beans, with the assurance that they would buy the harvest. Around 1997–98, bean cultivation began to spread quickly over all areas in Talas where beans can be grown. Enterprises in post-harvest operations, procurement and export of beans developed. For many years beans have been by far the most important economic factor in Talas, and the bean business has brought well-being to many of its inhabitants.
	Crop rotation in Naryn region	After independence, the emerging individual farms proved too small for a good rotation system, and many of the new farmers were unaware of the importance of crop rotation. As a result no crop rotation was practised, resulting in severe deterioration in soil fertility. The Naryn Rural Advisory Service (RAS) developed, in consultation with local farmers, a crop rotation system based on collaboration of farmers, and conducted a campaign to re-introduce it (training and supply of esparsette (<i>Onobrychis viciifolia</i>) or lucerne seed at reduced cost). This innovation spread on its own, widely beyond advisory clients.

	INNOVATION CASE	BRIEF DESCRIPTION
TAJIKISTAN	Beekeeping	In mountainous Tajikistan, beekeeping provides a promising economic opportunity. Around 10 years ago the government initiated a programme for recovery of the apiculture industry. International programmes also supported enhancement of beekeeping. The efforts combined production and marketing development. As a result, honey production doubled within only five years.
	Poultry production	The share of local eggs and poultry meat in the local markets in Tajikistan has increased substantially over the last five or so years. A government programme, as well as local and international organizations, achieved this through advisory support and financial assistance to poultry farms and small-scale household level producers.
	Livestock health – Brucellosis control	As a result of neglect of veterinary care for many years, in 2004 brucellosis affected 8.5% of sheep and goat herds in the country. A nation-wide vaccination campaign led by the Veterinary Association of Tajikistan, with government and international support, resulted in a reduction of the brucellosis infection prevalence level to 2.5%.
	Access of rural women to land	Awareness raising and capacity building for women working in agriculture by a local NGO and local authorities (with international support) resulted in an increase of dekhans farms headed by women in Hisor district from 12 to 345 within 5 years (2005–2010). Government laws and decrees provide the basis for enabling increased access of women to the productive resource “land”.
TURKEY	Tire Dairy Cooperative	Tire Dairy Cooperative was a small local cooperative with a few members until 2002. Since then its membership has increased to 2200 and it has 150 employees. The dairy plant of the cooperative processes 150 t of milk daily. It also established meat processing, and provides its members with feed and other livestock services. Increasing market demand for dairy products and a new initiative and skilled management were the driving factors.
	Cherries in Kemalpaşa	In Kemalpaşa area, cherry production quadrupled over the past 15 years. Much of the production is exported to Europe. Thanks to a new variety released by research, Kemalpaşa produces the earliest cherries in Europe and in high quality. This resulted in rapid development of all elements of the value chain.
UZBEKISTAN	Wheat production	With the aim of self-sufficiency the Government implemented a comprehensive state programme with coordinated actions of MAWR, local administration, research and a state-owned company. The programme includes financial incentives. As a result, wheat production about doubled in 10 years without a significant increase in land under wheat.
	Fruit and vegetable processing company	In 2007, a private entrepreneur established a fruit and vegetable company, motivated by the business opportunity and government incentives in the form of low-interest credit and low taxation. The demand from the processing plant enabled farmers to increase their production of fruits and vegetables, resulting in higher income and more employment opportunities for farm workers.
	Poultry in Samarkand region	In Samarkand region, a centre of poultry production is developing with several large poultry plants and numerous individual producers at various scale. The German company Lohmann plays a major role as a producer and provider of cross-breeds. Increasing demand for eggs and poultry meat in the country, as well as government incentives, are drivers of this innovation. The local authorities play an important role as facilitators and coordinators of the different actors, which include also research scientists.

ANNEX 2

TRIGGERS AND DRIVERS OF INNOVATION IN CASE STUDIES

	INNOVATION CASE	INITIAL TRIGGER(S) AND OTHER ESSENTIAL DRIVING FACTORS
AZERBAIJAN	High quality cereal seed	Government policy and state programme to achieve food security through self-sufficiency in grain production with financial support to all levels of the grain seed system
	Sugar beet in Aran economic region	Import substitution policy for sugar Establishment of sugar mill by private company
	Development of organic agriculture	Donor initiative Strong local NGO moving ahead what was initiated by donors
KYRGYZSTAN	Water User Associations (WUAs)	Livelihood-threatening problem due to collapse of water management system Availability of external model to address problem Comprehensive government policy framework Extensive donor support in terms of expertise and financing
	Bean value chain in Talas region	Market opportunity based on production cost differential Initiative of Turkish companies Farmers' interest in profitable, but low-investment crop with stable and secure sales
	Crop rotation in Naryn region	Individual farms too small for good rotation system – no crop rotation – severe deterioration of soil fertility and yields Advisory services developed system based on collaboration of farmers and conducted campaign to re-introduce crop rotation (training and seed of leguminous fodder crops at reduced cost)
TAJIKISTAN	Beekeeping	Government programme Economic opportunity for mountainous areas Complementary programmes from local and international organizations
	Poultry	Government programme Import substitution opportunity Complementary programmes from local and international organizations
	Livestock health -Brucellosis control	Serious problem for animal and human health because of brucellosis Nation-wide campaign with international support Veterinary association as driving local actor
	Access of rural women to land	Disadvantaged position of women engaged in agriculture due to traditional land access and inheritance mechanisms Government's willingness to enact laws and decrees to enhance the position of women Programmes by NGOs, local government and international partners to address the problem in practise

	INNOVATION CASE	INITIAL TRIGGER(S) AND OTHER ESSENTIAL DRIVING FACTORS
TURKEY	Tire dairy cooperative	Initiative and competent new cooperative management Increasing market demand for dairy products
	Cherries in Kemalpassa	New variety from research institution – earliest cherries in Europe
UZBEKISTAN	Wheat production	Government programme aiming at wheat self-sufficiency with coordinated actions of MAWR, local administration, research and state-owned company
	Fruit and vegetable processing company	Initiative of private entrepreneur Policy to support private processing sector with corresponding incentives
	Poultry in Samarkand region	Domestic market opportunity (substituting imports) Foreign investor bringing finance and knowledge Government programme and incentives



This publication represents a synthesis of assessments of national agricultural innovation systems in countries of Central Asia, South Caucasus and Turkey.

The first chapter gives an introduction of the project “Capacity Development for Analysis and Strengthening of Agricultural Innovation Systems in Central Asia and Turkey”, out of which the current publication reports about one of the project outputs achieved.

The second chapter describes the institutional landscape of the agricultural innovation systems, innovation pattern, and processes of innovation based on 14 selected case studies in these countries. It also covers the issue of financing the research and extension systems and the use of information and communication technology in the agricultural innovation systems.

The third and last chapter deals with the key constraints of agricultural innovation systems identified and provides recommendations on how to address them. These include recommendations concerning relevant policy issues, innovation management issues, and other issues such as the need of raising awareness on agriculture among young people and of improving the functioning of market systems.

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