Food and Agriculture Organization of the United Nations
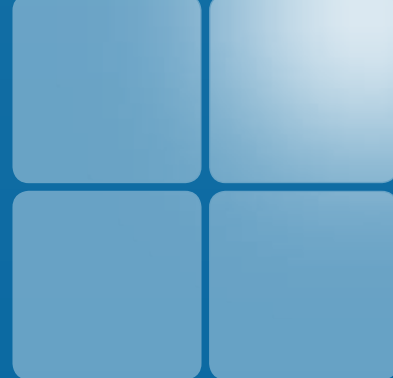
Status of Implementation of E-agriculture in Central and Eastern Europe and Central Asia

Insights from selected countries in Europe and Central Asia

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Contents

Foreword

Dear readers,

It is a pleasure for me to introduce to you this publication, which was prepared as a follow-up to the Regional Capacity Development Workshop on National e-Agriculture Strategies in Europe and Central Asia, organized by FAO and the GAK, non-profit organization of the Gödöllő Agricultural University and with the valuable participation of the International Telecommunication Union (ITU), the United Nations specialized agency for information and communication technologies based in Geneva.

As we know, the agricultural sector is confronted with many challenges posed by the impact of climate change, increased frequency of natural disasters, loss of biodiversity and erosion of the natural resource base, increasing food price volatility, inefficient supply chains and other challenges.

Agriculture is also becoming increasingly knowledge intensive: farmers have to make more and more complex decisions on the use of their land, the selection of the agricultural commodities they plant, the choice of markets on which to sell their agricultural products and other key decisions that impact their livelihoods and those of society at large. Their information needs are increasing accordingly. Information allows them to innovate, and hence to adjust and adapt to the challenges for their survival and improved livelihoods.

Indeed, FAO estimates that over 90 percent of the required global food production increase towards the year 2050 should come from yield increases of current arable lands based on the advancement of agricultural research, its application and transmission to farmers through effective research-extension linkages and the creation of an "innovation ecosystem". Information and Communication Technologies (ICTs), such as radio and emerging ones such as mobile phones are true enablers that we need in order to find new ways in which agricultural extension workers can deliver their information services to farmers. Linking knowledge to innovation is also crucial to addressing the information and knowledge gaps in the agricultural sector.

The development of ICTs is a major driver of economic growth. It is also an accelerator for innovation and change. FAO has been actively promoting the use of ICTs in agriculture and has focused on ICT innovation in improving agricultural production and value chains.

For example, food traceability systems using ICT have become a very important risk-management tool that allows food business operators or authorities to contain food safety problems and promote trust in the value chain. GIS and agro-meteorological technologies have contributed to better land use planning, crop forecasting and early warning systems. Space technology is also essential for monitoring threats from the growing number of natural disasters. The increasing use of mobile phone technology for information exchange such as disease surveillance and pest tracking has become routine in many countries of the region. We have also implemented projects on the establishment of a rural radio in Armenia, national online networks of research and extension in Albania and Armenia and have assisted national AgroWeb platforms and thematic networks for food safety, medicinal and aromatic plants etc. in Central and Eastern Europe.

However, innovation is an elusive combination of people, processes and technologies. Many projects put technology alone at the core of proposed solutions intended to address emerging and existing challenges, but this is not a sustainable solution in many cases. We should carefully study ways in which technology can be infused into existing workflows to make them more efficient and effective.

One efficient way to do this is through a comprehensive national strategy, which can prevent e-agriculture projects from being implemented in isolation resulting in duplication of efforts and resources, and instead develop efficiency gains from intra-sector and cross-sector synergies. In addition, a participatory planning and strategic approach in ICT applications in agriculture is contributing to improving inter-institutional collaboration, transparency and trust.

Recently, FAO and the International Telecommunication Union, have jointly drafted a National e-Agriculture Strategy Guide which aims to help countries mainstream ICTs into agriculture and develop or revitalize e-agriculture strategies in line with agricultural goals and priorities.

The Regional Workshop offered an excellent opportunity to present this guide to decision makers and agricultural information management experts from Eastern Europe and Central Asia, who were invited to discuss and validate it. Moreover, the participants were invited to share their experiences on their e-agriculture (-like) models, including success (or failure) experiences in the region. They discussed the role of existing national and regional communities of practice and knowledge networks on e-agriculture and identified synergies and possibilities of exchange and cooperation.

We decided to publish this paper as a follow-up document to the regional workshop with the intention of focusing especially on the situation in transition economies and to serve the policy makers and stakeholders in the agricultural sector in developing improved approaches and strategies to leverage agriculture through use of Information and Communication Technologies (ICTs).

I am confident that the readers of this publication will find useful information, data and references on the status of e-agriculture in the region. I hope that reading this document will be a pleasant and useful experience for you.

Vladimir Rakhmanin,
FAO Assistant-Director General, Regional Representative for Europe and Central Asia

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Acknowledgements

Acronyms and abbreviations

ACP – African, Caribbean and Pacific Group of States
AgroLib Ja – Agricultural Libraries in Jagodina
AIC – Agricultural Information Centre
AIS – Agricultural Information System
APIA – Payment and Intervention Agency for Agriculture
APMA – Agricultural Projects Management Agency
ARDA – Agricultural and Rural Development Agency
ARS – Automation Registration System
ATTCs – Agricultural Technology Transfer Centers
BoP – Balance of payments
BPR – Business process re-engineering
CA – Central Asia
CAP – The Common Agricultural Policy
CTA – The Technical Centre for Rural Cooperation and Agriculture
CwRS – Control with Remote Sensing
DSM – EU Digital Single Market
EAFRD – European Agricultural Fund for Rural Development
EC – European Commission
ECFS – Eurasian Center for Food Security
EEC – Eastern Europe and Caucasus
EIFL – Electronic Information for Libraries
ESCORENA – European System of Cooperative Research Network in Agriculture
ESIF – EU Structural and Investment Funds
EU – European Union
EU1 – Western Europe
EU2 – New members of the European Union
FADN – Farm Accountancy Data Network
FAO – Food and Agriculture Organization of the United Nations
FAO AIMS – Agricultural Information Management Standards
FAS – Farm Advisory System
FDMS – Farm Data Monitoring System
FLB – Farmer's Logbook
FTP – File Transfer Protocol
GAK – Gödöllői AgrárKözpont, GAK Education, Research and Innovation Nonprofit Co.
GAP – Good Agricultural Practices
GDP – Gross domestic product
GEL – Georgian lari
GERK – Register of Graphical Units of Land Use
GIS – Geographic Information System
GSMA – Groupe Speciale Mobile Association
H2M – Human-to-Machine
HTPP – High-throughput plant phenotyping
HW – Hardware
IAALD – International Association of Agricultural Information Specialists

IACS – The Integrated Administration and Control System
ICT – Information and communications technology
IICD and – International Institute for Communication and Development
IMEI – International Mobile Station Equipment Identity
IoT – Internet of Things
IP – Internet Protocol
IT – Information Technology
ITU – International Telecommunication Union
LFA – Less Favoured Areas
LPIS – Land Parcel Identification Systems
M2M – Machine to Machine
MePAR – Mezőgazdasági Parcella Azonosító Rendszer/ Land Parcel Identification System
MIS – Marketing Informational System
NEBIH – Nemzeti Élelmiszerlánc-biztonsági Hivatal/ National Food Chain Safety Office
NEC – Nippon Electric Company??
NFCSO – National Food Chain Safety Office
NGA – Next Generation Access
NGO – Non-governmental organization
Non – DSS-Decision support systems
NRI – Network Readiness Index
OSCE – Organization for Security and Co-operation in Europe
R&D – Research and Development
RKG – Register kmetijskih gospodarstev
SARD – Sustainable Agriculture and Rural Development
SAIS – Paul H. Nitze School of Advanced International Studies
SEE – South East Europe
STIPS – Serbian Agriculture Marketing Information System
UAV – Unmanned aerial vehicles
UITE – The Union of Information Technologies
UN – United Nations
UNDP – United Nations Development Programme
USAID – United States Agency for International Development
USD – United States Dollar
USSR – Union of Soviet Socialist Republics
VERCON – Virtual Extension and Research Information and Communication Network
VHR satellite – Very High Resolution Satellite
WEF – The World Economic Forum
WoT – Web-of-Things
WS – Regional Workshop
WSDL – standard web-service format
WSIS – World Summit of the Information Society

Summary

Current FAO projections indicate that the global population could increase by 2.3 billion people from today's levels, reaching 9.8 billion by 2050. At the global level, agricultural production and consumption in 2050 are projected to be 60% higher than today. This has to be achieved in spite of the limited availability of arable lands, the increasing need for fresh water and the impact of climate change. Innovative approaches – including information and communication technologies (ICTs) – are needed across the agricultural sector to increase productivity, conserve natural resources, and use inputs sustainably and efficiently.

Two events of the World Summit on the Information Society (WSIS) were held by the United Nations in the first half of the last decade. The Plan of Action included e-agriculture as an area of application of ICTs under Action Line 7. "ICT applications: benefits in all aspects of life". FAO was assigned the tasks of coordinating activities related to e-agriculture and officially launched the e-Agriculture Community of Practice in 2007 at www.e-agriculture.org.

The need for national e-agriculture strategies has been acknowledged by many stakeholders for some time. However, many countries have not yet adopted a national strategy for the use of ICTs in the agricultural sector. An e-agriculture strategy can offer critical support to rationalizing of resources (financial and human), better harnessing of ICT opportunities and addressing. The existence of a comprehensive national strategy can prevent e-agriculture projects from being implemented in isolation and develops efficiency gains from intra sector and cross sector synergies.

FAO and ITU – in collaboration with CTA – have developed a "National e-Agriculture Strategy Guide" to provide a methodology and a set of tools to assist countries in developing a national e-agriculture vision, action plan and implementation strategy.

Several events have been organized in the last few years in relation to e-agriculture strategies and the development of the guide. One meeting held in The Netherlands in April 2013 suggested "awareness creation and monitoring of the policy process at national level: campaigning and awareness creation should be undertaken by relevant actors to sensitize stakeholders about the importance of e-agriculture policies."

The Regional Capacity Development Workshop on National e-Agriculture Strategies was organized in June 2015 in Hungary, mainly to serve this goal. The event was initiated by the FAO Regional Office for Europe and Central Asia, inviting policy makers and practitioners primarily from the focus countries of the Region. The workshop raised awareness among the participants about the necessity of national e-agriculture policies and strategies, and provided information on the development methodology, especially the Guide and the Toolkit, which has been formulated by FAO and ITU in order to assist this process.

The event followed several related meetings in the last two-three years around the globe, and an online consultation with the e-agriculture community which also discussed national policies, strategies and the guide. However, the workshop in Hungary provided the first opportunity for the national stakeholders of Europe and Central Asia to gather, discuss and exchange experiences on this topic.

The main objective of the event was to present the concept, understanding, and practicing the techniques of, developing national e-Agriculture strategies – including the visioning, planning, implementing, monitoring and evaluating stages – using highlighted sections of the Guide. Participants were also requested to provide brief information on their national e-agriculture status in a structured way and were invited to present good practices of ICT use in agriculture of their countries, too. The workshop resulted in relevant findings and recommendations, requesting the development of an "advocacy note for decision makers" and a more detailed "follow-up paper" showcasing good practices and success stories, in order to further demonstrate the need and usefulness of national e-agriculture policies.

Participants agreed that an insight into the status of the region's e-agriculture should be summarized in a dedicated document which relies on information collected during the preparatory phase and the implementation of the workshop, taking the conclusions and recommendations into account, supplemented with the description of contextual background and reference data at the national and aggregated sub-regional level. The current publication intends to serve this request, in the context of the sub-regional and national status of e-agriculture of selected countries in the region of Europe and Central Asia.

Three participants of the workshop undertook the role of coordinating the preparation of the fol-

low-up paper, fulfilling the tasks of analyzing collected inputs, micro-research of related documents and statistical data, the structuring and editing of available content.

The workshop and the subsequent study produced the following main findings:

- The emerging role of ICTs in Europe and Central Asia is clearly observed and experienced in the region as a driver for agricultural development, especially in light of the growing demand for reliable information and fast access to it at every level of the sector.

- The state of the e-agriculture ecosystem varies from country to country, and is fragmented within the countries as well. This calls for a comprehensive strategic approach that would prioritize actions in order to maximize the benefits for the stakeholders involved in agriculture, food production, livestock, forestry and fishery at national level. At international and regional levels, it requires enhanced exchange and collaboration that would allow learning from neighbouring countries' experiences, hence avoiding repetition of mistakes and enabling faster development eventually.

- Issues related to IT development have usually high priority in the countries of the region and a long activity record. Since the early 2000s, numerous attempts have been made in every country to formulate strategies related to the use of ICTs. Those strategies however, driven by national information society development, had either too broad a scope or were not effective in ensuring the involvement and ownership of the Ministries of Agriculture. As a consequence, no country had a comprehensive e-agriculture strategy in place by the time this report was prepared.

- The process of country integration to regional economic organisations, such as European and Eurasian Unions, was seen as a powerful driver for increased efficiency of the institutional systems and that has triggered the interest and channelled the efforts of many governments towards formulating of a national e-agriculture strategy. The countries in the region however do not have enough capacity to go alone with the development and implementation of such strategies. Regional exchange and capacity development, facilitated by FAO, can offer sustainable solutions in this area.

The participants of the workshop agreed on the following steps, among others:

- Stimulate collaboration and knowledge sharing via online communities of practice, including existing regional networks such as ESCORENA and AGROWEB, and global platforms like the e-Agriculture Community, in order to demonstrate the conceptual models, methods, good practices including interoperability standards and Open Access – of effective use of ICTs in agriculture.

- Promote the development and implementation of national e-agriculture strategies, as part of national ICT and/or agriculture strategies. If needed, map the relevant existing policy environment that can be sometimes fragmented, within the agriculture and information sectors. Ensure that existing policies can be reviewed and further developed into national e-agriculture strategies. Build strategic partnerships with other governmental organizations that are responsible for the process, create a partnership ecosystem.

- Put more emphasis on the implementation, monitoring and evaluation phases from the beginning.

- Learn lessons, including from other sectors and others regions. Publish a regional ICT-agricultural services and projects database. Successes and failures from current and past projects within the domain of e-agriculture in the Region can both serve as positive argumentation for decision makers of policy development and useful lessons for all stakeholders involved in the strategy development and implementation process.

- Showcase new and emerging trends (related to WSIS Action Lines) especially among the good practices, identified during and after the meeting.

Background

Producing more food while simultaneously combating poverty and hunger, using scarce natural resources more efficiently and adapting to climate change are the main challenges world agriculture will face in the coming decades, according to the Food and Agriculture Organization of the United Nations (FAO).

"Some of the world's highest rates of population growth are predicted to occur in areas that are highly dependent on the agricultural sector and have high rates of food insecurity. Growth in the agricultural sector is one of the most effective means of reducing poverty and achieving food security. Innovative approaches are needed across the agricultural sector to increase productivity, conserve natural resources, and use inputs sustainably and efficiently."

Information and communication technologies (ICTs) have long been recognized as key enablers for bridging the digital divide and achieving the three dimensions of sustainable development: economic growth, environmental balance and social inclusion. ICTs have proven to be instrumental in delivering information and services in health, education, trade, commerce and other fields, and have contributed to increased transparency and accountability.

The General Assembly of the United Nations (UN) called for the holding of the World Summits (Geneva, 2003; Tunis, 2005) on the Information Society (WSIS). The Geneva Plan of Action set the objectives to build an inclusive Information Society; to put the potential of knowledge and ICTs at the service of development; to promote the use of information and knowledge for the achievement of internationally agreed development goals; and to address new challenges of the Information Society, at national, regional and international levels. The Plan of Action also included e-agriculture as an area of application of information and communication technologies (ICTs) under Action Line 7. "ICT applications: benefits in all aspects of life". The "Tunis Agenda for the Information Society", published on 18 November 2005, emphasizes the leading and facilitating roles that UN agencies need to play in the implementation of the Geneva Plan of Action.

Accordingly FAO was assigned the responsibility of organizing activities related to e-agriculture. Even prior to WSIS 2003, FAO actively promoted the use of ICTs for agriculture and food security, with a focus on rural communities and vulnerable people.

In June 2006, FAO hosted the first e-agriculture workshop, bringing together representatives of leading development organizations involved in agriculture. The
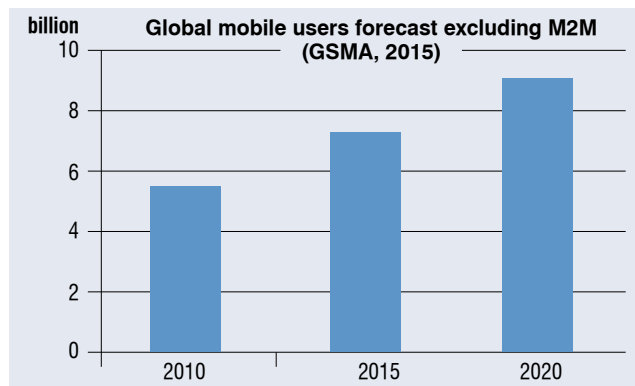
Figure 1.

meeting served to initiate development of an effective process to engage as wide a range of stakeholders involved in e-agriculture as possible, and resulted in the formation of the e-Agriculture Community, a community of practice. FAO brought together a group of founding partners who officially launched the e-Agriculture Community of Practice in 2007 at www.e-agriculture.org.

The aim of e-agriculture is to enhance agricultural and rural development through improved information and communication processes. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways of using ICTs in the rural domain, with a primary focus on agriculture. The broader concept of e-agriculture consists of technological application, facilitation, support of standards and norms, capacity building, education and extension.

Since the launch of the e-Agriculture Community of Practice, there has been significant progress in improving communication and decision making in rural areas through the application of new technologies.

The use of ICTs, such as mobile phones and the internet, has increased significantly in the last decade. It is estimated that there are almost 6.8 billion mobile connections among a world population of a little over 7 billion. The most recent 1 billion connections have been predominantly activated by the largest, but poorest, socio-economic group – people living on less than USD 2 a day. People involved in agriculture and related fields form the majority of these rural poor, and the increased availability of mobile connections provides a phenomenal opportunity to deliver information services to them.

The Sub-regional Office for Central and Eastern Europe was established in 1996 in Budapest, Hungary, in line with the decentralization policy of FAO, as a response to political and economic changes in

Low end phones — 2010: 76,6% — 2020: 17,2%
Mid-range smartphones — 2010: 7% — 2020: 40%
High-end smartphones — 2010: 12,4% — 2020: 20,5%
Dongles — 2010: 2,5% — 2020: 6,7%
Connected devices — 2010: 0,4% — 2020: 8,8%
M2M — 2010: 1% — 2020: 6,7%

Device mix % 2010/2020 (IDATE, 2011)
2010 / 2020

Figure 2.

the region. "Agricultural Information Management" was one of the key areas highlighted in the work program of the office from the beginning. In 2007, the FAO Regional Office for Europe also moved from Rome to Budapest and expanded its activities under the name of FAO Regional Office for Europe and Central Asia.

Numerous projects and events have been implemented over the last decade with the active participation of the regional office and national stakeholders, in relation with e-agriculture in the region. Just to mention a few: facilitating the AgroWeb CEE Network (agrowebcee. net) acting as a community of practice for information specialists, technical support to online presence of ES-CORENA networks, developing VERCON type projects in several countries, translating AGROVOC into different languages of the region, operating AGRIS focal points by national agricultural libraries, organizing information management and knowledge sharing workshops almost every year.

Recently, FAO has been developing the National e-agriculture Strategy Guide and Toolkit which aims to help countries mainstream ICTs in agriculture and develop or revitalize e-agriculture strategy in alignment with the agriculture goals and priorities. The Guide and the Toolkit can be used as useful resources to facilitate country decision makers in developing a national e-agriculture vision, action plan and implementation strategy. The existence of a comprehensive national strategy can prevent e-agriculture projects from being implemented in isolation – resulting duplication of efforts and resources – and develops efficiency gains from intra sector and cross sector synergy. In addition, a participato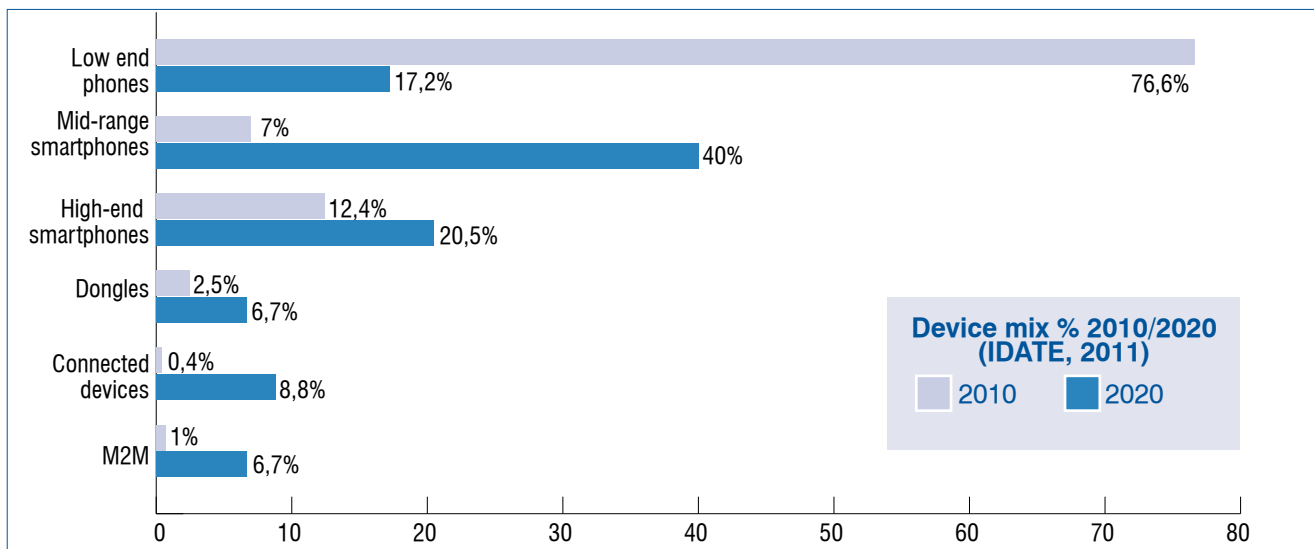ry planning and strategic approach in ICT applications in agriculture contribute to improving inter-institutional collaboration, transparency and trust in authorities.

A series of events have been held over the last two years, discussing issues related to national e-agriculture strategies and the Guide.

• The Technical Centre for Rural Cooperation and Agriculture (CTA), in collaboration with FAO, IICD and other development partners hosted the 2013 ICT Observatory meeting on strengthening e-agriculture strategies in the ACP countries from 24-26 April 2013 in Wageningen, The Netherlands. Case studies of e-agriculture strategies, ICT applications and policy frameworks were presented by participating countries and other key stakeholders playing a part in the area of ICT in agriculture and rural development. Participants were expected to challenge the concept and discuss lessons learned for formulating and implementing inclusive e-agriculture strategies in the ACP region and to promote information sharing, transparency and accountability in the area of agriculture. Collaborative actions to support capacity building and knowledge sharing on successful experiences were also discussed.

• The "e-Agriculture Stakeholders Consultation - Developing National e-Agriculture Strategy Guide" was held from 3 to 5 March 2015 in Bangkok, Thailand. The Stakeholder Consultation Meeting aimed to present Asia-Pacific examples in e-agriculture, especially the experience in Sri Lanka; to discuss and finalize the e-Agriculture Strategy Guide; to propose recommendations and identify opportunities for testing the toolkit in some pilot countries and create a platform to facilitate a dialogue among various stakeholders in the region on the implementation and adoption of e-agriculture services.

• The e-Agriculture Community of Practice, along with the FAO, ITU and CTA, organized an online forum on "National E-agriculture Strategy Development", which took place from 29 April to 11 May 2015 on e-Agriculture.org. The forum discussed the development of an "e-agriculture strategy development guide", a series of global and regional capacity development events and direct technical assistance to countries.

- The WSIS Forum held a session on 28 May 2015 in Geneva entitled "Paving the way to a national e-agriculture strategy" under the action line "C7: ICT Applications, e-Agriculture". The meeting examined the contribution of e-agriculture to address challenges related to the Sustainable Development Goals. It provided examples of approaches and included some of the factors affecting the free flow of information, the development of applications, ownership and inclusiveness, as well as government policies to encourage solutions.

- The Regional Workshop, organized by the FAO Regional Office for Europe and Central Asia and GAK Agribusiness Centre of the Szent István University, Hungary, has invited decision makers and agricultural information management experts from Eastern Europe and Central Asia. The workshop was held on 22-24 June 2015 in Gödöllő and Budapest, Hungary and aimed at bringing together policy makers and practitioners involved in the use of ICTs for agriculture, forestry and fishery; exploring synergies and collaboration; present and review the e-Agriculture Strategy Guide; collecting and sharing role of national and thematic networks. Participants were introduced to the well-structured method of observing the current e-agriculture environment and identifying the required components, which is an important element of developing and operating a successful e-agriculture strategy at the national level. They were also provided with guidance and practical training to improve their understanding and skills of using the e-Agriculture Strategy Guide and Toolkit, and had an opportunity to provide feedback on the training materials.

Map of countries participating in the Regional Workshop in 2015 in Hungary.

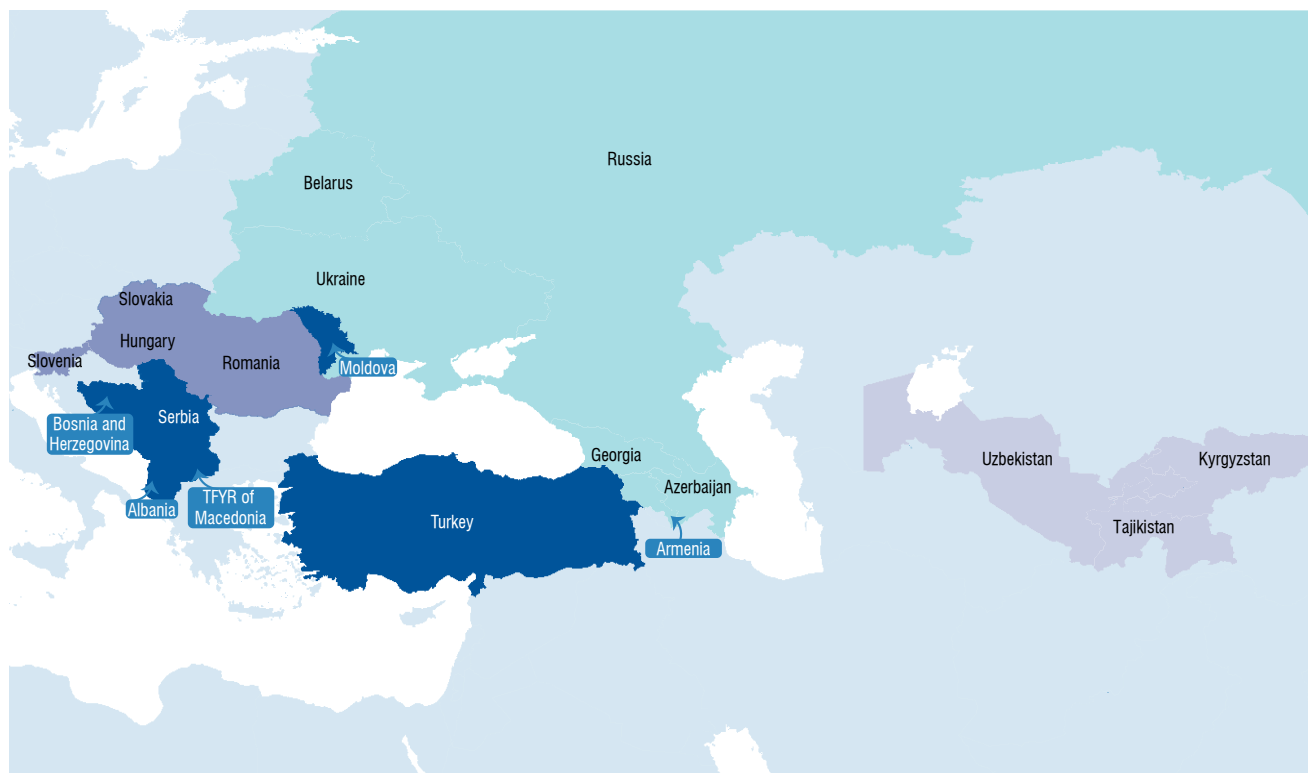Map of countries participating at the Regional Workshop in 2015 in Hungary

Figure 3.

Eastern Europe and Caucasus (EEC)

South East Europe (SEE)

New members of the European Union (EU2)

Central Asia (CA)

Region in numbers:
an overview of e-agriculture-related
data and policies

This chapter presents the main agricultural and information society characteristics of the region, using basic indicators and a policy analysis in order to provide the context for future e-agriculture strategy development.

> Information society is a widely used term to describe recent changes and development of social history. It is almost impossible to give a standard definition of the term, as this phenomenon impacts every aspects of people's lives and sector of the society. The main characteristic of an information society is that the creation, distribution and use of information and knowledge (parallel with the proliferation of information and communication technologies (ICT) are restructuring the way of conducting economic and business practices, running governments and engaging politically.

Five sub-regions of the Europe and Central Asia region have been set up for the purpose of the current study according to their common or similar geographical, economic, cultural and historical specifics, in order to assess, compare and evaluate the examined indicators at regional level. As only Eastern European states were represented at the Regional Capacity Development Workshop on National e-Agriculture Strategies in Hungary (regional workshop), and there are some significant differences between old and new EU-member countries, we divided those countries in two groups as well and used the data of EU-15 countries as a reference, because of the level of their development in ICT and agriculture. The list of countries according to the sub-regional division is shown in the annex. Each section provides a general description of the sub-region followed by country reports for the participant countries of the regional workshop ("workshop countries").

Western Europe (EU1)

The Western European countries – the "old" members of the European Union often called EU-15, with Switzerland, and Norway – can serve as a good reference point for a regional comparison, because the majority of them have developed innovative agriculture sectors, and also they have to formulate their (e-)agriculture development under the Common Agriculture Policy and the Digital Agenda which is an important pillar of the comprehensive Europe 2020 Strategy which are firm reference points for other countries in the region.

According to almost every information society measure, the EU-1 countries have higher values (internet use, households with internet access) and the complex indicators especially show developed network societies, as many of the most developed nations in the world in terms of network readiness and e-government are situated here. This makes a firm basis for information technology driven agriculture-development, despite the fact that the role of agriculture compared to the economy as a whole is much lower than in CEE-countries and Central Asia, and the importance and the characteristics of the sector vary very widely across these countries. The main policy drivers and initiatives in this sub-region are described in the sections below.

Digital Agenda for Europe

The Digital Agenda presented by the European Commission (EC) forms one of the seven pillars of the Europe 2020 Strategy which sets objectives for the growth of the EU by 2020. The Digital Agenda proposes better exploitation of the potential of ICTs in order to foster innovation, economic growth and progress.

ICT is crucial to tomorrow's sustainable economy. The EC is committed to building an environmentally sustainable, low-carbon economy with smart technologies.

The Common Agricultural Policy (CAP)

- CAP is the European Union's system of direct payments for farmers and subsidies.
- Its main objectives are to ensure a decent standard of living for farmers and to provide a stable and safe food supply at affordable prices for the 500 million consumers of the EU. The CAP has gone through many transformations since it was established in 1962, and continues to change today. The June 2013 reform is focused on three priorities:.
- Viable food production.
- Sustainable management of natural resources.
- Balanced development of rural areas throughout the EU.

The CAP budget is spent in three areas which are closely interrelated and must be managed coherently:

- Income support for farmers and assistance for complying with sustainable agricultural practices: farmers receive direct payments, provided that they follow the standards of food safety, environmental protection, animal health and welfare. Direct payments are fully financed by the EU, and account for 70 percent of the total CAP budget. 30 percent of direct payments depend on compliance with sustainable agricultural practices which improve soil quality, biodiversity and the environment, such as crop diversification, the maintenance of permanent grassland or the preservation of ecological areas on farms.
- Rural development measures: these are intended to help farmers modernize their farms and become more competitive, while protecting the environment, contributing to the diversification of farming and non-farming activities and the vitality of rural communities. These payments are part-financed by the member countries, represent around 20 percent of the overall CAP budget and the projects usually last for more than one year.
- Market-support measures: these payments finance for example market-support measures such as export subsidies to food companies and help when

adverse weather conditions destabilize markets, accounting for less than 10 percent of the total CAP budget.

The CAP has a budget of EUR 53 billion a year, making it the European Union's most expensive programme. The CAP is accounted for 37.8 percent of the EU's 2014 to 2020 budget, compared to nearly 71 percent in 1984.

The Integrated Administration and Control System (IACS)

Member States have to take the necessary measures to assure that transactions financed by the European Agricultural Guarantee Fund under the CAP are actually carried out and executed correctly, and to prevent and deal with irregularities. To this end, for all direct payments, Member States should operate an Integrated Administration and Control System (IACS).

In physical terms, IACS consists of a number of computerized and interconnected databases which are used to receive and process aid applications and respective data. Thus it provides for:

- A unique identification system for farmers;
- An identification system covering all agricultural areas called land parcel identification system (LPIS);
- An identification system for payment entitlements;
- A system for identification and registration of animals (in member states where animal-based measures apply).

The fulfilment of the criteria for receiving aid is assessed through administrative controls and through checks carried out on-the-spot.

Several countries in the process of EU accession are already at advanced stages of information systems development, which are typically considered as modules of the national IACS, while some other countries in the region have started e-agriculture projects with functionalities similar to IACS.

ICT-AGRI

ICT-AGRI is an EU project whose main objective is to strengthen European research within the area of precision farming and to develop a common European research agenda. ICT-AGRI develops international research calls to pool fragmented human and financial resources over the boundaries of the participating countries, in order to improve both the efficiency and the effectiveness of Europe's research efforts.

http://ict-agri.eu/

New members of the European Union (EU2)

Ten countries joined the EU in 2004 followed by Bulgaria and Romania in 2007 and Croatia in 2013. While the average agriculture value added in the sub-region is more than double of that in the EU/Western Europe (Romania, Bulgaria and Hungary are the top three countries), because of the share of industry and mainly of the service sector, it remains under the average of other sub-regions. (See the indicators table by sub-regions in Annex for more details). Mobile coverage is almost universal in this part of Europe (99.74 percent), and the number of mobile subscriptions is higher than in other sub-regions. (127.67). Two thirds of the individuals use internet; this figure is the highest in Estonia (80 percent), Latvia (75.2 percent) and Hungary (72.6 percent), while it is lowest in Romania (49.8 percent) and Bulgaria (53.1 percent).

The average score of the World Economic Forum's Network Readiness Index (NRI), which measures, on a scale from 1 (worst) to 7 (best), the country performance in leveraging information and communications technologies to boost competitiveness and well-being is 4.57, the second highest among the sub-regions, but significantly lower than in EU1 countries, while the Government Online Service Index that evaluates the scope and quality of government online services, ranges widely: the Baltic states are matching the results of Western Europe, while other countries' performance is mediocre. In these countries, access to basic ICT tools and the internet is not the main obstacle to e-agriculture strategies and the governments have also had experience in fulfilling the potential of ICTs. Among the Regional Workshop participant countries, Slovenia has the best NRI score.

As mentioned earlier, because of the Common Agricultural Policy and the EU funding programming periods, agriculture and information society policy is shaped by the logic and requirements of the EU-related processes, and there are agriculture and rural development strategies and country "digital agendas", for the period 2014-2020. Sometimes there are some minor overlaps between these documents, but there are no specific e-agriculture strategies currently in place in the workshop countries.

As an EU-requirement, Integrated Administration and Control System (IACS) was built in every country allowing for the management of payments under Common Agriculture Policy funds. These electronic systems and their components (e.g. the electronic land registers, as the GERK in Slovenia and MePAR in Hungary) can serve as a basis for a comprehensive e-agriculture ecosystem. In these EU countries, the private sector has also begun to develop innovative farm-applications, many of which are listed in the Section: "Regional solutions, applications, initiatives and networks on ICTs in agriculture and rural development" of this paper.

Hungary

Population	9 861 673
GDP per capita (USD)	13 902.705
Agriculture, value added (% of GDP)(2013)	4.373
Labor force in agriculture %	5.2
Land use %	58.964
Mobile phone subscriptions/100 pop	116.4
Individuals using Internet/100 pop	72.6
Households with Internet access at home/100 pop	71.5
Fixed broadband Internet subs/100 pop	24.1
Mobile broadband subs/100 pop	26.3
Government Online Service Index	0.559
Importance of ICTs to government vision	3.553
WEF Network Readiness Index	4.337
WS Participant Rank by WEF NRI index	5

Table 1.

Agriculture is a traditionally important sector in the Hungarian economy, as the country has favourable conditions for many types of farming, and about 70 percent of the land area is suitable for agricultural production. Despite these facts, the share of agriculture in the economy has been decreasing. However, Hungary's 4.3 percent agriculture value added is still the third highest among EU-countries, and the sector employs 5.2 percent of the work force.

Internet usage is high among the population, and the majority of households have an internet subscription. The country is lagging behind in terms of mobile broadband subscription, mainly caused by the affordability of the service. The Government Online Service index is higher than the average of the region. The Network Readiness Index ranks Hungary fifth among the Regional Workshop participant countries, with an index value that is under the average of Central and Eastern European countries.
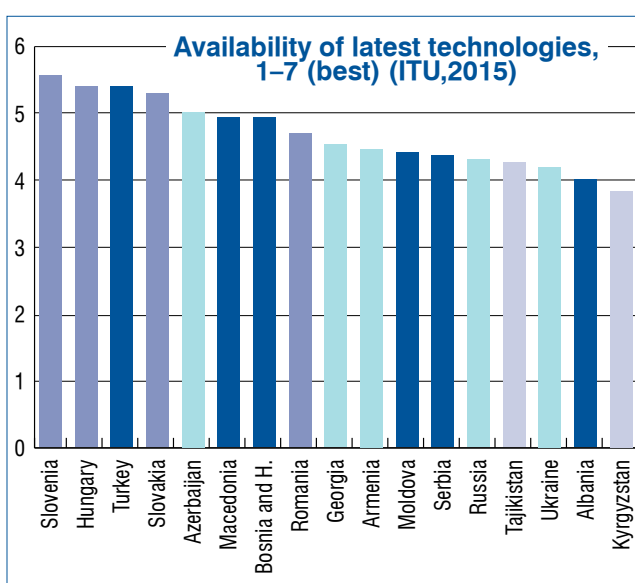

Figure 4.

The first policy document was the National Information Society Strategy in 2001. After the establishment of the Ministry of Informatics and Tele-

communication, a new strategy was created: the Hungarian Information Society Strategy, in 2003. This strategy was followed with sectoral action plans that included an independent e-agriculture programme. The programme document contained a comprehensive set of actions in order to transform agriculture with the use of ICTs. Despite this document, the whole strategy, particularly the e-agriculture programme remained weightless, and only some parts of it were implemented – those which were already in the pipeline. Agricultural policy has been shaped in the last 15 years by the European Common Agriculture Policy.

The recent strategy document, the National Info-communication Strategy (for the period 2014-2020) was approved by the government in February, 2014. The primary objectives of the 2014-2020 period are focusing on the fields of digital infrastructure, competence, economy and state.

Agriculture is an important pillar of the Hungarian economy, and there is also a firm strategic framework both in the fields of agriculture and info-communication. A comprehensive e-agriculture strategy could significantly help building synergies between the existing elements of this strategic framework and make a crucial contribution to the further development of agriculture.

Romania

Population	19 910 995
GDP per capita (USD)	9 996.670
Agriculture, value added (% of GDP)	5.362
Labor force in agriculture %	29
Land use %	59.704
Mobile phone subscriptions/100 pop	105.6
Individuals using Internet %	49.8
Households with Internet access at home %	58.1
Fixed broadband Internet subs %	17.3
Mobile broadband subs %	37.6
Government Online Service Index	0.441
Importance of ICTs to government vision	3.432
WEF Network Readiness Index	4.151
WS Participant Rank by WEF NRI index	10

Table 2.

87 percent of the territory of Romania is rural, and agricultural land covers almost 60 percent of the country. The share of agriculture in the Romanian economy is approximately 6 percent, which is one of the highest in Europe. Farming structures are polarized, due to the huge number of small, subsistence farms: the average farm size is 3.4 ha. Agriculture still provides one third of total employment in the country. Romania's internet use is the lowest in the region, as only the half of the population uses the internet, and the impact of information technology is far from its potential, especially in agriculture. The ratio of individuals who have never used the internet is the highest in Romania (39 percent) among the European Union countries. In terms of the Network Readiness Index, Romania's score is average and behind other European Union countries of the workshop, but it is worth mentioning that the country marked a considerable improvement gaining 12 places on the rank list from 2014 to 2015.

Information society strategy development started early in Romania, with the National Strategy for the New Economy and the Implementation of the Information Society by the Ministry of Communications and Information Technology in 2002. The recent strategy in the field of information society is the "National Strategy on Digital Agenda for Romania", adopted in the middle of 2014. The strategy targets the ICT sector directly and aims to contribute to economic growth and increase competitiveness in Romania, both by direct action and support of development. Taking into consideration the seven pillars of the Digital Agenda for Europe 2014-2020, Romania defined four major fields of action:

- e-Government, Interoperability, Cyber Security, Cloud Computing, Open Data, Big Data and Social Media – increase efficiency and reduce the public sector costs in Romania by having a modern administration.
- ICT in Education, Health, Culture and e-Inclusion– support at a sectoral level that will ensure ICT investments create a positive impact in the social context.
- e-Commerce, Research & Development and Innovation in ICT – builds on the comparative advantages of regional Romania and supports economic growth in the private sector.
- Broadband and Digital Services Infrastructure ensures social inclusion and enables the benefits across all other fields of actions.

The strategy is supported by thematic strategies in the fields of cyber security, open data, e-health, research and development. The responsible body for information development is the Ministry for Information Society.

As many people work in agriculture in Romania, the importance of agriculture is high, such as the development of agriculture with the use of ICTs. In terms of ICT access, the country is lagging behind the most European states so development in this area is crucial, as without more people using the internet, e-agriculture-related development cannot be successful. The e-agriculture strategy could be part of the broader National Strategy on Digital Agenda for Romania, especially as the strategy is supported by different thematic strategies.

Slovakia

Population	5 418 506
GDP per capita (USD)	18 416.542
Agriculture, value added (% of GDP)	3.742
Labor force in agriculture %	3.2
Land use %	40.081
Mobile phone subscriptions/100 pop	113.9
Individuals using Internet %	77.9
Households with Internet access at home %	77.9
Fixed broadband Internet subs %	15.5
Mobile broadband subs %	53.6
Government Online Service Index	0.488
Importance of ICTs to government vision	3.291
WEF Network Readiness Index	4.235
WS Participant Rank by WEF NRI index	8

Table 3.

The contribution of agriculture to GDP in 2014 was less than 4 percent in Slovakia, and only around 3 percent of the population works in agriculture, which is the lowest among the countries of the workshop. Agricultural land covers around 40 percent of the country (where mountains make up 60 percent of the territory), and there is a slow change of arable land to grassland. There are approximately 16 000 agricultural holdings, half of them using less than 5 hectares.

The basic information society indicators – regarding usage, availability and affordability – are quite good: more than three quarters of the population uses the internet, and the same ratio of the households have internet subscriptions. The number of mobile broadband subscriptions are remarkably high. In other areas, the country's performance is average, the overall Network Readiness Index of Slovakia does not stand out from the results of other Central European countries.

The first information society strategy and action plan was adopted in the first half of 2004. The document set the priority areas and goals of information society development. The three main pillars of the strategy were content, human resources and infrastructure. A parallel governmental policy and action plan "Minerva" were developed in 2005 with some overlapping between the two action plans. One of the successful projects from this period was the provision of free electronic access to the Land Register. An e-Government strategy was also adopted in 2008. A new Information Society Strategy for 2009-2013 replaced the first strategy, with the identification of six key development areas: broadband connections, information security and standards, e-government, e-health, digital literacy and e-education and reducing energy consumption and increasing energy efficiency.

Under the scope of the new EU-programming period, Slovakia adopted the Strategic Document for Digital Growth and Next Generation Access Infrastructure (2014-2020), with special focus on the services for citizens and businesses, on effective public administration and on the development of broadband/next generation network infrastructure. The Ministry of Finance of the Slovak Republic is the government body responsible for the information society development. The ministry dedicated a separate web portal (www.informatizacia.sk) for information society related issues.

The agriculture sector does not play a very important role in the Slovakian economy, however the information society development indicators are favourable to help the sector increase further its efficiency. A well-defined national information society strategy is in place already, which could facilitate the formulation of e-agriculture strategy. The relatively small agriculture sector may act as disincentive to this process.

Slovenia

Population	2 062 218
GDP per capita (USD)	23 962.576
Agriculture, value added (% of GDP)	2.151
Labor force in agriculture %	8.3
Land use %	23.818
Mobile phone subscriptions/100 pop	110.2
Individuals using Internet %	72.7
Households with Internet access at home %	75.6
Fixed broadband Internet subs %	25
Mobile broadband subs %	41.8
Government Online Service Index	0.425
Importance of ICTs to government vision	3.428
WEF Network Readiness Index	4.642
WS Participant Rank by WEF NRI index	1

Table 4.

Slovenia is one of the smaller European countries, with a territory of 20 273 km2 and with a population of around 2 million people. The role of agriculture in the economy is limited for many reasons, mainly due to the unfavourable environmental conditions for farming: the majority of the country is covered by mountains and forests and more than three-quarters of the surface belongs to areas classified as less favoured (LFA). Agricultural land use (23 percent of the whole territory) is dominated by permanent grasslands and livestock production.

The basic indicators of internet access and use are fairly good: almost three-quarters of the population use the internet and more than 75 percent of the households have internet connections. According to other indicators, Slovenia is above the average of the central and eastern European countries. The country also has the highest rank in the Network Readiness Index among the workshop participants.

Slovenia was one of the first countries in the region with an information society development strategy, adopted in 2003 (which was followed with a broadband network development strategy a year later). A Government Centre for Informatics and the Ministry of Information Society was set up, but both were abolished later on. This indicates that in-

formation society related policy in Slovenia now has a lower priority than before. The latest strategy in the field was Development Strategy for the Information Society in the Republic of Slovenia (2010), guided by European initiative "i2010". Some thematic strategies were also written (e.g. Strategy for Effective Government Informatics, Strategy for Telemedicine), under the scope of the Slovenian National Strategy for 2006-2013.

Now the Directorate for the Information Society at the Ministry for Education, Science and Sport is responsible for the development of the information society. The National Rural Development Programme of Slovenia for the period 2014-2020 emphasizes the importance of promoting access to information and communication technologies (ICT) in rural areas and also the knowledge transfer and innovation in agriculture.

While the role of agriculture in the economy is limited, about half of the country's population lives in rural areas with predominance of mountains, hence the potential for enhancing rural development though ICTs is considerable. In contrast to other workshop represented countries from this sub-region, while the information society indicators in Slovenia are favourable, there is no recent information on society strategy development in Slovenia. An e-agriculture strategy could be based on the relevant parts of the Rural Development Programme and on the fairly good availability of ICTs in the country.

Based on the importance of agriculture and on the developed infrastructure and usage of ICTs, there are countries in this sub-region where an e-agriculture strategy could make a significant impact. In these countries, existing information society strategies also can help create such a strategy. There are special ICT-related strategies in every country in harmony with the Digital Agenda of the European Union, sometimes they are dealing with rural areas but mainly in terms of network infrastructure and internet access, there are only few agriculture-specific initiatives, and no sign of systematic harmonisation of agriculture and IT-policy making. ICT development is no longer handled by a single ministry in many countries of this region which can make cooperation more difficult.

South East Europe (SEE)

The region has the second highest agriculture value added among other sub-regions, and Albania has the same position in agriculture value added (percent of the GDP) among the Regional Workshop-participant countries, and Moldova is also above the average (11.9) of the SEE countries.

The labour force in agriculture is above 20 percent in the region: almost a quarter of the population working in the sector (Albania leads the way with 41 percent, and Moldova is again above the average with 26.4 percent), therefore we can safely state that agriculture still plays an important role in the economy of the countries in this region.

Regarding the main ICT-indicators, the region has the highest mobile network coverage by a slight margin, but the number of mobile subscription is the lowest here, while still exceeding the one subscription/inhabitant ratio (only Bosnia-Herzegovina and Turkey fall short of this line among WS countries), with an average of 113 subscriptions per 100 inhabitants. This indicator can sometimes be deceptive as how people are managing their mobile subscriptions differs from country to country. Sometimes they have more than one for personal purposes, while in other countries there is no separate subscription for personal and work-related purposes. We can state that as a rule-of-thumb without context this indicator can only be used with some caution, but in our case, the average number of over 110 subscriptions per 100 people shows that mobile phones are ubiquitous in the region.

In terms of internet users and households with internet connections, the region is lagging behind the other parts of Europe, but performs a bit better than CIS regions, as more than the half of the pop-
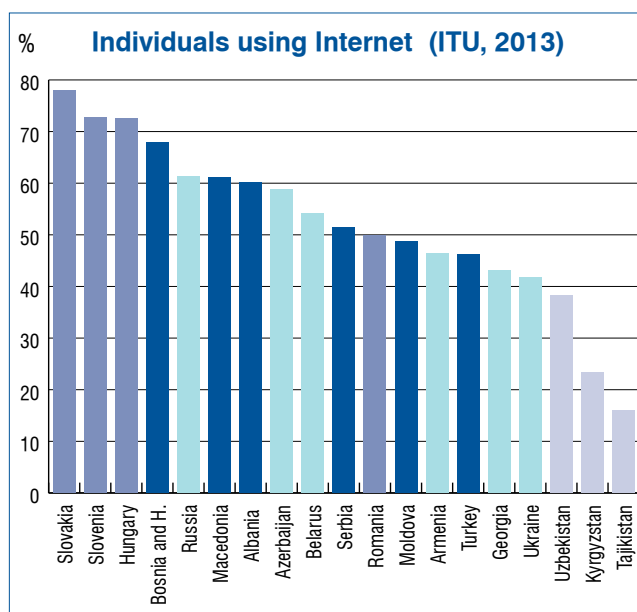

Individuals using Internet (ITU, 2013)

Figure 5.

ulation uses the internet (56 percent) and almost half of households have internet connections, although rural regions regularly show lower penetration rates.

There are some interesting disparities among countries in the region: while the TFYR of Macedonia has the best figures in almost every ICT-access indicator, Bosnia-Herzegovina has the highest percentage of internet users – but in every other indicator, the country is lagging behind the other countries in the sub-region. According to the Network Readiness Index, the TFYR of Macedonia and Turkey are among the best of the Regional Workshop participant countries (3rd and 4th) which shows that in these countries ICTs have a major impact on government, economy and society. However, there is still room for improvement, as TFYR of Macedonia struggles with e-government services according to the UN's Government Online Service Index.

Agriculture and information society policy-making is strongly influenced by the ambition of EU-integration in all of the countries in the region. Since the early 2000s, information society strategies have been created (sometimes with the help of international development organizations), and almost every country in the region has a recent digital development document (e.g. "Albania's Digital Agenda" or the 2015-2018 Information Society Strategy and Action Plan in Turkey), essentially all focusing on infrastructure development and also on government, education, health and business issues, and do not cover agriculture in a comprehensive way. There were a few projects in the region that can be connected to e-agriculture, with various backing (government, civil society, business and donors) and success.

As it was stated at the EU-countries-section, e-Cadastre/ Land register projects are under way or implemented (e.g. TFYR of Macedonia) and some governments are trying to use information technology to integrate all agricultural data and government services. Two such initiatives were presented at the Regional Workshop: the e-agriculture program of Moldova and the Agricultural Information System (AIS) project from Turkey.

Albania

Population	2 894 475
GDP per capita (USD)	4 619.211
Agriculture, value added (% of GDP)	22.671
Labor force in agriculture % (2010):	41.5
Land use %	43.843
Mobile phone subscriptions/100 pop	116.2
Individuals using Internet %	60.1
Households with Internet access at home %	24.5
Fixed broadband Internet subs %	5.8
Mobile broadband subs %	24.7
Government Online Service Index	0.449
Importance of ICTs to government vision	3.744
WEF Network Readiness Index	3.703
WS Participant Rank by WEF NRI index	15

Table 5.

In Albania, agriculture is still an important part of the economy, with about 20 percent of GDP being generated by the sector and 40 percent of the labour force working in agriculture. The land used for agricultural production (compared to the whole surface of the country) is low, because of the mountainous and hilly regions that cover almost 70 percent of the country. These regions are mainly underprivileged.

According to information society development, we can say that the government in Albania recognized the importance of telecommunication and ICT-development early on, and made significant efforts (also fuelled by the ambition of EU-integration) in this field, including market liberalization, creating a firm regulatory framework, realizing e-government projects and creating information society strategies and action plans. Due to these efforts, the mobile network coverage, the mobile subscriptions and the number of individuals using the internet increased and these indicators are acceptable in European comparison. However, the number of fixed and mobile broadband subscriptions is low, partly caused by the relatively high tariffs.

Albania has been actively formulating information society policy since 2003, when the first information society strategy was approved by the government. Early success stories include the establishment of a business registration centre, which is the electronic, UN-award winning e-procurement system and an e-schools project. The first strategy was followed by the Cross-Cutting Strategy for Information Society 2008-2013 (as a part of the National Strategy for Development and Integration 2007-2013), with sectoral action plans, and a parallel governmental initiative called Digital Albania, started in 2009 (in this year, the Ministry for Innovation and Information and Communication Technologies was also established). Now, the main direction of development is set by the Albanian government program 2013-2017, which more or less mirrors the

policies and priorities of the European Union in the field of information society development. The government program includes three main areas of intervention:

- Enhancement and promotion of electronic services for citizens, businesses and administrations;
- Use of ICT in education to overcome the digital divide and to enable youth;
- Consolidation of digital infrastructure in the entire territory of the Republic of Albania, strictly respecting European principles of free competition and fair business practices.

.
The governmental program is backed by Albania's Digital Agenda 2015-2020 strategy and an action plan with detailed actions and measures for this five year period.

The importance of agriculture, the existing ICT-infrastructure and favourable policy environment are positioning Albania among the first countries in which an e-agriculture strategy could make a significant impact on the sector.

Bosnia and Herzegovina

Population	3 824 746
GDP per capita (USD)	4 796.208
Agriculture, value added (% of GDP)	7.571
Labor force in agriculture % (2014):	20.5
Land use %	42.333
Mobile phone subscriptions/100 pop	91.2
Individuals using Internet/100 pop	67.9
Households with Internet access at home/100 pop	47.5
Fixed broadband Internet subs/100 pop	11.8
Mobile broadband subs/100 pop	22.2
Government Online Service Index (2014)	0.373
Importance of ICTs to government vision (2014)	3.746
WEF Network Readiness Index (2014)	3.985
WS Participant Rank by WEF NRI index	13

Table 6.

Bosnia and Herzegovina is situated in the central part of the Balkan Peninsula. Agricultural land covers 42 percent of the territory, but only a smaller amount of the land is suitable for intensive farming. The agriculture value added is lower than the regional average, while the labour force working in agriculture is 20 percent.

Bosnia-Herzegovina has a very complex state-structure, which makes major reforms slow to implement. This is reflected in the policy-making processes of the country – both in the field of agriculture and information society development. It also affects the main driving force behind changes: EU-integration. The latest progress report (2014) of the EU states that the country remains at a standstill in the European integration process. It is true in terms of a countrywide rural development strategy (of which, a public consultation was launched in May 2014)

and the establishment of an agency for the development of the information society. At the moment, the Ministry of Transport and Communications is responsible for issues relating to information society development.

Bosnia-Herzegovina was among the first countries with an information society development strategy in the region: with the help of UNDP, a policy and a strategy was accepted in 2004, for the period 2004-2010. The strategy was followed with the Action Plan of Information Society Development in Bosnia and Herzegovina, which contained concrete actions and steps need to be taken, around the five pillars of the strategy: e-legislation, e-education, e-governance, e-infrastructure, e-industry. Later on, countrywide information society strategies were not formulated.

Despite difficulties in creating and implementing countrywide strategies, internet usage is one of the highest in the region and still increasing: two-thirds of the population use, and half of households have internet subscriptions, while the number of mobile broadband subscriptions is low in regional comparison.

Although agriculture is an important sector in Bosnia Herzegovina, and the major ICT-indicators are good in regional comparison, the difficulty of creating comprehensive strategies in the country can be a barrier to formulating an e-agriculture strategy. Nevertheless such a strategy could have a major impact on agriculture, and could also serve as a good practice for strategy making.

TFYR of Macedonia

Population	2 108 434
GDP per capita (USD)	5 370.698
Agriculture, value added (% of GDP)	10.231
Labor force in agriculture %	17.3
Land use %	50.238
Mobile phone subscriptions/100 pop	106.2
Individuals using Internet %	61.2
Households with Internet access at home %	61.9
Fixed broadband Internet subs %	15.7
Mobile broadband subs %	38.3
Government Online Service Index	0.244
Importance of ICTs to government vision	4.883
WEF Network Readiness Index	4.416
WS Participant Rank by WEF NRI index	3

Table 7.

Agriculture plays an important role in the TFYR of Macedonia, as it contributes 10 percent of GDP, and half of the territory of the country is under agricultural use. However, agriculture employs only 17 percent of the working population. The production of value added products, such as wine, fruits and vegetables, is increasing, and the development of irrigation could support this direction. Forests cover about 37 percent of the land. The average size of individual farms is less than 3 hectares.
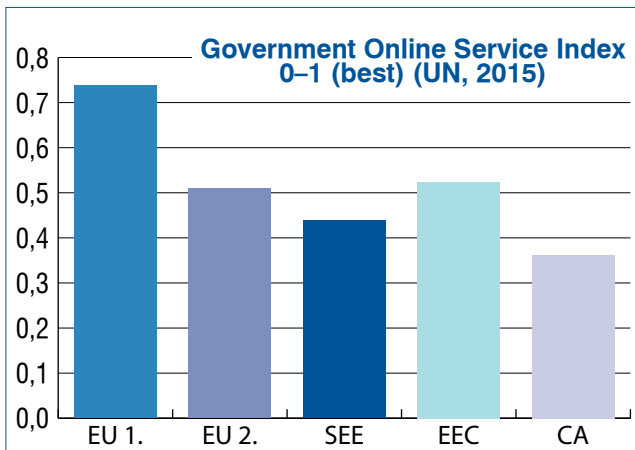
Government Online Service Index 0–1 (best) (UN, 2015)

Figure 6.

At government level, the Ministry of Information Society and Administration is the central institution for information society development policy making, which is actively involved in formulating initiatives in the information society domain to systematically develop the country with the implementation of ICT, and also as a part of the EU-integration process. The independent regulatory body, the Agency for Electronic Communications was established in 2005. The first information society development strategy of the country was adopted in 2004, which included an action plan and identified the necessary mechanism and the legal and fiscal framework for successful information society development). Follow up thematic strategies include the strategy for e-content development 2010-2015 and a National Strategy for e-Government 2010-2012.

The path of development has resulted in many legislative activities and laws adopted in the past years (e.g. on telecommunications, e-signatures, e-communications, e-commerce, on free access to public information). There are many successful initiatives in the field of information society development in different areas; e.g. a computer for every child at school, an e-taxation portal, an e-procurement system, e-payment system for governmental services, online applications for new jobs in governmental institutions and an e-Cadastre project (http://katastar.gov.mk).

The TFYR of Macedonia is among the countries where ICT has begun to make an impact on every level of society. The basic internet indicators are the highest in regional comparison, and keep increasing, hence the TFYR of Macedonia is scoring significantly higher than its neighbours in terms of importance of ICTs for government vision and the impact of ICTs on new services and products. This trend is also well reflected by the steadily increasing component of access to basic services part of the NRI. The country moved up by 20 places of its position in the last two years, according to World Economic Forum's NRI.

The successful ICT-projects and the commitment of the government to use ICTs as major development tool create a good climate for e-agriculture development.

An e-agriculture strategy could follow in the footsteps of other ICT-related initiatives of the country, and make agriculture remain an important sector, contributing significantly to the GDP of TFYR of Macedonia.

Moldova

Population	3 556 400
GDP per capita (USD)	2 233.772
Agriculture, value added (% of GDP)	15.232
Labour force in agriculture	26.4
Land use %	74.863
Mobile phone subscriptions/100 pop	106
Individuals using Internet %	48.8
Households with Internet access at home %	46
Fixed broadband Internet subs %	13.4
Mobile broadband subs %	47.2
Government Online Service Index	0.528
Importance of ICTs to government vision	3.673
WEF Network Readiness Index	4.031
WS Participant Rank by WEF NRI index	11

Table 8.

Moldova is bridging the EU markets and the growing markets of the CIS countries, with ongoing negotiations for EU-integration. Agriculture plays an important role in the country, the agriculture value added makes up 15 percent of the GDP, 26 percent of the labour force is employed in agriculture and Moldova has the highest land usage for agriculture among the countries which participated in the workshop.

The ICT indicators of the country are average or just below average: Half of the population uses the internet, and also half of households have internet subscriptions. The price of telecommunication services is just above the average of the WS-countries. According to the WEF NRI index, in terms of efforts of the government, Moldova is making rapid progress, especially in reference with the government services online and e-participation indicators and progressing well with the promotion of ICTs. Other indicators show that, the country performance is about average, however the impact of ICTs on new services and products still remains an area that requires significant improvement.

The good progress of Moldova in the ICT development is associated with the successful implementation of a series of strategies, beginning with National Strategy for Building an Information Society ("Electronic Moldova" or E-Moldova), adopted in 2005. The main priority of the early strategies was the development of an appropriate information infrastructure at various levels. Among others, an online fiscal declarations system, a biometric passport and automated biometric border crossing system, the Moldova digital map, mobile digital signature and other online services (e-record, e-license) were implemented. The main framework for state

ICT development, the Technological Transformation Strategic Program or "e-Transformation" program (supported by the World Bank), was accepted by the government in 2011.

The recent strategy "Digital Moldova 2020" aims at building a modern information society. The strategy is backed by an Action Plan, with the measures and actions needed to be taken to achieve the main goals of the strategy. The strategy's main pillars are:

- Access and infrastructure - connectivity and network access improvement;
- Digital content and electronic services promoting digital content and generating services;
- Capacities and utilization - strengthening literacy and digital skills to enable innovation and usage stimulation.

The importance of agriculture in the economy of Moldova and the good basis created by the information society policy resulted in an already formulated e-agriculture programme. The details of this program can be read in the next section of this report.

Serbia

Population	7 129 428
GDP per capita (USD)	6 152.867
Agriculture, value added (% of GDP)	9.689
Labour force in agriculture	21
Land use %	57.775
Mobile phone subscriptions/100 pop	119.4
Individuals using Internet %	51.5
Households with Internet access at home %	48
Fixed broadband Internet subs %	13.9
Mobile broadband subs %	54.8
Government Online Service Index	0.394
Importance of ICTs to government vision	3.224
WEF Network Readiness Index	3.954
WS Participant Rank by WEF NRI index	14

Table 9.

Agriculture plays an important role in the Serbian economy, as almost one-quarter of the population works in the sector and it creates 10 percent of value added in percent of the GDP. Fifty seven percent of the total land area is used for agricultural purposes. Agriculture and rural development policy making is dominated by the requirements of the EU-integration process.

According to statistics, the individual internet-usage is average in Serbia, as half of the population regularly use the internet, and half of households have internet subscriptions. The number of mobile broadband subscriptions is remarkably high. However, according to the indicators of the Network Readiness Index, the government was not so successful in promoting ICT-development as a top priority or making an impact on government service provision. It is clear that efforts

shall be enhanced to straighten the capacities of the policy-makers and ministry officials involved in agricultural sector with the aim of formulating and implementing a holistic strategy and better enabling environment for businesses to allow faster gains for the agricultural sector in Serbia through the use of appropriate ICTs.

The first strategy, paving the way of the information society development, was adopted in 2005 (National Strategy for an Information Society in Serbia), with special focus on e-business, e-banking, e-health, education, e-government, the development of telecommunication infrastructure and a proper legal framework The strategy for broadband development until 2012 and the electronic administration development strategy 2009-2013 constituted a part of the enabling policy environment. Earlier, a specific ministry, the Ministry of Telecommunications and Information Society had been dedicated to information society -related policy making, which responsibility was transferred to the Ministry of Foreign and Internal Trade and Telecommunications in 2011. The current information society strategy (Strategy for Information Society Development in the Republic of Serbia until 2020) was adopted in 2010, with a subsequent action plan for 2013-14, adopted in 2013.

The document is harmonized with the Digital Agenda for Europe, as the strategy being entitled "Digital Agenda for Serbia". The strategy defines basic objectives and priorities of the development of information society in Serbia in six areas:

- Electronic communications, infrastructure development
- E-government, e-health and e-Justice
- ICT in education, science and culture
- Electronic commerce (e-commerce)
- Business ICT sector
- Information security

An important agriculture sector, moderate information society indicators and existing strategic background make Serbia another country where a comprehensive e-agriculture strategy could have a significant impact on the sector.

Turkey

Population	75 837 020
GDP per capita (USD)	10 542.806
Agriculture, value added (% of GDP)	8.034
Labor force in agriculture %	23.6
Land use %	49.903
Mobile phone subscriptions/100 pop	93
Individuals using Internet %	46.2
Households with Internet access at home %	49.1
Fixed broadband Internet subs %	11.2
Mobile broadband subs %	32.3
Government Online Service Index	0.559
Importance of ICTs to government vision	4.210
WEF Network Readiness Index	4.410
WS Participant Rank by WEF NRI index	4

Table 10.

Agriculture is an important part of the Turkish economy, and it contributes 9 percent to GDP and employs a quarter of the labour force. Agricultural land covers the third of the country, and there are 6 million agricultural holdings (with an average size of 6 ha). Partly due to the favourable climate and soil conditions, the country has a diverse food-production and Turkey is self-sufficient in terms of agricultural products. The Turkish agriculture has grown steadily in the last few years, and the country's target for its agricultural sector is to be among the top five agriculture producers globally by 2023.

Internet penetration is just under the 50 percent mark, as about 47 percent of the population use the internet and almost the half of households have internet subscriptions. The number of broadband internet subscriptions has been growing steadily in the last few years and this trend will continue. According to the relevant indicators of the Network Readiness Index, the level of competition in the telecommunication sector is high, and it is mirrored in mobile coverage and in the affordability of mobile services.

Information society development began under the umbrella of the project "e-Transformation Turkey" in 2003 with the aim of coordination, developing e-government and facilitating EU-integration. After two action plans (for 2003-04 and for 2005), the first information society development strategy of the country has been created for the period 2006-2010, with seven action lines (e.g. social transformation, ICT adoption by businesses, citizen-oriented service provision, widespread and affordable telecommunications infrastructure and services).

In early 2015, a new document was adopted: 2015-2018 Information Society Strategy and Action Plan, the responsible entity for the strategy is the Ministry of Development. The main driving forces behind the creation of the document are the Tenth National Development Plan and Digital Agenda for Europe, because of the ongoing EU-integration process. The strategy has eight priority areas:

- ICT sector development
- Broadband infrastructure and industrial competitiveness
- Qualified Human Resources and Employment
- Adoption of ICT in society
- Information security and user confidence
- ICT and innovation
- Internet entrepreneurship and e-commerce
- User centered public services

As in many countries in this sub-region, agriculture is an important part of Turkish economy and there is also a significant governmental effort to make ICT development a priority. It is materialised in an e-agriculture initiative. The details of this initiative are included in the next section of this report.

Households with Internet access at home (ITU, 2013)
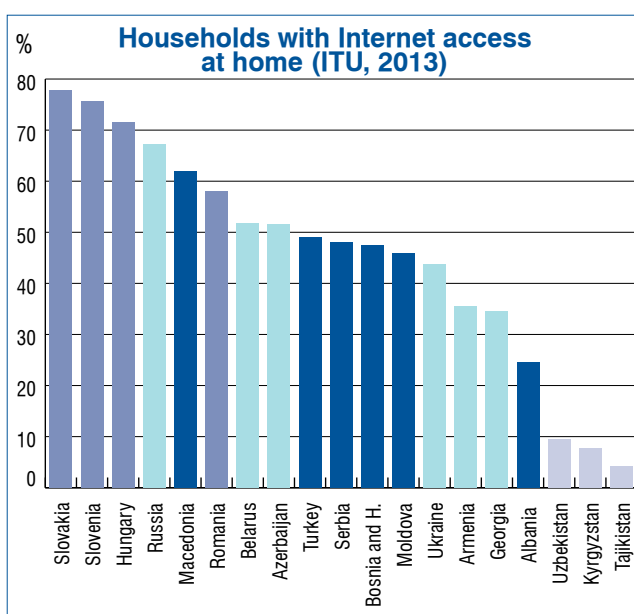
Figure 7.

A very diverse region in terms of policy making and strategies. In some countries there is no comprehensive information society development strategy, which makes it more difficult to promote strategic approach in e-agriculture. In other countries, there are general information society strategies (basically in harmony with the Digital Agenda of the EU), which contain some common elements (content development, universal access, development of digital literacy) that can support e-agriculture strategies as well. Besides that, there are countries (e.g. Moldova or Turkey) with a concrete e-agriculture governmental program which mostly aim at collecting, organizing, publishing and using all official and governmental information in the sector.

Eastern Europe and Caucasus (EEC)

The most diverse group of countries is represented by Belarus, Russian Federation, Ukraine and the Caucasian countries (Armenia, Azerbaijan, Georgia). There are significant differences between these countries if we look at the agricultural labour force in the population, as more than a third of employment in Armenia and Azerbaijan happens in agriculture, and this ratio is 53 percent in Georgia, the highest among the workshop participant countries. In Belarus, Russian Federation and Ukraine, on the other hand, this ratio is about 10-15 percent. Agriculture contributes around 10 percent of GDP in the region, Russian Federation (4 percent) and Armenia (22 percent) are the exceptions.

According to the information society indicators, these countries perform fairly well: more than half of the population use the internet in the sub-region (51 percent), and almost half of households subscribe to the internet (47 percent). The sub-region has 124 mobile phone subscriptions per 100 people, which is just slightly fewer than the average of the European regions, and this number is 152 in Russian Federation (implying that many people have more than one device). The mobile network coverage is nearing 99 percent, and the telecommunication tariffs are also affordable.

The more complex indicators show that ICT plays an important role in all these countries, especially for government service provision. The Government Online Service Index is the second highest among the sub-regions, the average score tops the index score of the new EU-member group too, and Russian Federation, Armenia and Georgia are in the first three places among all workshop participant countries. Russian Federation also has the second highest NRI-value, while the Caucasian countries all have similar scores, where the sub-index scores show that in every aspect, information technology has begun to make an impact on the society.

From the policy point of view, the main priority of e-agriculture related IT-development is the collection and distribution of all agricultural data collected by state agencies. In some countries, a unique information-system for agriculture has been proposed, and in Azerbaijan, the development of the system is based on the IACS-principles of the European Union.

A very diverse sub-region in terms of policy making and strategies. Many countries in this sub-region have low to moderate share of agriculture to the GDP but still considerable employment in agricultural sector. The ICT-indicators in most of the countries have promising prospects for e-agriculture, but information society development strategies in many cases are not structured around one single strategic document, that can delay of the preparation of national e-agriculture strategies.

Armenia

Population	2 983 990
GDP per capita (USD)	3 646.663
Agriculture, value added (% of GDP)	21.935
Labor force in agriculture % (2011):	38.9
Land use %	59.115
Mobile phone subscriptions/100 pop	112.4
Individuals using Internet %	46.3
Households with Internet access at home %	35.6
Fixed broadband Internet subs %	7.9
Mobile broadband subs %	31
Government Online Service Index	0.614
Importance of ICTs to government vision	4.226
WEF Network Readiness Index	4.247
WS Participant Rank by WEF NRI Index	7

Table 11.

Agricultural value added to Armenia's GDP is 22 percent (as of 2014) with over 70 percent of the total land area used for agriculture. However, due to low productivity in the sector in recent years and limited land resources suitable for extensive agriculture development, the country now focuses on the IT and ICT development with investments in the telecommunications (with private participation) reaching USD 54 420 000 in 2013 as the means of diversifying the economy. Some of such investments are applicable to agricultural sector modernization and development.

In 2008, the Government of the Republic of Armenia approved the Concept of development of information technologies. The main aim of the Concept is to define the prospects and directions of development of information technologies and the information society. With this Concept, the government of Armenia envisioned the country to become the technological hub of the region. The Concept set targets for enabling the use of IT and ICT in different industries and provided capacity for educational programs dedicated to training of IT specialists in the country. Another aim of the Concept is to create a strong R&D sector, which would help Armenia to compete on the international market of IT and ICT technologies in various sectors.

In 2015, during a meeting with representatives of the Union of Information Technologies (UITE) the government discussed issues concerning the further development of information technology and to promote innovative ideas. The meeting attendees touched upon the process of modernization of the educational system, training high-quality personnel, increased international cooperation, as well as prospects for the implementation of programs aimed at attracting investment into the economy.

It was also concluded that strengthening the ties of agricultural science and production by more intense cooperation between the Ministry of Agriculture and the Agrarian University will make the whole agriculture sector more efficient.

Agriculture is an important sector in Armenia's economy, and there are coordinated efforts to make agriculture more effective and more productive. This strategic aim provides a good climate for e-agriculture as ICTs are one of the best tools to achieve effectiveness and productivity goals. The modest ICT-indicators compared to other states in the sub-region also contribute to the favourable environment of an e-agriculture strategy.

Azerbaijan

Population	9 537 823
GDP per capita (USD)	7 884.190
Agriculture, value added (% of GDP)	5.692
Labor force in agriculture %:	37.7
Land use %	57.687
Mobile phone subscriptions/100 pop	107.6
Individuals using Internet %	58.7
Households with Internet access at home %	51.5
Fixed broadband Internet subs %	17
Mobile broadband subs %	43.9
Government Online Service Index	0.433
Importance of ICTs to government vision	5.237
WEF Network Readiness Index	4.280
WS Participant Rank by WEF NRI Index	6

Table 12.

4.74 million hectares or 55 percent of the total Land area in the country is agricultural land, while only 1.8 million hectares are cultivated land. In 2014, the agricultural sector contributed only 6 percent of the country's GDP, which is drastically less than in 2001, when agriculture contributed over 20 percent of GDP, due to a shift from the traditional agrarian economy to industry and the service sector, particularly with the development and increased revenue from the oil and gas sector over the last decade. However, the agricultural sector remains one of the main pillars of the economy since this sector provides income and employment for 38 percent of country's workforce and ensures 40 percent of income for rural areas. Currently, the sector is characterized by low productivity, high levels of soil degradation and salinization. Only recently, the government identified the agricultural sector as a priority for development and committed to modernizing it. ICT technology would be one of the tools used to improve the sector as the president of Azerbaijan has declared ICT as a national priority, and also the Ministry of Communications and IT was established in 2004. A policy document (National Information and Communication Technologies Strategy for the Development of the Republic of Azerbaijan (2003-2012)) was also approved. The share of ICT

goods and services exported from the country has been constantly growing over the last seven years. In this context, the Government has embarked on the establishment of e-agriculture system in the country. According to the Decree of the President of the Republic of Azerbaijan dated 16 April 2014, a decision has been taken to establish electronic agriculture information system in stages over the three-year period in order to ensure transparency and accountability in state support to the agriculture sector. Based on this decision, the establishment of e-agriculture system, following IACS principles and consisting of seven sub modules and in line with EU experience, is underway in Azerbaijan and is being implemented by an IT team of international consortium.

Furthermore, within the ongoing World Bank project in Azerbaijan, international consultants have been involved in the development of a feasibility study and national system for the identification of animals and registration of holdings.

Within the FAO project on "Capacity and institutional development for improved value chain coordination TCP/AZE/3403", an electronic database system has been established on retail and wholesale prices of agricultural products, which is daily updated and available to the public through the sub- domain of the Ministry of Agriculture (marketing.agro.gov.az).

In addition, a countrywide Farm Data Monitoring System (FDMS) is operating in Azerbaijan which was established under a joint EC/FAO Program on Information Systems to Improve Food Security Decision-Making. All these initiatives and developments promise rapid development and application of ICT tools.

In 2015, the Government declared that Azerbaijan is planning to develop information and communication technology sector and agricultural sector as priority areas of economic development.

Despite the fact that agriculture contributed with only 6 percent to the country's GDP, Azerbaijan is committed to "digitalize" the sector. The creation of an electronic agriculture information system is a good indicator of this process. As ICTs and agriculture are both considered as crucial for economic development, an e-agriculture strategy can help harmonise these priority areas and avoid duplication of efforts on recent ICT and agriculture related projects.

Belarus

Population	9 470 000
GDP per capita (USD)	8 040.048
Agriculture, value added (% of GDP)	8.867
Labor force in agriculture % (2009):	10.5
Land use %	43.349
Mobile phone subscriptions/100 pop	118.8
Individuals using Internet %	54.2
Households with Internet access at home %	51.8
Fixed broadband Internet subs %	29.8
Mobile broadband subs %	45.9
Government Online Service Index	0.323
Importance of ICTs to government vision	-
WEF Network Readiness Index	-
WS Participant Rank by WEF NRI Index	-

Table 13.

In 2014, agriculture contributed 9 percent to total GDP. Currently, the sector is in decline, giving up its positions in the country's economy to other, more profitable, sectors, such as construction and extractives. In order to grow and improve productivity and profits, the sector requires deep reforms and modernization.

A strong effort to push ICT into the agricultural sector is visible and is incorporated into the National Program of the Expedite Development of Services in the Area of Information and Communication Technology for 2011–2015 (National Program). To date, Belarus has implemented a number of national programmes that have helped to modernize and develop the agricultural sector: Research program of the Union State "Development of advanced resource-saving ,environmentally friendly technologies and equipment for the production of biologically high-grade animal feed "for 2011-2013; State Program "Sustainable Rural Development" 2011-2015; Republic Program to "Equip organizations of agro-industrial sector with modern technology and equipment and to provide for construction, repair and modernization of production facilities of these organizations in 2011-2015"; and others. Such programmes have also introduced technology into the sector.

The Ministry of Agriculture is the main official provider of information about Agricultural market (prices), seeds, agricultural (including innovative) technologies, relevant legislation; useful information and links to other sources for farmers.

Through the website, the Ministry of Agriculture presents themselves as the information hub, where industry professionals, businesses, and all parties interested in agriculture could find useful links to the sources of useful information. In addition, the government created the Unified portal for administrative procedures handled by other State Agencies relevant to agribusiness. This portal is linked to the Ministry of Agriculture website.

The national program on information and communication and the recent ICT-related developments of the Ministry of Agriculture could serve as a good basis for an e-agriculture strategy. The relatively good ICT-indicators also provide a favourable environment to it, despite the modest importance of agriculture in the economy of the country.

Georgia

Population	4 504 100
GDP per capita (USD)	3 669.981
Agriculture, value added (% of GDP)	9.203
Labour force in agriculture (2007):	53.4
Land use %	35.473
Mobile phone subscriptions/100 pop	115
Individuals using Internet/100 pop	43.1
Households with Internet access at home/100 pop	34.6
Fixed broadband Internet subs/100 pop	10.2
Mobile broadband subs/100 pop	16.4
Government Online Service Index	0.598
Importance of ICTs to government vision	3.951
WEF Network Readiness Index	4.226
WS Participant Rank by WEF NRI Index	9

Table 14.
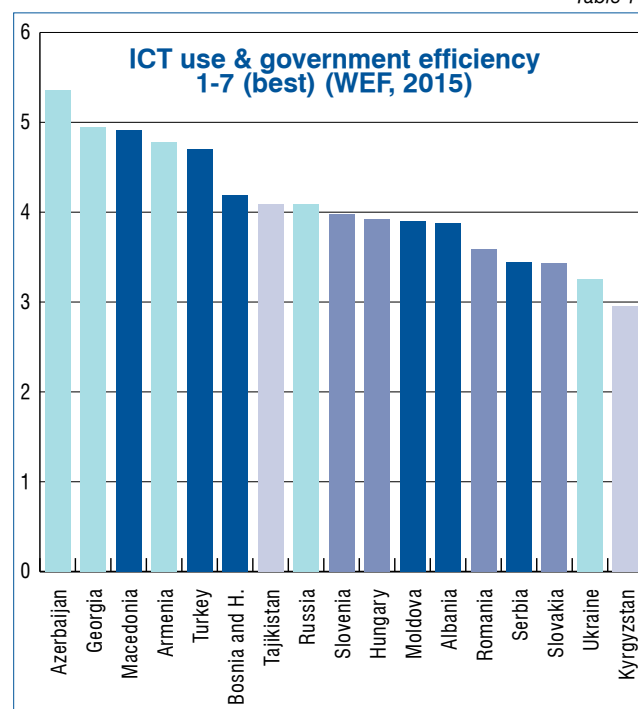
Figure 8.

Agricultural value added to GDP is 9 percent. The sector experienced visible growth in 2013, when the annual growth in value added reached 11 percent. About 35 percent of arable land is currently cultivated. What stands out is that almost 100 percent of the sector is private.

In 2007, the country had poorly developed ICT infrastructure in the agricultural sector. Since then, ICT use in the sector has improved, although not significantly. The 2012 Agricultural Sector Development Strategy proposed the establishment of e-services for the sector use.

The Strategy of Agricultural Development of Georgia 2015-2020 emphasized the creation of efficient market information collection, processing and dissemination services, which would collect data from various stakeholders engaged in the agricultural sector. Currently, the market information e-system, which collects and processes retail price on agricultural goods from across the country has already been developed and is in use. This e-system helped to create farm registry, and improved the cross-agency coordination within the Ministry of Agriculture.

Several state agencies, which are essential for the agricultural sector, collect and provide e-data for farmers and other stakeholders to use (such as the National Environment Agency, which provides on-line weather forecasts; the National Food Agency of Georgia, which provides data on pests and disease outbreaks; and the National Statistics Office of Georgia, which monitors trade data, prices, agriculture, environment and food security indexes; etc.).

While the agricultural value added to GDP is 9 percent, more than a half of the population work in the sector, which places agricultural development high in the Georgian development agenda. While the recent initiatives in agriculture are mostly based around data collection: to use all the data properly and also to build on the horizontal results of the e-Georgia strategy, an e-agriculture strategy could be well used.

Russian Federation

Population	143 819 569
GDP per capita (USD)	12 735.918
Agriculture, value added (% of GDP) (2013)	3.950
Labor force in agriculture % (2009)	9.7
Land use %	13.089
Mobile phone subscriptions/100 pop	152.8
Individuals using Internet/100 pop	61.4
Households with Internet access at home/100 pop	67.2
Fixed broadband Internet subs/100 pop	16.6
Mobile broadband subs/100 pop	60.1
Government Online Service Index	0.709
Importance of ICTs to government vision	3.824
WEF Network Readiness Index	4.532
WS Participant Rank by WEF NRI Index	2

Table 15.

The agricultural sector contributes to only 4 percent of GDP (2013). Most of the sector's land resources are cultivated by corporate farms, while privately owned individual farms produce the most output on 20 percent of arable land. The sector is in need of drastic reforms in order to improve productivity and profitability.

In 2006, newly-approved Federal Law "On the Development of Agriculture" included a separate article entitled "The System of Public Information Support in the Area of Agriculture," where it is stated that the role of IT is im-

portant in the development of the agro-industrial sector of the country. The document proposed the creation of the Information System in agriculture, which would be covering various data in a single source. In addition, the Ministry of Agriculture has developed a State Program "Development of Agriculture and Regulation of Markets for Agricultural Products, Raw Materials and Food in 2008 2012". A section of this program "Creating General Conditions for Agricultural sector effectiveness" proposed a unified information management and public support system for the Agricultural sector.

Currently the government is developing information systems to make management decisions on specific territories based on the most recent and substantive information available. Works are carried out to implement and adapt geographic information systems for the industry creating digital cartographic materials and collecting operational data through satellite monitoring.

The Ministry of Telecom and Mass Communications of the Russian Federation is responsible for information society development and the ministry has many well defined goals for the period 2012-2018. As ICT usage is high in the country, but the role of agriculture in the economy is low, a possible e-agriculture strategy could focus on adapting the favourable ICT environment into the field of agriculture.

Ukraine

Population	45 362 900
GDP per capita (USD)	3 082.461
Agriculture, value added (% of GDP)	11.788
Labour force in agriculture	17.200
Land use %	71.285
Mobile phone subscriptions/100 pop	138.1
Individuals using Internet %	41.8
Households with Internet access at home %	43.7
Fixed broadband Internet subs %	8.8
Mobile broadband subs %	5.4
Government Online Service Index	0.268
Importance of ICTs to government vision	2.697
WEF Network Readiness Index	4.009
WS Participant Rank by WEF NRI Index	12

Table 16.

In 2014, agricultural sector contributed 12 percent to GDP. The sector experienced decline due to dramatic geopolitical issues still unfolding in Ukraine. Ukraine is one of the top producers of several agricultural commodities such as sunflower seed oil, corn, sugar, honey, nuts, and wheat. Due to very favorable conditions (climate and rich soils), Ukraine has great potential for the improvement and further development of the agricultural sector.

(In 2013, Ukraine imported ICT goods in equivalent of 4 percent of the total goods imports, and the investment in the telecommunications sector with private share ac-
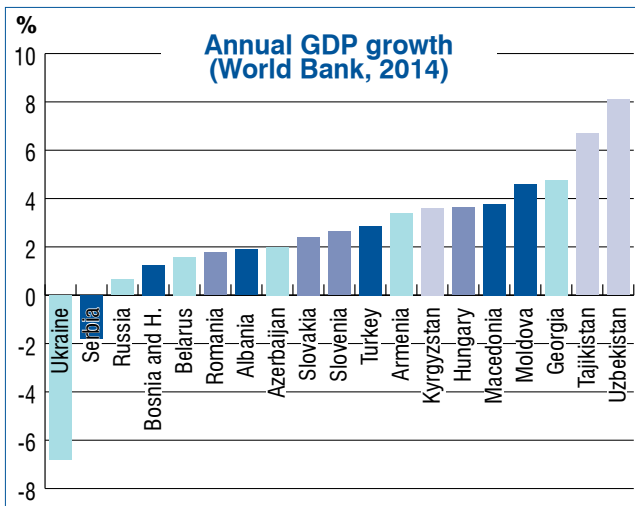
Figure 9.

counted for USD 184,800,000. ICT service exports accounted in 2013 for BoP USD 5,021,000,000).

In 2012, the National University of Life and Environmental Sciences of Ukraine initiated the creation of 20 electronic systems monitoring Ukrainian agriculture.

Ukraine has a great potential and also there is room for improvement in terms of information-society measures as well. An e-agriculture strategy could drive the development of both fields together.

Many countries in this sub-region have low to moderate share of agriculture to the GDP but still considerable employment in the agricultural sector. The ICT-indicators in most of the countries have promising prospects for e-agriculture, but information society development strategies in many cases are not structured around one single strategic document, that can delay of the preparation of national e-agriculture strategies.

There is a need for structural reforms in agriculture in almost every country of this sub-region providing good opportunity to create and implement e-agriculture strategy. There are various reform programs and development plans both in the field of ICT-development and agriculture, sometimes there are overlapping initiatives as well. The main direction of e-agriculture development is the one-stop-shop approach by governmental organizations.

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Central Asia (CA)

This group consists of five neighbouring countries from Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The importance of agriculture is clearly the highest here among all the sub-regions, as the average of agricultural value added is almost 17 percent, and all the workshop participant countries are above this average (Kyrgyzstan: 17.3 percent, Uzbekistan 18.8 percent), Tajikistan even stands out from the rest of the countries with 27 percent. The average GDP per capita is the lowest among the country-groups, and workshop-participant countries have the lowest figures in Central Asia and also among other workshop-participant countries. Land use varies widely between countries, and about one-third of the countries' workforce are employed in agriculture.
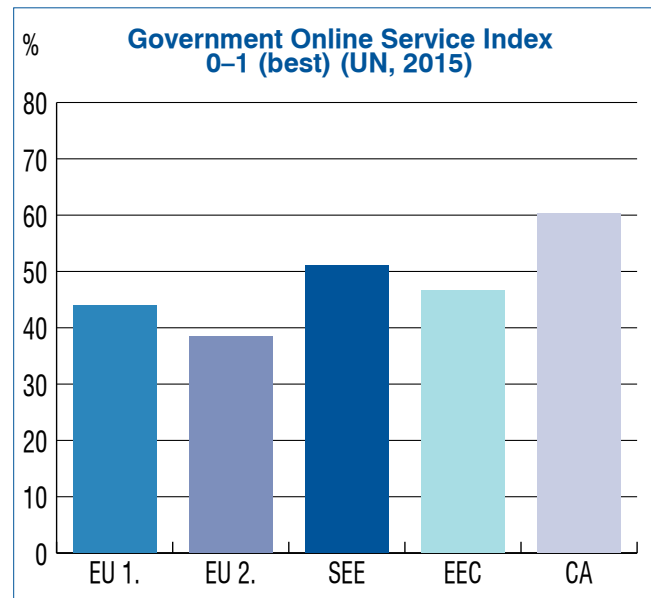
Figure 10.

Agriculture is one of the most important economic activities in these countries, which makes e-agriculture strategies highly relevant in the sub-region. However some serious connectivity issues especially in rural areas have to be solved in order to implement successfully such a strategy at national level.

The use of ICT is moderate in the sub-region: less than one-third of the population uses the internet (28 percent) and only 17 percent of households have internet connections (and this figure is under 10 percent among the Regional Workshop participant countries). Mobile devices can bridge the access divide, as the mobile network coverage exceeds 95 percent, and the average number of mobile subscriptions in the region is high (117/100 people, which is higher than in the SEE-countries), but shows huge disparities between countries (e.g. 121 in Kyrgyzstan, 92 in Tajikistan and 74 in Uzbekistan).

The average of the WEF Network Readiness Index is 3.76, the lowest among the regions, and the Government Online Service Index is also low, however, Uzbekistan's score of 0.448 puts the country in the middle of the pack of Regional Workshop participant countries (Kazakhstan has a remarkable score of 0.748 in the region).

Kyrgyzstan

Population	5 834 200
GDP per capita (USD)	1 269.139
Agriculture, value added (% of GDP)	17.258
Labour force in agriculture (2008):	34
Land use %	55.221
Mobile phone subscriptions/100 pop	121.4
Individuals using Internet %	23.4
Households with Internet access at home %	7.7
Fixed broadband Internet subs %	1
Mobile broadband subs %	22.7
Government Online Service Index	0.276
Importance of ICTs to government vision	2.701
WEF Network Readiness Index	3.539
WS Participant Rank by WEF NRI Index	16

Table 17.

In 2014, the agricultural sector contributed 17 percent of GDP and it employs about half of the total labour force of the country. The dominant sub-sectors in Kyrgyz agriculture is livestock/animal husbandry and cotton production. Currently, the sector is experiencing a decline in productivity due to land degradation, salinization, and overgrazing. Significant reforms are needed to improve productivity and profitability of the sector and restore soil resources.

A major push for the development of ICT in the Republic was made by the National Strategy "Information and Communication Technologies for Development of the Kyrgyz Republic" in 2002. Since then, the government proposed numerous programmes and legislation to expand and improve use of ICT across the economic sectors, including the 2012 Strategy for the Sustainable Development of the Kyrgyz Republic for 2013-2017, where the government outlined the vision for e-Governance.

In 2013, the Government formed the ICT Council Secretariat and the National Center for e-governance, which is a part of the Council. The National Center is a working body of the Council and is intended to ensure its ongoing activities, develop projects of strategic documents in the field of ICT and e-government to coordinate and efficient use of financial and human resources to carry out standardization work and solve many other problems.

The Government's strategy for the implementation of e-governance for the period 2013-2017 provides for the development of national electronic systems in the priority sectors, such as environmental protection and climate change, agriculture, emergency, etc. Such a

strategy fits into the "Intellectual Kyrgyzstan" Program, which aims to supply all economic sectors of the country with access to IT and ICT.

Specific to the agricultural sector, in 2006, the Kyrgyz government – with the support of OSCE – decided to implement the project "Access to rural areas: development of the internet in rural areas". The main objective of the project was to eliminate the digital divide between rural and urban areas through the establishment of favourable conditions for the penetration of the private sector in the ICT sector, the development of licensing procedures, information and communication technologies.

The Strategy for the Agricultural sector development for the period till 2020 emphasizes the importance to provide ICT to the sector.

Furthermore, the Ministry of Agriculture aims at serving as a provider of the agricultural knowledge and data through its website. In addition, the government is working closely with such countries as Poland, which now provides investment for the Kyrgyz agricultural sector modernization.

Tajikistan

|	
Population	8 408 947
GDP per capita (USD)	1 099.023
Agriculture, value added (% of GDP)	27.414
Land use %	34.831
Mobile phone subscriptions/100 pop	91.8
Individuals using Internet %	16
Households with Internet access at home %	4.3
Fixed broadband Internet subs %	0.1
Government Online Service Index	0.063
Importance of ICTs to government vision	3.922
WEF Network Readiness Index	3.204
WS Participant Rank	17

Table 18.
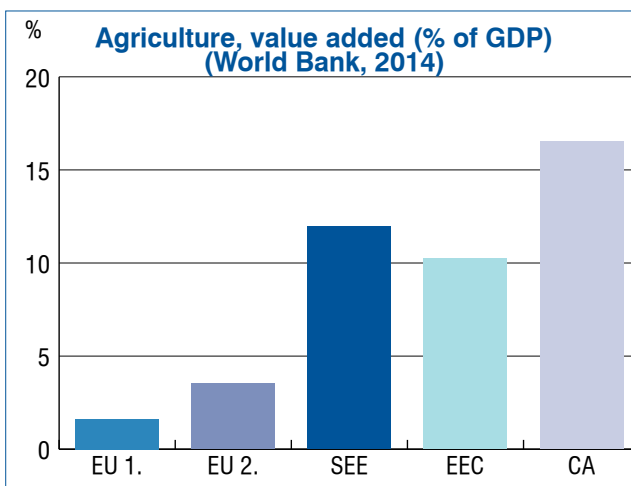
Figure 11.

Agriculture is very important for the country's economy, contributing over 27 percent of GDP (2013). The sector employs over 60 percent of the total population, yet
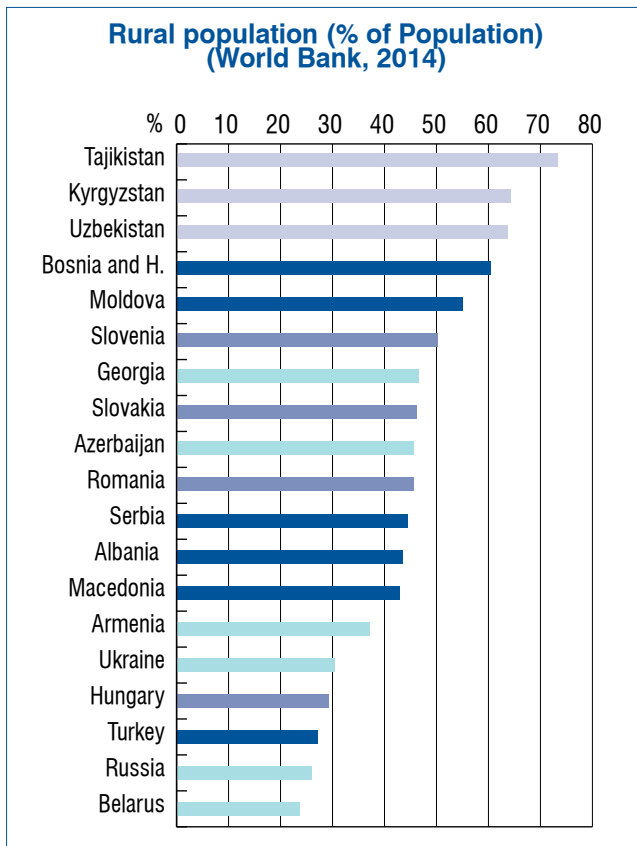
Rural population (% of Population) (World Bank, 2014)

Country	% (0–80)
Tajikistan	
Kyrgyzstan	
Uzbekistan	
Bosnia and H.	
Moldova	
Slovenia	
Georgia	
Slovakia	
Azerbaijan	
Romania	
Serbia	
Albania	
Macedonia	
Armenia	
Ukraine	
Hungary	
Turkey	
Russia	
Belarus	

Figure 12.

Agriculture, value added (% of GDP) (World Bank, 2014)

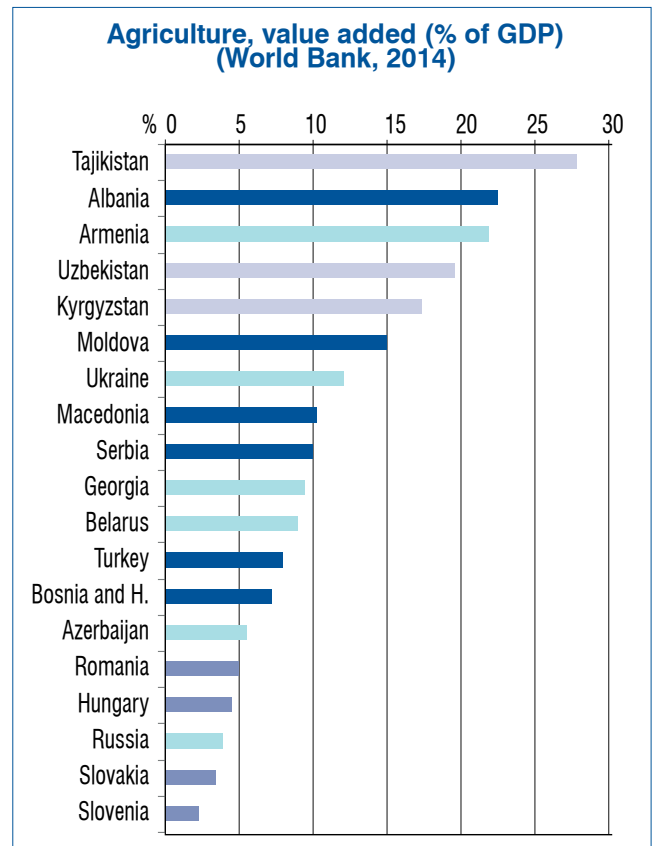| Country	% (0–30)
Tajikistan	
Albania	
Armenia	
Uzbekistan	
Kyrgyzstan	
Moldova	
Ukraine	
Macedonia	
Serbia	
Georgia	
Belarus	
Turkey	
Bosnia and H.	
Azerbaijan	
Romania	
Hungary	
Russia	
Slovakia	
Slovenia	

Figure 13.

provides very low wages. Significant dependency on the sector and its poor state calls for drastic reforms.

The 2011 Concept of the e-Governance allowed for government support to wide spread use of ICT in the economy. In 2014, the President of the Republic approved the Regulation about the Council on information and communication technology under the President of the Republic of Tajikistan, which leads and coordinates the development and spread of the information and communication technologies, the implementation of the state information policy, and the development of e-government in the Republic of Tajikistan.

Computer Literacy development and improvement is one of the areas highly supported by the Government. In recent years, many different specialized courses for the development of ICT skills, often organized with the support of international organizations, have been offered particularly to the workers at the managerial level. Some private companies provide training for those wishing to learn, for example, elements of programming or web design. However, the majority of such opportunities are currently concentrated in Dushanbe.

In rural areas, the only place of access to ICTs is the school. Often parents are investing their own money in it, so that children can gain access to new technologies, knowledge and skills. This is facilitated by the internet service providers that invest in the development of centers of public access to ICTs.

A nation-wide strategic view on the use of ICTs in agriculture and rural development would have huge development potential in Tajikistan to merge the information and knowledge gaps of the farmers and rural communities, being more than 70% of the population, especially in the mountain areas (more than 80% of the land). However, the strategy for e-agriculture shall first address adequately the problem of very low level of ICT-access in the country.

Uzbekistan

Population	30 742 500
GDP per capita (USD)	2 037.699
Agriculture, value added (% of GDP)	18.798
Labor force in agriculture %	-
Land use %	62.741
Mobile phone subscriptions/100 pop	74.3
Individuals using Internet %	38.2
Households with Internet access at home %	9.5
Fixed broadband Internet subs %	1.1
Mobile broadband subs %	20.3
Government Online Service Index	0.449

Table 19.

In 2014, the agricultural sector contributed 19 percent of GDP and employed about a fifth of the labour force. Agriculture takes up about 10 percent of the total land area of the country, with land cultivated for cotton production pasture. Due to lack of access to water resources (Aral Sea issue), soil degradation, and soil pollution, cotton production in particular is

becoming ineffective. The country is now in need of drastic sector reforms.

In 2015, the government announced the new Road Map for national economic development, where it emphasized the importance of the agricultural sector development and the need to implement steps for the sector's modernization. Simultaneously, the government proposed a package of documents focused on the continuation of structural reforms in the agricultural sector, the introduction of advanced agricultural technologies, comprehensive mechanization of agriculture, as well as the deeper processing of raw materials. Specialized government agencies are now finalizing the Program of agricultural sector development for 2015-2019. The proposed program provides for the research and development in the areas of seed selection process, water technologies, storage and processing, etc. Unfortunately, no specific emphasis on the need and importance of the ICT in the sector is highlighted in this Program.

At the same time, Uzbekistan is already working towards implementing more ICT in agro-industrial sector. The National Portal, which gathers agricultural best internet resources (agriculture.uz) provides access to information about the scientific, educational and informational activities performed by institutions involved in the agricultural sector, as well as links to national and foreign best internet resources on agriculture and related industries. Furthermore, the portal provides information and consulting services to various clients, such as ministries, libraries, information centers, Agrarian Universities, science and research centers, NGOs, agromarketing organizations and agricultural enterprises. A major agricultural scientific institution – Tashkent State Agrarian University – is the brain behind the website and its consulting services.

E-agriculture strategies were not formulated earlier in the region, but information society development strategies were created (especially in the field of e-government, but the importance of IT in agriculture are also explicitly emphasized in some countries), and recently specific governmental units were set up to coordinate the development of information technology and telecommunications. The high importance of agriculture and the recent developments in ICT are an opportunity to formulate e-agriculture strategies. There are a few specific agriculture information portals in the region and also some mobile-phone and SMS based services for farmers, among other existing development projects in the field.

Connectivity is still an issue in rural areas, e-agriculture developments have to aim for issues related to access to the internet and ICTs. The main ICT-development policies in this region recently targeted e-governance.

Regional solutions, applications, initiatives and networks on ICTs in agriculture and rural development

Initiatives and projects in the field of ICTs in agriculture and rural development which demonstrate the potential of the technologies and boundaries of their acceptance by the farmers and rural communities can boost society-large discussion on and make pertinent the need for action on national e-agriculture strategies. In addition to sensitizing policy makers, those examples can provide useful lessons for all stakeholders involved the strategy development and implementation process, as observed by the Workshop participants.

Hence, the Workshop participants requested further actions to be taken by FAO and GAK in identifying, collecting and make available initiatives and projects that demonstrate innovative ways of using ICTs, in the context of smart and connected agriculture in the region that show both success and failures.

This chapter presents such initiatives, classifying them into several groups, discusses briefly the lessons learned from stalled projects and failures, and proposes a more structured way for identifying good practices in e-agriculture, based on FAO's substantive work. In addition, information boxes shed more light on several innovative IC technologies in agriculture and the FAO approach on Good Practices.

PROJECTS AND INITIATIVES IN THE REGION

The examples presented are categorized according the following topics:
- agricultural advisory services;
- e-government; farm management;
- information management and knowledge sharing for agricultural innovation systems;
- market and price information;
- precision agriculture;
- risk management;
- others.

AGRICULTURAL ADVISORY SERVICES

Knowledge dissemination and extension is an essential part of modern agriculture, because it provides professional information for improving the farming methods and living standard of farmers. As agriculture becomes more and more information and knowledge driven, ICTs can help advisory service providers assist farmers through new channels and services with more localized, more relevant and timely information.

Farmers' Club

- Country: Turkey
- Organization: Vodaphone
- Access: Commercial
- Operational: since 2012
- ICT technology: SMS

The service uses mobile technology to give farmers the information they need to improve their harvests and livelihoods, improving Turkish farmers' productivity. Farmers who sign up to the service receive SMS alerts with weather forecasts, crop prices and other information that is tailored to their local area and crop types. More than 770,000 farmers subscribed to the Farmers' Club in 2012-13, up from 600'000 the previous year. Around 300 million SMS alerts were sent to farmers in 2012-13 and an 'education truck' touring Turkish communities helped to improve 25,000 farmers' knowledge about the benefits of using their mobile to access information to improve their harvests.

Farmers' Club members use especially designed rugged mobile phones that can be dropped in mud or trodden on, and still work. Bespoke payment schedules help farmers manage their spending, including an annual billing option to pay at harvest time, when their income is highest.

http://www.vodafone.com/content/sustainabilityreport/2015/index/transformational-solutions/agriculture.html

FOODIE

- Country: EU/Turkey
- Organization: EU project consortium
- Access: Public
- Operational: since 2015
- ICT technology: LOD, GISS

The key point of the FOODIE project is creating a platform hub on the cloud where spatial and non-spatial data related to agricultural sector are available for agri-food stakeholders groups and interoperable. It will offer an infrastructure for the building of an interacting and collaborative network; the integration of existing open datasets related to agriculture; data publication and data linking of external agriculture data sources, providing specific and high-value applications and services for the support of planning and decision-making processes. The FOODIE platform will contain farming data such as maps, sampling data, yield, fertilization, etc. Some of this data will be obtained from sensors on the farm and will have the character of private data; Public Open Data as land satellite images, environment and biodiversity information, agro-food statistical indicators, nature data, hydrometeorlogical data, soil data, etc.; commercial data, mainly VHR satellite images and ortophotos, but it could be also market related data; voluntary data like OpenStreetMap, voluntary collected data about market situation, agriculture production etc. *www.foodie-project.eu*

InternetDataKUHD

- Country: Slovakia
- Organization: PS SR, š.p.
- Access: PS SR, š.p.
- Operational: since 2009
- ICT technology: Web portal

The service provides information for professionals, the public and farmers on performance recording, genetic evaluation of livestock and the livestock central register in the Slovak Republic, as well as milk analysis and paternity. The breeding information system contains information on cattle, swine, sheep and goats' performance recording and the current results of analysis for farmers, as well as statistic data for professionals and managers. The livestock central register provides information from cattle, swine, sheep, goats and poultry central regarding quantities and transfers of livestock on farms in the Slovak Republic. *www.pssr.sk*

Internet of Things (IoT), Machine to Machine (M2M) and Big Data

ITU defines IoT as a "global infrastructure for the information society, enabling advanced services by interconnecting physical and virtual things based on existing and evolving interoperable information and communication technologies." It is also a "broad vision of a future where everything objects, machines and people is connected and communicating, uniting the physical and digital worlds", as GSMA sees. In agriculture we may find such things among transportation fleet management devices, food processing and farm building appliances (i.e. thermostats, alarms), farm machinery (fertilizers, sowing machines), weather stations, pheromone traps, GPS units, smart phones, vending machines, servers and of course notebooks, PCs, etc. IoT includes Human-to-Machine (H2M) and M2M communication.

M2M refers to the technology which enables wired and wireless devices to connect to and communicate with each other in order to carry out certain functions without human intervention, providing meaningful information and basis for decisions. From this aspect IoT is a broader concept, which involves the connection of things not just to one another, but also to people and systems. Any device (machine) can be connected theoretically as long as it has the necessary hardware (sensor, network connection and other special electronics) and software components. Technically speaking M2M implies No-IP protocol between the things (devices), IoT implies IP-protocol between the things (devices, people, systems) and Web-of-Things (WoT) implies HTTP-protocol between the things.

More separate concept than the above two, but still in context with them, Big Data is often described with the "three Vs", referring to the big Volume of the Data, which also has great Variety and complexity, and generated at a high Velocity. Big Data also means the processing, interpretation and representation of large volumes of data – which is usually collection of collections of data and typically in the physical size of petabytes or zettabytes – originating from different sources in a way that makes the data meaningful and usable.

E-GOVERNMENT

e-Government is the integration of ICTs into public services provision in every level. It means the restructuring and digitization of public services and the back-office systems and procedures of public administration. The development of e-Government in agriculture is straightforward: from land administration to monitoring policies and subsidies, many governmental services are already being supported by different information systems.

Agricultural Information System (AIS)

- Country: Turkey
- Organization: Ministry of Agriculture
- Access: Public
- Operational: : since 2012
- ICT technology: Various

All areas of Turkish agriculture are recorded in the AIS, so analyses on various subjects can be prepared, and the results can be obtained at the end are carefully evaluated and processed. The integrated Agricultural Information System is to deliver a permanent and solid solution to producing agriculture statistics. AIS is fully based on Geographical Information Systems (GIS) standards, an instant access to any agricultural statistics is provided. Furthermore, the more accurate and precise data contributes to the national agricultural policies and strategies to remain at up-to-date level. The integrated system also promotes picking up the most appropriate product and objective agricultural subsidies in the strategically right agricultural parcels. By using Agricultural Information System, the actual number of farmers and agricultural parcels can be determined. It is possible to optimize the utilization of natural resources, and also to planning the production and usage of subsidies will be made effectively. Risk management can be improved and also reliable statistical data for agriculture will be produced with data collection for agricultural census.

www.agrowebcee.net/uploads/media/Turkey.pptx

Agro-Card: Assistance to small farmers in spring seasonal works

- Country: Georgia
- Organization: Agricultural Projects` Management Agency
- Access: Public
- Operational: since 2013
- ICT technology: e-Banking

The project was initiated by the Ministry of agriculture in 2013. Until 2015, 800 000 small farmers received GEL 310 000 000 worth of benefits for the land development and agricultural goods. Specialized plastic cards, so called "Agro–Cards" were created exclusively for the 800,000 beneficiaries, which can be used for different kinds of banking services. As a result, access to agricultural goods and services increased. The program received positive overall feedback from both farmers and input materials' suppliers.

The main project benefits are: Transparency: full access to statistical data in real time. Every transaction is reflected in APMA database immediately. Control: the agency is able to fully control the purpose of expenses, points are spent only on agricultural goods. Flexibility: bank can transfer points to the beneficiaries in a very short period of time, farmers are able to use cards multiple times, buy agricultural goods from different suppliers and control the card remotely via SMS. Multi-functionality: "Agro Card" will be implemented in the future for the various programs;

Social benefits are: Innovation: Agro-card is one of the first steps towards implementing modern technologies for service providers, the business sector and farmers involved in the project. Free Card for bank services: in many regions of Georgia, the population often has limited access to financial institutions and services, Agro-cards helped them to integrate with the banking transactions. Access to technologies: beneficiaries had to understand the process of using plastic cards, bank terminals and buying goods with no cash operations. Process automation: simplified management, improved reporting, control, electronic transactions that contributed to success of the project. Stimulated activities: it had a positive impact, because most of the farmers increased the amount of land plowed, and used more fertilizers and machinery services. Additional value: Agro Card led to an increase in the sales and revenues of input materials' suppliers.

Agro-portal for farmers

- Country: Georgia
- Organization: Ministry of Agriculture Georgia
- Access: Public
- Operational: since 2015
- ICT technology: Web portal

The agro-portal is expected to supply the information needs of all major agricultural industry stakeholders in Georgia. This framework uses the agriculture value chain to identify key stakeholders that are likely to get agricultural services from the agro-portal. Georgian farmers can see and get all services from the same place as the Ministry and its member agencies. It should be a single electronic space, where visitors have to take the field in conjunction with a comprehensive answer to all questions. This will be the structure of the agencies, scientific works, projects and hot-line. For Georgian farmers who are living in different parts of Georgia it will be an easy way to get information. *www.farmer.gov.ge*

e-Agriculture Strategic Program

- Country: Moldova
- Organization: Agricultural Information Centre
- Access: Public
- Operational: since 2012
- ICT technology: Various

The e-agriculture programme, coordinated by the Agricultural Information Centre (AIC), was created in 2012. AIC is an independent economic agency, under the Ministry of Agriculture and Food Industry, responsible for the development and implementation of the e-Agriculture Strategic Program. AIC became the Unique National Operator of all information systems in agri-food sector in Moldova in 2013.The e-agriculture program has three main objectives:
- Modernization of public services through digitization and reengineering the operational processes.
- Streamlining the activities of the entities from agribusiness sector through modern technologies.
- Streamlining the elaboration and implementation of development and monitoring policies from the agri-business sector.

There are many expected results of the programme, especially facilitating the process of development, management and implementation of development policies of the agribusiness sector and providing the business environment with accurate, coherent information, which will enhance business development in the agricultural sector. It also can contribute to the re-engineering of public services and operational processes in agriculture, forecasting business development in agriculture and the professional development of personnel from the agricultural sector. *www.cia.md/eng/about/about_cia*

eRKG

- Country: Slovenia
- Organization: Ministry of Agriculture, Forestry and Food
- Access: Public
- Operational: since 2007
- ICT technology: GIS

This portal provides various datasets for viewing and downloading. The viewing option is mostly used by farmers, who use it to view their holdings (GERKs) and various other datasets, which are relevant for their applications for funds. Some of these datasets can also be downloaded via portal in .shp format. The most commonly downloaded are GERK, and land use data (data is occasionally updated, older data is also available). Data which is available for viewing of download has only those attributes, which are allowed according to privacy legislation. Finally, eRKG application is available for farmers with web digital certificates. eRKG provides farmers with additional information about their agricultural holdings. This information is not available via publicly accessible portal because of the privacy issues. *http://rkg.gov.si/GERK/*

IACS Hungary

- Country: Hungary
- Organization: Agricultural and Rural Development Agency
- Access: public
- Operational: since 2003
- ICT technology: Various

The structure of the Hungarian Integrated Administration and Controls System (IACS) set up and operated by the ARDA (Agricultural and Rural Development Agency = Hungarian paying agency). The IACS data system consists of the Land Parcel Identification System (MePAR), Identification system for farmers, Identification system for payment entitlements, System for identification and registration of animals (cattle, sheep, and goat). The Integrated control system supports administrative control, Control with Remote Sensing (CwRS) and on the spot checks with area measurement.

In Hungary the ARDA also operates the customer recording system, the recording and checking systems aimed at managing the measures, the national GIS records on vine-lands, the intervention store register, the records system of low amount (de minimis) agricultural supports, the monitoring data recording system.

Nearly 200, 000 farmers must submit subsidy claims electronically via the Governmental Gateway which is unique in Europe and is in contrast with the relatively low internet penetration of this group. The 'secret' of this success is that the majority of the farmers are assisted or fully served by the state village agents' network and the private advisors. Compared to the conventional paper-based applications, one of the main benefits of the electronic way is the elimination of administrative or technical error in the submitted claims which also means that farmers can receive the agricultural subsidies faster.

IACS Romania

- Country: Romania
- Organization: Payment and Intervention Agency for Agriculture
- Access: Public
- Operational: 2004-
- ICT technology: Various

The Integrated Administration and Control System is implemented at the Payment and Intervention Agency for Agriculture (APIA). The system ensures the complete management of area payments for farmers, from national and European funds.

The components are: Data Caption Module, Administrative Control (Check) Module, Spot Check Module, covering the functionalities related to classical field control and by remote sensing, Payment Calculation Module and Payment Authorization Module.

The main activities covered by the functionalities are: Importing the data related to farmers requests for financial aid, within each payment measure; Eligibility check-up; Financial aid requests check-up; Land parcel crosscheck; Risk analysis (based on predefined criteria); On-the-spot checks; Verifying data related to remote-sensing checks; Calculation of payments and associated debts; Payment authorization.

The integrated IT system of APIA and IACS accomplishes: records of farmers, farms and agricultural holdings; processing farmers' aid applications and of any other applicants for area aid payments performing both administrative controls and on-the-spot-checks; calculation and approval of payments per farm, including quality control and audit activities; effective execution of payments to farmers; payments accounting standard accounting procedures based on the expenditures and revenue accounts records of geographic and alphanumeric data regarding the areas declared by farmers, printing maps for farmers, both per physical block and per farmer management of foreign trade schemes – trade licenses, calculating and issuing guarantees, development of the set of trade licenses – import-export reports management of intervention schemes regarding the acquisition, the public and private storage and sale, as well as development of functionality modifications of tender sale-purchase application of milk subsidy schemes in schools within the intervention measures for milk and dairy products; management in the IT system of payments regarding the aid measure for financial aid in the bee-keeping program; management and monitoring of payments from the national schemes providing financial support management of advances and guarantees debts management and monitoring of payments from national schemes; management and monitoring of payments from the European schemes.   *http://www.siveco.ro/en/solutions-business-to-public/eagriculture/iacs*

Real Estate Registration

- Country: Kyrgyzstan
- Organization: Real Estate Registration Agency
- Access: Public
- Operational: 2000-
- ICT technology: GIS

The World Bank financed two projects over 12 years in this area, in the value of 17.5 m USD in the form of loans and grant, with 25 percent of the funds allocated to the ICT.

- The national ICT Strategy (2000-2015) has the following phases and IT System(s):
- Phase 1: Automation Registration System (ARS). Completed;
- Phase 2: Central database; loading data from all local offices; Sales Data Base; GIS-applications testing;
- Phase 3: Data replication; Data provision to Tax and Statistical Authorities; Services provision to external users; digital archive. Completed;
- Phase 4: Financial System integration with ARS; Final goal is Integrated Centralized Information System.

No IT unit has and no IT staff have been appointed, although nine IT consultants have been hired. There are plans for a transition to a Single enterprise with permanent ICT Division. Key challenges are the insufficient communication infrastructure in the regions; lack of qualified IT employees; no sufficient knowledge and skills to use, modify and further develop GIS Open Source application; data quality issues.

Lessons have been learned: BPR is important; do not automate the paper system; HW/software platform should be based on the locally available technology and existing communication infrastructure; step-by-step approach for software development proved to be successful; implementation of centralized IT system contributed to data quality improvement.

ICT for the governance of tenure resulted that the time for issuing extracts reduced to two days and became electronically available on the Web. Time for registering secondary transactions (sales, mortgage) is reduced to two days. Thanks to the e-services available, transparency has been improved and corruption reduced; the information to TAX and Statistical office and the sales data base became available; fees, requirements, and time for responses has been published.

Submission of seasonal agricul tural employment agreement data

- Country: Hungary
- Organization: Hungarian Tax Office
- Access: Public
- Operational: since 2015
- ICT technology: Mobile application

The application supports the electronic submission of the simplified employment agreement. It is mainly used in the casual and seasonal agreements for agricultural and tourism activities. The submitted form is legally equivalent to the paper based format of the National Tax Agency. The main functionalities of the application include: Individual submission, with a simplified form enabling the whole process to take only a few minutes. Advanced submission, for several employers or an employer with many employees, with repeated submission functions and other efficient tools. Employer and employee database, to store personal data objects which are frequently reused. Past submissions, with a historical view of submitted entries, which can even be withdrawn, in line with the legislation in force. Book keeping facilities, exporting and emailing in attachment the data needed for the accountant to prepare the employer monthly report. Settings. In order to be able to access the system, the user needs an account to the e-government gateway, an empowerment document should be attached in advance if the submission is performed on behalf of another person, and an active internet connection is also necessary when the submission is triggered.

https://play.google.com/store/apps/details?id=hu.bme.mik.navbejelento

FARM MANAGEMENT

As data collection, data processing and data sharing are developing rapidly, the amount of information available to farmers is continuously growing, allowing them to make better decisions. Using farm management information systems, farmers can organize, manipulate and use all the data and information they have regarding their farms, by electronic means.

Farmer's Logbook

- Country: Hungary
- Organization: GAK
- Access: Public, private
- Operational: since 2009
- ICT technology: Web service

The National Food Chain Safety Office (NFCSO) offers interoperable solutions for agricultural software developers. In Hungary the national regulation of several land based payments, including the Agro-Environmental Scheme, LFA (Less Favored Area), Natura2000, Young Farmers, Greening, areas under the Nitrate directive etc. is linked to the obligation that farmers must keep records of their parcels, animal and farm operations data in the so called "Farmer's Logbook" (FLB). Some of the records should be updated daily, some others weekly or monthly. The printouts from the logbook shall be presented during the physical checks for the inspectors of the paying agency (ARDA). In some special cases (such as the agro-environmental scheme or the Nitrate directive), farmers must submit the content of the logbook to the NFCSO of Hungary in electronic format, in an encrypted XML file, via the Governmental gateway. In order to assist this process, NFCSO published an XML schema (XSD document) of the data structure that they can validate and receive, therefore they gave a green light for software developers to better serve their clients, by being able to generate the XML data in the required format, from the preferred software used by the farmers. Because of the obligations set by the national regulations, currently the FLB is the most widely used and detailed agricultural information system in Hungary holding records of farm operations, events and other data. The quality of the content is the best available at this level, because of regular controls electronically (obligation of annual submission to the authorities) and being the source of main evidence at physical controls on the farm. GAK FLB (http://gn.gak.hu) is the most comprehensive and popular non-profit oriented system. Over 20 percent of the national area under the arable stewardship scheme (main arable production program) is contained and maintained in the GAK FLB. The total area of farms in the GAK FLB reference database (arable stewardship scheme) is 20.2, percent of the total national area. The advantage of the solution is that farms can access from anywhere, because the system is web-based. The data can be easily combined with regular farm software, thanks to some interoperability solutions offered by the authorities, such as the above mentioned submission data scheme, but also the downloadable excel file offer by the ARDA containing the parcel and claim data of the farmer.

The NFCSO of Hungary also offers an open-ended interface online, in standard web-service format (WSDL) which included the list, detailed metadata and the scanned document of licensed pesticides and fertilizers. This web service is also available for software developers on request, as such, the service is used by the GAK FLB as well.

https://gn.eurofarmer.hu/

INFORMATION MANAGEMENT AND KNOWLEDGE SHARING (ACCORDING TO FAO TERMINOLOGY) FOR AGRICULTURAL INNOVATIONS SYSTEMS

The sharing of knowledge, experimental data, opinions, good practices and resources among the actors of agricultural innovation systems is essential for accelerating the transfer of verified, credible and up-to-date knowledge to wider audiences and members of the farming community. ICTs and networking can develop and strengthen institutional and human capacities in national agricultural research and extension systems.

Albanian network for research, innovation and extension in agriculture platform

- Country: Albania
- Organization: Ministry of Agriculture
- Access: Public
- Operational: since 2011
- ICT technology: Web portal

The network was established in the framework of a FAO project in 2011, following the VERCON conceptual model. The platform was launched in 2012 and became a new channel for distributing information for farmers and extension service specialists. It is also a new opportunity for institutions to promote their activities, programs, projects and to improve links between stakeholders, especially extension services, ATTCs (Agricultural Technology Transfer Centers) and directorates of agriculture. There are some challenges ahead of the network, including the modernization of technology, the integration with specific platforms in e-government and the increase of users through capacity building and involvement of young people.   *http://agri.al*

VERCON

- Country: Armenia
- Organization: Agricultural Support Republic Center
- Access: Public
- Operational: since 2009
- ICT technology: Web portal

To support the initiative of the Government of Armenia aimed at improving the agricultural advisory services provided to farmers, FAO, in collaboration with the Ministry of Agriculture of the RA, launched the Project for Establishment of a Virtual Extension and Research Information and Communication Network (VERCON) in Armenia. Under the project, it was intended to create a common web-based information sharing and communication platform for Armenian research and advisory institutions equipping them with efficient networking tools and capacities to help improve quality of the advisory services provided to farmers. As one of the most evident signs of success, the Armenian and international professionals involved in the development of AGRO.AM Network as well as the user community point out that the scope of the FAO project initially aimed to establish a pilot network of five institutions (the Agriculture Support Republican (National) Centre, Agriculture Support Marz (Local) Centers in Ararat and Shirak regions, Research Center of Vegetable, Melon and Industrial Crops, and the Armenian State Agrarian University), but it has been expanded in the course of the implementation to include all Agriculture Support Centers offering advisory and information services to farmers and agricultural producers in ten provinces (marzes) of Armenia Technically supported and coordinated by the Agriculture Support Republican Center, currently the network consists of
13 institutional websites linked together under the umbrella of a common national-level AGRO.AM platform. Eleven Agriculture Support Centers under the Ministry of Agriculture, as well as the State Agrarian University of Armenia and the Research Center of Vegetable, Melon and Industrial Crops are involved in the network, which allows them sharing news, electronic publications, advisory and educational materials and resources, research data and other information on the web.

www.agro.am

AgroWeb Belarus

- Country: Belarus
- Organization: Belarus Agricultural Library
- Access: Public
- Operational: since 1998
- ICT technology: Web portal, Social media

AgroWeb Belarus, a part of the Belarus Agricultural Library Internet site and a part of the AgroWeb Central and Eastern Europe Network, was created with the aim of collecting and providing information on agricultural institutions and other important agriculture related subjects to help users find information and contacts in Central and Eastern European countries and the former USSR.

AgroWeb CEE Network has been established by organizations and individuals involved in agricultural and rural development in Central and Eastern Europe (CEE). Participants started to develop a collaborative network, in view of the lack of information on the Internet about agricultural topics in the region in 1998. The AgroWeb Network was established and is maintained by representatives of participating countries, and facilitated by the regional chapter of International Association of Agricultural Information Specialists (IAALD) and by FAO.

www.aw.belal.by/

MAP Thematic network

- Country: Regional
- Organization: Escorena
- Access: Public
- Operational: since 2012
- ICT technology: Web portal

The Medicinal and Aromatic Plants Network is a part of the ESCORENA network (European System of Cooperative Research Network in Agriculture). ESCORENA on the web is a European initiative to enhance sustainable agricultural development and food security by improving the use of information, communication, and associated technologies. The overall aim is to enable ESCORENA members, its partners and users to exchange opinions, experiences, good practices and resources related to agricultural research, and to ensure that the knowledge created is effectively shared and used in the European region and worldwide.

The MAP Network was established in April 2012 at the technical consultation was held in Budapest, Hungary. The aims of the Network are to promote the voluntary exchange of information and experimental data, and facilitate voluntary exchange of experts, medicinal plant genetic resources and technologies; to establish close links between researchers, teachers, practitioners and institutions working on the same subject to stimulate interaction and accelerate the transfer of knowledge and technology advances to all members and to encourage and assist the submitting of joint research projects applications by participants of different countries to the international funding agencies.

www.agrowebcee.net/map

National site navigator

- Country: Uzbekistan
- Organization: Tashkent State Agrarian University
- Access: Public
- Operational:
- ICT technology: Web portal

Agriculture.UZ is the national site navigator at the best agrarian Internet resources of the Republic of Uzbekistan. It provides access to information about the activities of scientific, educational and information institutions agribusiness, as well as links to national and foreign best Internet resources on agriculture and allied sectors.

The portal provides information and consulting services to agricultural institutions involved in the integration process (ministries, libraries, information centers, universities, research institutes and centers, NGOs, agromarketing organizations and agricultural enterprises). *www.agriculture.uz/*

Highly personalized farm management information systems

As data collection and data processing advance, it provides a good environment for enhanced decision making. However, working with huge amount of different data (open, linked or even big data such as historical data, real-time farm data, different guidelines and regulations etc.) requires easy-to-use information systems that can collect, process and present this data in a way that is relevant for the farmer in any circumstances. These kinds of information systems can use state-of-the-art mobile devices (especially wearable technologies, such as clothes or accessories incorporating advanced electronic technologies (glasses, watches etc.)) for supporting farmers while working on the fields. Using advanced farm management information systems, farmers can organize, manipulate and use all the data and information that is presented to them in an exponentially growing basis.

MARKET AND PRICE INFORMATION

Market and price information services gather the necessary marketing information and present them through different channels (e.g. e-mail, SMS, voice message, portal) to the users. ICTs make both the collection and the consumption of market information (prices, trends) easier and quicker. More sophisticated, localized and timely or "real time" services can be built on new ICT-innovations.

"Export Moldova" - Market Assistance website

- Country: Moldova
- Organization: National Agency for Rural Development
- Access: Public, USAID/CNFA
- ICT technology: Web portall

"Export Moldova" has been incorporated into the larger national extension service website. Export Moldova provides a portfolio of important information to traders and producers to facilitate their access to export markets. The information covers 13 products and drills down to detailed market information on export markets, varieties, packaging, and postharvest handling and processes, as well as EU quality standards, the standards endorsed by Global G.A.P., and similar information.

www.acsa.md/category.php?l=ro&idc=178

AgMarket

- Country: Hungary
- Organization: National Agricultural Advisory, Training and Rural Development
- Institute (NAKVI)
- Access: Public
- Operational: since 2015
- ICT technology: Mobile application

NAKVI developed a mobile application which allows the user to easily find producers and healthy agricultural, including fresh and processed farm food – products in the neighbourhood. The program intends to improve direct market access for small farms, increase sales opportunities and enable customers to evaluate producers and products, providing feedback to the farmers and other customers. The contact data, as well as the description and location of the local markets and products are searchable and can be displayed in detail. Producers may also use a traditional web-page to register themselves and administrate their offerings. The mobile application can be downloaded from iOS and Android smart phone app stores.

http://www.hoi.hu/app/termekkereso/index_main1.php

Agravista

- Country: Moldova
- Organization: National Federation of Agricultural Producers
- Access: Public
- Operational: since 2004
- ICT technology: Web portal

The National AGROinform Federation was established by a network of 30 regional NGOs that were working for the economic development of rural communities. The online service (see www.agravista.md) not only makes a wide variety of market information available to farmers, but producer groups can actually do online trading with domestic and international buyers. In the first year alone, products valued at over USD 90 million were offered for sale online, with more than USD 10 million in contracts being signed. According to the federation's annual report, AGROinform upgraded the Marketing Informational System in 2014. For the MIS, a new software was launched. Farmers placed almost 3 000 commercial offers in the new system, and MIS had 78 000 registered users last year.

www.agravista.md/

Agroinform.tj

- Country: Tajikistan
- Organization: "Sugdagroserv Consulting" NGO
- Access: Public
- Operational: since 2011
- ICT technology: Mobile application

AgroInform.Tj provides complex information service for the representatives of agrobusiness: from farmers to processors, wholesalers, agricultural input suppliers, and others who have an interest in the agricultural sector. The mission of the platform is to intensify market for agricultural products in Tajikistan through establishing business connections and providing accurate and detailed information necessary for conducting agrobusiness. AgroInform.Tj was initiated in the framework of "Local Market Development" project of Swiss Association for International Cooperation (Helvetas) and Inter-church Organization for Development Cooperation (ICCO, Netherlands) and "Aid for Trade" project of United Nation Development Program (UNDP) and the Government of Finland. Continued development of the system has been supported by the Ministry of Agriculture of Tajikistan, the Central Agricultural Department of Sugd region and other partners.   *www.agroinform.tj/*

Agro-marketing

- Country: Azerbaijan
- Organization: Ganja Agribusiness Association (GABA), Azercell LTD
- Access: Public, commercial
- Operational: 2014-2015
- ICT technology: SMS, Web portal

The main goal in the implementation of the project is the application of information-communication technologies in agriculture in Azerbaijan by providing farmers with advice regarding their activities.
Some of the planned goals have already been successfully implemented within the project framework, including the presentation of information about the project to the farmers who will participate in the project through phone calls ; creation of the www.agromarketing.az web portal and supply with information; creation and support of SMS advisory service; creation of hotline advisory services for farmers. One hundred farmers were selected based on the following criteria to benefit from the project services: volunteerism; farmers engaged in market-oriented crop production; farmers using mobile phones; farmers capable of using SMS services of the mobile phones. The Agromarketing web portal was developed in order to support product sales and to improve marketing of the farmers' products, as well as to improve the access of farmers to the input supply and service sectors during agricultural production. The web portal has information on 16 enterprises regarding the input supplier and service sectors "Farming tools and machines", "Fertilizer, Pesticides and Agrocredits".
www.agromarketing.az

STIPS

- Country: Serbia
- Organization: USAID Serbian Extension Service
- Access: Public
- Operational: since 2004
- ICT technology: Web portal

USAID supported the Serbian Extension Service in the development of a Serbian Agriculture Marketing Information System network, known as STIPS. The project was launched in cooperation with the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia and the U.S. Ministry of Agriculture. Besides the Institute, which is the project coordinator, experts of the Agricultural Professional Service are also included in this project. Eighteen Agricultural Professional Services (Agricultural Stations) are directly engaged in data collection, while the dissemination of the data is performed by all 34 services. The aim of the Project is to report on the supply, demand and price trends of the dominant fruit, vegetables, livestock, grain and feed in Serbia. The Project includes 5 wholesale and 18 green markets, 15 slaughterhouses, 18 silos and other retail stores that sell grain and feed. In the Department for Extension there are 13 experts in all areas of agricultural production. The users of the system are farmers, banks, businesses, media, consultants and analysts.   *www.stips.minpolj.gov.rs/*

PRECISION AGRICULTURE

The use of geographic information system (GIS), remote sensors and other information gathering tools make site specific field-management possible. The ultimate purpose of method is optimization, from both an economic and an environmental standpoint. By using precision technology farmers can use the optimal amount of any inputs needed for efficient production of high crop yields.

Drones for Agriculture

- Country: Hungary
- Organization: AgriDron Ltd.
- Access: Commercial
- Operational: since 2013
- ICT technology: UAV

Agridron employs the Unmanned Aerial Vehicle-based low cost remote sensing system in precision agriculture. They offer both fixed wing and multirotor platforms. The application focuses on weed control, nutrient management, soil and damage mapping. Precision nutrient management planning of arable lands is used throughout a vegetation period. 3D modelling, point cloud creation and elevation models with orthorectification from still images are supported using special software. *www.agridron.com/*

Unmanned aerial vehicles (UAVs or drones)
The development of flying robots gives rise to the possibility that most field-crop scouting currently done by humans could be replaced by unmanned aerial vehicles (UAVs or drones) with machine vision and hand-like grippers. Many scouting tasks, such as for insect pests, require someone to walk to distant locations in a field, grasp plant leaves on representative plants and turn them over to see the presence or absence of insects. For faster prevention the site-specific information goes far beyond maps of soil conditions and yield to include sensed images that can indicate crop health across the field. Such remotely sensed images are also commonly collected from unmanned aerial vehicles, which provide highly detailed pictures of the crop and field characteristics. These images, whether analyzed visually or by computer, show differences in the amount of reflected light that can then be related to plant health or soil type. Once the extent of the disease is identified in a field, future treatments can be applied only where the disease exists. Advantages of UAVs include relatively low cost per flight and high image detail, but the legal framework and lack of e-agriculture national strategies for their use in agriculture remains under development.

Precision farming solution

- Country: Romania
- Organization: National Institute of Research and Development for Potato and Sugar Beet, NEC Europe Ltd,, Dacom
- Access: Commercial
- Operational: since 2014
- ICT technology: M2M

The solution provides farmers with accurate planting, fertilizer, irrigation, protection and harvesting guidance via a user-friendly application that uses data from in-field soil sensors and weather stations, combined with local weather forecasts and aggregated, regional multi-year agronomy datasets. The sensors automatically record soil moisture and temperature on a 24/7 basis. Wind speed, direction, temperature, humidity, rain and sunlight levels are also captured across the farm. This is supplemented by visual inspections and reports by the farmers on crop growth rates and signs of insects and disease.

The real-time data from the sensors and weather stations is automatically collected via the mobile network and compared to growth, fertilizer, pesticide and water absorption models for the region to deliver advice on the ideal spraying time and dosage levels that reflect highly localized needs. This avoids the wastage that occurs when chemicals are applied too late or early in the crop or larvae growth cycle or are affected by wind drift or rainfall wash-off.

The trials were carried out in Brasov one of the famous potato growing areas in Romania in this growing season. The research suggests farmers can reduce expenditure on chemical inputs by up to 40 percent per hectare compared to non-DSS benchmark farms. There is additional margin for improvement if farmers follow the guidance exactly rather than erring on the side of caution and applying additional doses. The

solution is also expected to enhance the inherent quality of farm products, for example the protein level in maize or the symmetrical shape of the potatoes. Terabytes of crop production data need to be analysed and modelled on an ongoing basis over many years to maximize the success of precision farming solutions. In the next phase of the project, NEC will leverage its big data analytics capabilities to accelerate the complex process of assessing the Dacom's diverse data sets and search for hidden patterns. NEC is also looking at opportunities to create new crop yield data services to help support banks' farm investment decisions and enable food exchanges to have more accurate crop yield data in the future.

www.nec.com/en/press/201410/global_20141023_03.html

Towards more and more precise agriculture
Nowadays, farms are transforming into a high-tech enterprises that most 20th-century farmers might barely recognize. After all, it was only around 100 years ago that farming in the northern hemisphere transitioned from animal power to combustion engines. Over the past 20 years the geographic information system (GIS), remote sensors and other new tools have moved farming even further into a technological wonderland. As amazing as today's technologies are, they are just the beginning of the era of modern farming. It is something that is already happening, as large agricultural corporations and farmers collect vast amounts of information on crop yields, soil-mapping, fertilizer applications, weather data, machinery, and animal health. Self-driving machinery and drones able to automatically survey and treat crops are becoming commonplace on farms that practice what is coming to be called precision agriculture. The ultimate purpose of all this high-tech gadgetry is optimization, from both an economic and an environmental standpoint. Farmers only want to apply the optimal amount of any input (water, fertilizer, pesticide, fuel and labour) needed for efficient production of high crop yields.

RISK MANAGEMENT

Risk and uncertainty are embedded in agriculture production: the changing weather and the biological processes make perfect control of processes impossible. ICTs can help to manage emerging risks regarding to natural disasters, diseases outbreaks or severe weather and climate trends. Solutions mainly help farmers to prepare and react to unfavourable situations and circumstances with higher chances of risk.

NEBIH Navigator

- Country: Hungary
- Organization: National Food Chain Safety Office of Hungary (NÉBIH)
- Access: Public
- Operational: since 2014
- ICT technology: Mobile application

NÉBIH is -focused on one of its key objectives, which is to inform the broadest range of consumers about the requirements of the food safety regulations and learn how the supervision of the food chain safety system works. NEBIH intends to deploy the most efficient tools to facilitate conscious consumer behaviour to ensure stronger cooperation among the consumers and to build more efficient and flexible relationships between the authorities and the customers. Using this application, on the one hand, consumers may directly receive notifications about food safety incidents affecting a wide range of the population and, on the other hand, they can directly report problems experienced in the field of food chain safety irregularities with photo and audio attached, also by using a free toll "Green number" which is also offered in the framework of this application.

https://play.google.com/store/apps/details?id=hu.gov.nebih.playstore.launcher

Pest warning system

- Country: TFYR of Macedonia
- Organization: UNDP and the Municipality of Resen
- Access: Resen municipality, UNDP, Swiss Development Cooperation
- Operational: 2012-
- ICT technology: SMS, Web portal

UNDP with the Municipality of Resen (using funds from the Global Environment Facility and the Swiss Development Cooperation) introduced a system to raise awareness of the dangers of pesticides and to help local farmers adopt more environmentally sustainable agricultural practices. These efforts have already led to a 30 percent reduction in the amount of pesticides used by local farmers each season. The main function of the system is to monitor pests and diseases, with the installation of six solar-powered agro-meteorological monitoring stations and a number of insect pheromone traps. The problem with such a system

is getting the data directly to farmers, and the previous system of posting paper flyers in the squares was far from adequate to ensure all farmers were adequately and promptly informed. To overcome this, an SMS system was developed by the Faculty of Computer Science of the University of Cyril & Methodius in Skopje, with UNDP support. The new notification system is part of a six-year project to restore and protect Prepa Lake, funded by the Swiss Development Cooperation.

www.e-agriculture.org/news/reaping-fruits-technology-fyr-macedonia

SmartVineyard

- Country: Hungary
- Organization: QuantisLabs Ltd
- Access: Commercial
- Operational: since 2008
- ICT technology: Sensor, web

The solution intends to address the challenges of grape protection directives by allowing remote plant disease monitoring and comprehensive decision support with on-site sensors an intuitive, web based user interface. Automated predictions of fungal diseases, and microclimate monitoring supports agriculturists in producing the highest quality crop with minimized yield loss. Due to a network of compact measuring devices on cultivated areas, viticulturists are armed with precise, individualized data and recommendations and helped avoiding intuition based decision. All measured data and relevant information can be accessed on an ultimate agro-intelligence dashboard. Accurate, real time information helps farmers decide when and where to spray and neither its installation nor its utilization requires any specialist technical know-how or experience.

www.smartvineyard.com/

Using cell phone to reduce harvest loss

- Country: Turkey
- Organization: Agricultural Directorate
- Access: Public
- Operational: since 2012
- ICT technology: SMS

The project gathers information about pest control and frost prevention from weather stations throughout the country and sends this information to farmers via cell phones, for example to alert farmers ahead of peak pest seasons to help them choose the best time for pesticide application. The agricultural department established five weather sites to monitor the need for pest control and frost prevention, and now provides this information to farmers via their cell phones. The service gathers information about when pests are likely to be prevalent by placing pest traps and observing temperature levels. Using the information, the farmers have been able to reduce their use of pesticides by 50 percent – lowering expenses and improving crop productivity. The tracking of temperatures also helps farmers to prevent losses from frost by monitoring temperatures hourly and sending text messages to the farmers, who can then take crisis management measures, such as burning dead leaves near their fields.

https://weblogtheworld.com/formats/featured/using-cell-phones-to-reduce-harvest-losses

Web Trap on Android

- Country: Hungary
- Organization: GAK Nonprofit Ltd, St Stephen University
- Access: Public-private
- Operational: since 2013
- ICT technology: Smart phone

The concept and prototype of an insect trap online monitoring device was developed jointly by two Hungarian advisory centers with the principal objectives of functionality and economy. A pheromone trap is a type of insect trap that uses pheromones to attract insects. A pheromone-impregnated lure is encased in a conventional trap. The components of the device include an entry level android smart phone, a plastic box with wooden looks to accommodate the phone, a delta-shape sex pheromone trap with transparent plastic sheets and the pheromone. The prototype was developed with a community approach in mind so that anyone can assemble and operate it following the public guidelines. Attention was taken to avoid high cost, such as insurance of the device, using expensive solar cell and other risks. The technical task of the 'android trap' is to

shoot one picture a day about the sticky surface of the trap, and upload it to the web server via FTP connection. The IMEI number of the sim card, the date-time and battery level is sent with the image, prefixed to the file name. Thanks to optimized phone power settings an unexpectedly long operation time can be reached without recharge (20-40-180 days by normal-extended internal-external battery). Users may browse images and related data online in a user friendly web application.   *http://gov.gak.hu/modul/sit/gak_sit.pdf*

OTHER

AgroLIb Ja

- Country: Serbia
- Organization: Jagodina Public Library
- Access: Public
- Operational: since 2010
- ICT technology: Internet, web

The main aim of the Agricultural Libraries in Jagodina (AgroLib Ja) project was the revitalization of rural libraries. The project was supported by Electronic Information for Libraries (EIFL), and the City Council of Jagodina. The project sought to increase farmers' ICT literacy as well as the availability of ICT resources in libraries throughout rural Jagodina. It transforms village libraries into communication, information and education hubs that lead to economic and social changes in the community and beyond. The rural library branches offer the following facilities: Internet access and ICT training (sharing best practices, searching for useful information, not least state subsidies and incentives); agricultural lectures (enhanced agricultural production by applying advice from renowned experts); agricultural journals and literature; online marketplace. The project won many awards, including WSIS price in 2013.   *www.agrolib.rs/*

M-PESA

- Country: Albania
- Organization: Vodaphone
- Access: Commercial
- Operational: since 2015
- ICT technology: Mobile payments

Vodafone's mobile money transfer service, M-Pesa is based on a system of payments and store of value system accessible through mobile phones. M-Pesa in Albania is mainly aimed at the unbanked and under-banked population. It offers a platform to build new solutions specific to the agricultural sector. For example, M-Pesa improves access to financial services for farmers and fieldworkers, enabling them to exchange, save and borrow small amounts of money, and helps them access insurance to cover the cost of replanting if the weather destroys their crops.

LESSONS LEARNED FROM THE PROJECTS AND INITIATIVES' IMPLEMENTATION

The main lessons learned from unsuccessful projects can be structured into three main areas: (i), technical (ii) institutional and (iii) policy dimensions.

Main technical issues are poor design and implementation plan – i.e. underestimating the complexity of the agricultural content domain. Stalled initiatives can also be observed at research oriented projects which often stop at the prototyping phase and do not evolve into sustainable product or service, or do not really create favourable conditions for continuation, despite the promise, in many cases, of the original proposal. The realization of real market impact of programs supporting such projects is a challenge for many donor organizations.

Among institutional constraints, it is worth mentioning that frequent changes in organizations, especially governmental ones, influenced by elections and the rotation of political parties, bringing in new concepts, strategies and changing staff, make it extremely difficult to maintain the operation of such ICT projects in the long run. Therefore, in many cases it is more advisable to give the opportunity for the NGOs to host such services, but this may raise another type of problems such as resources, authority and responsibility. Another common issue relates to the fact that most of the projects – which mainly provide open-access, public benefit services – have been developed with the technical and financial support of big donor organizations working in

the Region. Even though such projects are usually requested by the recipient organizations or countries, the requests are often formal and not well coordinated within the requesting organization itself. Consequently the exact need assessment and requirement definition, and later the sense of ownership is weak or missing, which leads to sustainability problems.

In this respect, a functional e-agriculture strategy could serve as a reference on how projects fit into the e-agriculture environment in a given country and what the critical factors of success are (policy dimension).

FAO APPROACH ON GOOD PRACTICES

As mentioned above, the examples presented in the section "Projects and initiatives in the Region" came as an immediate response to the Workshop participants' recommendation and aimed at raising awareness about the great potential of the technologies in agriculture in Europe and Central Asia; some of the possible issues that the implementers can face at technical, institutional and policy levels; and to a certain extent can provide ground for further analysis about the technology's acceptance.

FAO has substantively elaborated on the conceptualizing and practice of Good Agricultural Practices (GAP) by defining them as "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products". The concept of GAP may serve as a reference tool for deciding, at each step in the production process, on practices and/or outcomes that are environmentally sustainable and socially acceptable. The implementation of GAP should contribute to Sustainable Agriculture and Rural Development (SARD). More generally, a "good practice" can be defined as "a practice that is not only good, but a practice that has been proven to work well and produce good results, and is therefore recommended as a model; it is a successful experience, which has been tested and validated, in the broad sense, which has been repeated and deserves to be shared so that a greater number of people can adopt it".
Main criteria of a good practice:
- effective and successful: has proven its strategic relevance as the most effective way in achieving a specific objective; it has been successfully adopted and has had a positive impact on individuals and/or communities;
- environmentally, economically and socially sustainable: meets current needs, in particular the essential needs of the world's poorest, without compromising the ability to address future needs;
- gender sensitive: must show how actors, men and women, involved in the process, were able to improve their livelihoods;
- technically feasible: which is the basis of a "good practice". It is easy to learn and to implement;
- inherently participatory: they support a joint sense of ownership of decisions and actions;
- replicable and adaptable: has the potential for replication and should therefore be adaptable to similar objectives in varying situations;
- reducing disaster/crisis risks, if applicable: contributes to disaster/crisis risks reduction for resilience.

Summarizing this chapter's findings, it can be concluded that ICTs have a strong role to play in improving farmers' livelihoods, food security and nutrition rural development in sustainable way in Europe and Central Asia. However, to achieve those development goals, the ICTs have to propose workable solutions to real problems of farmers (solution-oriented and demand-driven technologies). In addition, the development of technologies per se is not sufficient guarantee of success; benefits to farmers and other agricultural stakeholders can be fully realised only when the innovative practices are scaled up. To that end, systematic commitment from the governments is needed to establish appropriate enabling environment for ICT innovations in agriculture, including e-agriculture strategy, legislative framework, support on financial and credit instruments, R&D and education, institutional capacities, e.g. for extension services, infrastructure and markets development.

Workshop discussions and findings

Preliminary review of country status

The organizers published an online questionnaire to collect information on the participants' specifics in a structured way, from two months before the workshop until the opening day.

The background of the main thematic points came from the e-Agriculture Strategy Guide, chapter 9. "Gather information on the current e-agriculture environment, with reduced number of questions focusing on the more relevant ones.

The objectives

- Get a basic insight into the e-Agricultural status of the participating countries
- Let the organizers better prepare with the workshop program
- Reveal the perceptions of the participants on, and the transparency of the e-agriculture processes in their countries.

The questionnaire received 15 responses, composed of nine submissions in English and six in Russian. The respondents were mainly from the governmental sector (10 decision makers from ministries and five practitioners from NGOs and academia). From the quality of the answers it was assumed that information related to the e-agriculture, especially its strategy component is not always publicly available and rarely explicit. Therefore, the first (governmental) group has better chance to access and use this information. While some of the respondents provided detailed descriptions, it was also found that the quality of the responses – i.e. validity, reliability, relevance – should have been much more attention than quantity.

**Results of the responses to some highlighted questions**

The importance of e-governance is well recognized according to the majority of the WS participants.
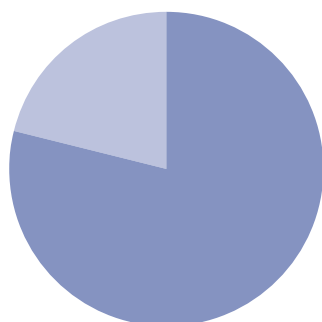
National vision for e-Governance?

79% YES (Albania, Belarus, Georgia, Kyrgyzstan, Moldova, Russia, Azerbaijan, Uzbekistan, Turkey, Slovenia, Tajikistan)

21% NO (Armenia, Bosnia and Herzegovina, TFYR of Macedonia)

According to the respondents, the government or the political parties of the majority of the participating countries are committed.

Figure 15.
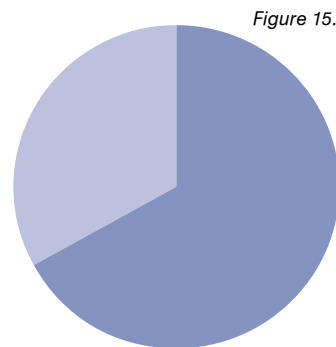
Commitment and/ or initiatives exist in e-agriculture?

67% YES (Albania, Azerbaijan, Belarus, Kyrgyzstan, Russia, Slovenia, Tajikistan, Turkey)

33% NO (Armenia, Bosnia and Herzegovina, Georgia, TFYR of Macedonia)

Only two participants reported a failure or stall of a large scale project in e-agriculture.

Figure 16.
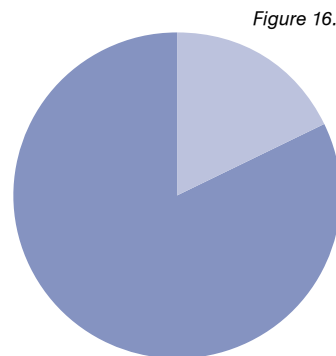
Projects failed or stalled?

18% YES (TFYR of Macedonia, Turkey)

82% NO (Albania, Armenia, Azerbaijan, Georgia, Moldova, Russia, Slovenia, Tajikistan, Uzbekistan)

Interoperability standards or other requirements are applied in the majority of the countries, although only by short margin.

Figure 17.
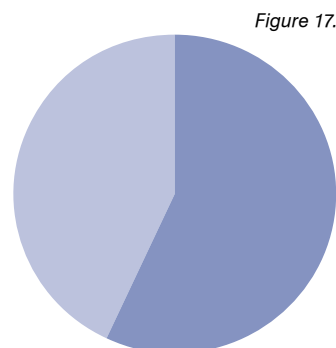
Interoperability standards exist?

57% YES (Albania, Belarus, Kyrgyzstan, Moldova, Slovenia, Tajikistan, Turkey, Uzbekistan)

43% NO (Armenia, Bosnia and Herzegovina, Georgia, TFYR of Macedonia, Russia, Azerbaijan)

Respondents uniformly answered 'no' to the following questions:
- Are there recognized qualifications in the domains of e-agriculture and extension?
- Have there been any attempts to coordinate between multiple agriculture knowledge management and advisory services providers?

Findings and recommendations

Based on the discussions during the workshop and the preparation of the follow-up paper the main findings are summarized as followed:

• The emerging role of ICTs in Europe and Central Asia are clearly observed and experienced in the region as a driver for agricultural development, especially in light of the growing demand for reliable information and fast access to it in every level of the sector. In most of the countries, the telecommunication infrastructure is sufficient, and a growing number of farmers can access ICT, but the country statistics sometimes can be deceptive: country average scores not reflecting to the state of rural areas (lower coverage and/or costly services), and the level of information literacy is usually low among farmers, especially among smallholders. Comprehensive e-agriculture strategies have to deal with issues relating to the accessibility of ICT. Parallel to this, new, state-of-the-art ICT-based services and technologies are being developed continuously, there is an overwhelming wave of innovations in this field, where an e-agriculture strategy can help to choose which path to follow.

• The state of the e-agriculture ecosystem varies from country-to-country, and fragmented within the countries as well. Government readiness is often lacking in this field, and the governmental systems are not using state-of-the-art technologies. There are no formulated e-agriculture strategies in the region, but there are some governmental e-agriculture initiatives (Moldova, Turkey, Azerbaijan), basically aiming for integrating multiple state agricultural information systems and databases. Most of the participants of the workshop understood and appreciated the relevance, usefulness and importance of having a dedicated strategy for information and communication in agriculture. One of the barriers to such a strategy formulation can be the lack of cooperation between the stakeholders of the e-agriculture ecosystem that makes it difficult to develop a horizontal strategy. There are few "champions" (person or agency) of this field who could organize and coordinate IT-developments in agriculture.

• Issues related to IT development have usually high priority in the countries of the region and a long activity record. Since the early 2000s, numerous attempts have been made in every country to formulate strategies on IT-development. Every country in the region has developed some kind of general information society development strategy, sometimes many of them. However, the implementation of these strategies is often showing a mixed picture – the existence of a strategy does not guarantee the successful implementation. Those strategies, driven by the information societies in the countries, had either too broad a scope or were not effective in ensuring the involvement and ownership of the Ministries of Agriculture. Most of the countries also have separate sectoral strategies for the public administration (e-government) or education (e-education). These sectoral strategies and the national agriculture and rural development strategies sometimes have some overlapping elements, but these elements usually do not go much further than general concepts. As a consequence, no country had a comprehensive e-agriculture strategy in place by the time this report was prepared.

• The process of country integration to regional economic organisations, such as the European and Eurasian Unions, was seen as a powerful driver for increased efficiency of the institutional systems and that has triggered the interest and channelled the efforts of many governments towards formulating of a national e-agriculture strategy. Countries that have most e-strategy like approaches are either members of the European Union, in the process of accession to the EU, or which decide to develop a similar system for some reason. This is explained by the legal obligation set by the EU to operate an integrated information system in relation with the Common Agricultural Policy. These countries are also overloaded with the daily burden of running this relatively rigid structure, making it difficult to see themselves and the rest of e-agriculture from an external and holistic perspective. The timing of their strategy development also follows the EU lifecycle, typically before the accession and the seven years programming periods. In between these periods they are usually in the "treadwheel". For the same reason countries are more likely to be open and start developing an e-agriculture strategy which do not belong to the above group. The countries in the region, however, do not have enough capacity to go it alone with the development and implementation of such strategies. Regional exchange and capacity development, facilitated by FAO, can offer sustainable solutions in this area.

• The strategy is not a solution provider itself for the various challenges but it can create an enabling environment where solutions can be delivered. Having the national e-agriculture strategy in place is not a guarantee of success, but without it the efficiency and the performance of the overall sector is expected to be much lower.

• The complexity of agriculture – characterized by numerous types of actors, sectors, regulations, biological factors, etc. – is an important aspect to explain why it is more difficult to initiate and implement a successful e-strategy than in some other areas of the economy. The underestimation of its complexity is another risk which is often demonstrated by ICT development experts without experience in the field. Agriculture also suffers from the problems which exist in other areas, such as the 'Silo effect'.

• The farmer should be in the center of the strategy, which should not be 'forgotten' during the process driven by governmental authorities and other stakeholders isolated from the 'end users'. Departments tend to look ahead until the boundaries of their own duties and responsibilities, and expect positive impact from the strategy which promises to solve their problems first. Therefore, the strategy should be planned and implemented to ensure a win-win for farmer and government (and other stakeholders).

• The pace of high-tech innovation is increasing in agriculture. Agricultural production has come so far in even the past couple decades that it's hard to imagine what it will look like in a few more. We will need as much innovation and creative thought in agriculture beyond 2050 as we've had in the previous years. Also for this reason we will need a functional e-strategy on national and international level that may be the pillar of the future farming regulations and sustainable smart agriculture.

Based on the workshop discussions and the preparation of the follow-up paper the main recommendations are:

• Preparation of two follow-up documents was suggested. Firstly, a very concise advocacy document to be used as a selling material for decision makers, also demonstrating best practices and quick wins. Secondly, a more detailed paper including the background, regional comparisons, country profiles, success stories and lessons learnt.

• Personal discussion of the topic should be continued at different levels and types of meetings, according to the conclusions. For example, it was suggested to present the results of the workshop at the ITU Telecom World 2015 Congress in October 2015 in Budapest. It also seemed timely to bring up the topic of the workshop at EU Commission meeting in September 2015 in Budapest. A more focused meeting should be organized with the EU later to check their initiatives, actions in the field of strategic approach to e-agriculture (as the EU Common Agricultural Policy is one of the most important aspect of agricultural information management for countries in the accession process and also in the member states, as mentioned above).

• Stimulate collaboration and knowledge sharing via online communities of practice, including existing regional networks such as ESCORENA and AGROWEB, and global platforms like the e-Agriculture Community, in order to demonstrate the conceptual models, methods, good practices – including interoperability standards and Open Access – of effective use of ICTs in agriculture, often based on strategic approaches.

• Promote the development and implementation of national e-agriculture strategies, as part of national ICT and/or agriculture strategies. If needed, identify the related policies existing, and sometimes isolated, within the agriculture and information sectors. Ensure that existing policies can be reviewed and further developed into national e-agriculture strategies. Build strategic partnerships with other governmental organizations that are responsible for the process, create the partnership ecosystem. Workshop participants should try to get approval (buy-in) from the decision makers in their home country which may officially request assistance from FAO for the process, as very likely the guidance is needed not just for the start but also for implementation.

• Put more emphasis on the implementation, monitoring and evaluation phases from the beginning, as the process is usually successful until the end of the planning (strategy development) phase and the subsequent steps lose orientation.

• Learn the lessons from other sectors and others regions. There are several national e-strategies working in other sectors of the Region (such as e-health), and at the same time there are some countries with functional national e-strategies out of the Region. Both types of examples are worthwhile to study closely and learn from the experiences. There are numerous examples available at the FAO's e-Agriculture Community of Expertise which can serve as a starting point.

• Publish a regional ICT-agri services and projects database. Successes and failures from current and past projects within the domain of e-agriculture in the Region can both serve as positive argumentation for decision makers of policy development and useful lessons for all stakeholders involved the strategy development and implementation process. Studying the practices – contained in the repository of e-agriculture related projects and functioning services at the national and regional level – can support the realization of a comprehensive e-agriculture strategy. This paper highlights some interesting examples from the online database:

http:// www.agrowebcee.net/awhu/e-agriculture-strategy

• Showcase new and emerging trends (related to WSIS Action Lines) especially among the good practices, identified during and after the meeting, such as Machine to Machine (M2M), Linked data, Open data, Smartphone applications, Mobile financial services in agriculture, Drones for agriculture, Autonomous machines, High-throughput plant phenotyping (HTPP), etc.

• Regional specifics mean different success stories and lessons learned. In the EU there is more emphasis on ICT systems enabling the flow of subsidies, related legislations rules, control and payment mechanisms (IACS, LPIS, FADN, etc.) while in the other countries the production, technology and innovation (yield increase, risk management, etc.) usually play a more important role. Therefore, it would make sense to attract decision makers with examples showcasing their type of problems and solutions which are also in the centre of their political and professional interest.

• Investigate how the rural gender gap (and the digital gap) can be closed with the e-strategy. Recent FAO study shows that several countries of the Region are similar to the other parts of the globe in a sense that women still face a consistent gender gap when it comes to access to productive assets, inputs, and services related to agriculture. It should be examined.

National e-agriculture strategy development and the FAO-ITU guide

The structure of the Guide:
Part 1: A national e-agriculture vision that responds to agricultural and development goals

This part develops a national e-agriculture vision that responds to agricultural and development goals. It explains why a national approach to e-agriculture is needed, what a national e-agriculture plan will need to achieve, and how it will be done.

- Why: This is the strategic context for e-agriculture, encompassing the agricultural sector growth and demographics, the existing agriculture extension systems, the existing agriculture services, information flow and transaction streams in agricultural value chains, and the resulting implications for e-agriculture.

- What: This is the role e-agriculture will play in the achievement of agriculture – sector goals. It serves as a high level message for policy-makers and answers the question of "where does our country want to go with agriculture, and how will e-agriculture help us get there."

- How: This gives the various e-agriculture components – or building blocks – that must be in place to realize the national e-agriculture vision.

Part 2: A national e-agriculture action plan that reflects country priorities

This part lays out an e-agriculture action plan that reflects country priorities and the e-agriculture context. It structures activities over the medium term, while building a foundation for the long term.

Part 3: A plan to monitor implementation and manage associated risks

This part establishes a plan to monitor implementation and manage associated risks. It shows the progress and the results of implementation and helps in securing long-term support and investment.

As it has been clearly articulated – being one of the key findings of the regional workshop – there is good understanding and strong interest by every participant country in a more purposeful, well coordinated method of organizing e-agriculture related activities at the national level. In order to achieve this goal in a more efficient and comprehensive way, FAO provides technical assistance and guidance in several areas of a strategic approach, which the countries may benefit from. This chapter highlights condensed information about the opportunities and techniques.

A recent policy brief issued by FAO summarizes observations and recommendations about developing national e-agriculture strategies, made through the online forum on e-Agriculture Community of Practice. The document makes the case for developing such strategies as follows:

"The phenomenal growth in the use of ICTs in rural areas over the last decade implies a tremendous potential to improve the livelihoods of smallholder farmers and rural communities. Nevertheless, many e-agriculture pilot projects are not implemented in a coordinated way and are not sustainable.

Mainstreaming e-agriculture initiatives has been challenging in many countries because of the lack of a clear strategy, and a failure to create synergies with other sectors and linkages between parallel initiatives. The growing impact of e-agriculture and the use of ICTs for the global agricultural and rural sector need to be supported by the development of national e-agriculture strategies. These strategies will help to make agricultural and rural development more effective and responsive to farmers' needs and expectations.

A national e-agriculture strategy is essential for creating the enabling environment in which discussions and collaboration among different stakeholders and different sectors can take place. The strategies need to respond to the key issues that impede the adoption and the mainstreaming of ICTs in agriculture. Therefore, the process of developing an e-agriculture strategy should be a meaningful process where stakeholders of the different sectors involved meet, exchange and discuss.

A national e-agriculture strategy should be based upon a shared vision of all stakeholders on the topic of ICTs in agricultural and rural development. The

strategy should increase efficiency and coordination. In order to be efficient, the strategy should be developed based on good practice principles.

Various government ministries and their departments, as well as private sector actors, non-governmental organizations and development institutions already work closely with farmers. They all offer their services and support, but too often work in silos. A national strategy would aim to bring all stakeholders together to work towards common goals, which would increase the efficiency of the support offered to farmers by realizing potential synergies, avoiding duplication of interventions and increasing cost effectiveness of the services and support.

A national e-agriculture strategy needs to accommodate ICT strategic alliances, for example with the financial sector to promote mobile finance. These strategic alliances need to be identified and good practices in the related fields documented and shared for better uptake within the field of ICTs for agriculture. For the development of national e-agriculture strategies, lessons should be learned from ICT for development policies and strategies in general."

FAO and ITU – in collaboration with CTA – have been working on a "National e-Agriculture Strategy Guide" to provide a methodology and a set of tools to assist countries in developing a national e-agriculture vision, action plan, implementation strategy and a monitoring framework.

The Guide is a resource that can be used by all governments that are developing or revitalizing their national e-agriculture strategies, regardless their current level of e-agriculture advancement is. It is a practical, comprehensive, step-by-step document, primarily intended for the most relevant government departments and agencies, particularly the Ministry of Agriculture and the Ministry of Information Technology and Communication.

Although the Guide is comprehensive, it does not necessarily need to be fully employed. Individual governments and their departments can tailor it to their own national policies, resources and requirements, and to the expectations of their citizens. They can choose, refine and develop the parts that are of use for them and create their own unique e-agriculture vision and action plan.

A successful application of the Guide does, however, require the support of a team experienced in strategic planning, analysis and communication processes. One of the team's early priorities should be deciding at what point stakeholders are brought into the process. This is an important step, because the team will have to work closely and continuously with the many stakeholders. The process should include stakeholders from the agricultural sector but also from other sectors with an interest in e-agriculture and keen to contribute. Once the core team that will put in place the e-agriculture strategy is well established and has begun its work, they can start engaging with stakeholders.

Like all strategies and plans, the outcomes of the Guide are not static and represent a specific understanding at a point in time of what a country needs to achieve in order to address its particular goals and challenges. Changes in a country's strategic context will require a dynamic approach to updating the e-agriculture vision and the associated action plan so that they remain relevant. This requires understanding the key triggers for refreshing the vision and action plan, whether these are specific events that change a nation's strategic context for e-agriculture or a defined period of time after which a revision is required.

Ongoing engagement with essential agriculture and non-agriculture stakeholders must also be maintained. Success in implementing a national e-agriculture vision is heavily dependent on having the continued support and guidance of stakeholders. Therefore, it does not come to an end after a national strategy has been developed.

Continued communication is also vital. Stakeholders should be regularly informed on the progress of the program, and in particular, any impacts or results that are noticed during implementation. This ensures transparency, which is essential to maintaining stakeholder support and momentum for further activity and investment in e-agriculture.
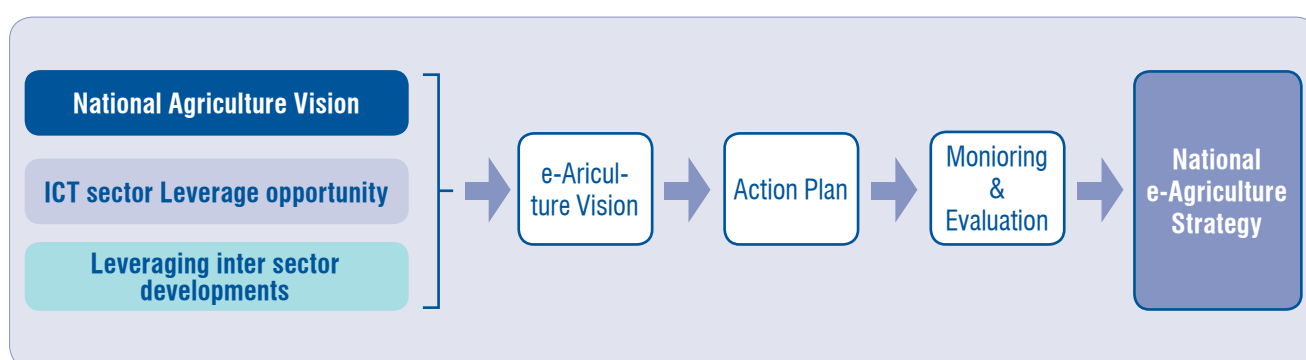

National Agriculture Vision

ICT sector Leverage opportunity

Leveraging inter sector developments

e-Ariculture Vision

Action Plan

Monioring & Evaluation

National e-Agriculture Strategy

Figure 18.

Each section of the Guide describes the activities required, along with practical advice informed by realworld experience. Countries can undertake the entire set of activities, or those specific to their contexts and constraints. How the Guide is used, and the end result, will depend on these factors and on each country's priorities and vision.

Countries can focus on a range of structured activities that lead to the progressive development of a national e-agriculture strategy. These include:

• Identifying the key agriculture and non-agriculture stakeholders and having initial engagement with them as they become closely involved in creating a national e-agriculture vision and plan and its subsequent implementation.

• Establishing governance mechanisms to provide improved visibility, coordination and control of e-agriculture activities that occur across the country's agriculture sector.

• Establishing the strategic context for e-agriculture. This provides the foundation for the e-agriculture vision and plan, and enables the government to assess and make informed decisions on whether to pursue opportunities that present themselves from the ICT industry and other stakeholders.

Forming an understanding of the current e-agriculture environment in terms of the e-agriculture components that already exist, as well as existing programs or projects that will deliver e-agriculture capabilities.

The Guide identifies the short, medium and long term goals for countries, recognizing the importance of demonstrating outcomes and benefits throughout the process of national strategy implementation, and to build and maintain momentum and support for e-agriculture; and thereby improve the Agriculture of their populations.

Finally, while it is aimed at a specialized, professional readership, the Guide's approach keeps the general public firmly in mind, recognizing that it is they who will be the ultimate beneficiaries of e-agriculture in their country.

The Guide also comes with a customizable toolkit to lead the users through the process.

The toolkit is available in Excel format and contains several worksheets which help to design and visualize several steps of the strategy development, for example to link strategic recommendations with outputs, schedule actions, identify and prioritize services.
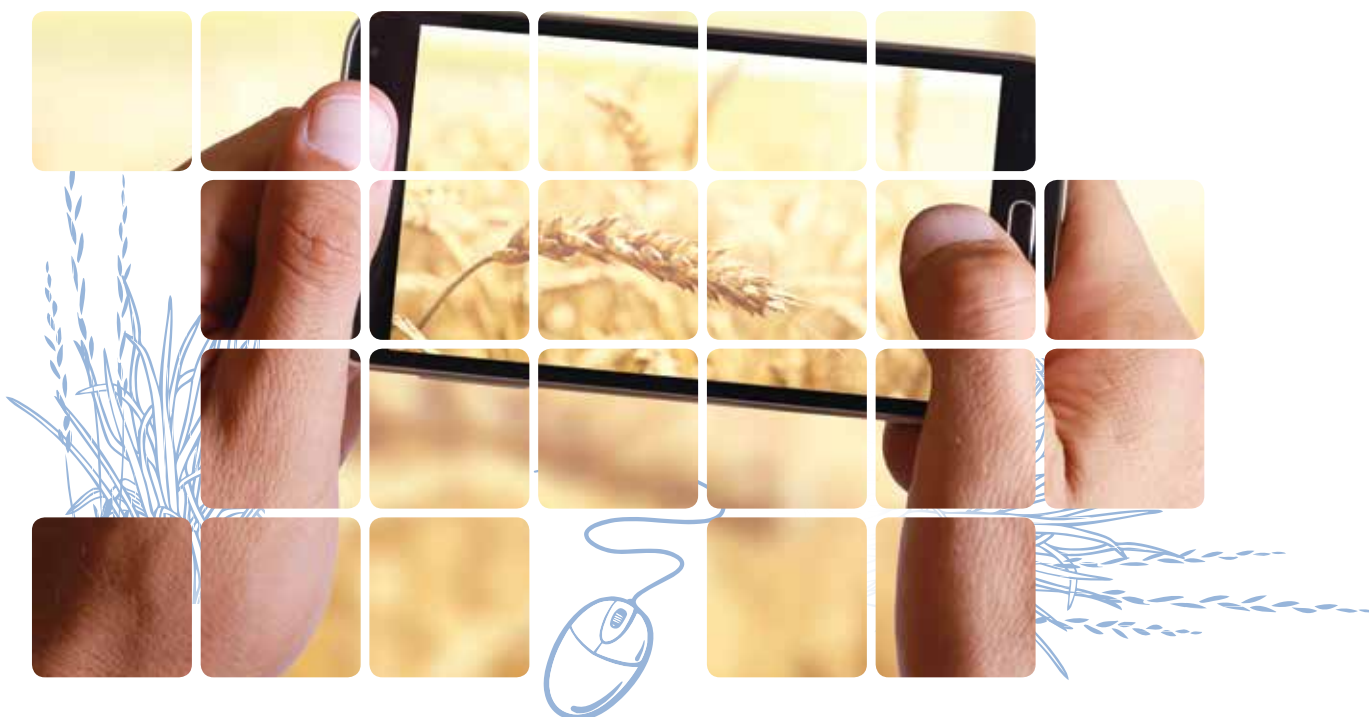

Photo: Shutterstock

Annex

Description of indicators

INDICATOR	DIMENSION	YEAR	URL
Source: The World Bank, URL: http://data.worldbank.org/indicator			
Population	people, total	2014	http://.../SP.POP.TOTL
GDP per capita	current US$	2014	http://.../NY.GDP.PCAP.CD
Agriculture, value added	% of GDP	2014 , 2013 (Hungary, Russia, Tajikistan)	http://.../NV.AGR.TOTL.ZS
GDP growth	annual %	2014	http://.../NY.GDP.MKTP.KD.ZG
Labor force in agriculture	% of total labor force	2012, 2011 (Armenia), 2010 (Albania), 2009 (Belarus, Russia), 2008 (Kyrgyzstan), 2007 (Georgia)	http://.../SL.AGR.EMPL.ZS
Land use/Agricultural land	% of land area	2012	http://.../AG.LND.AGRI.ZS
Source: International Telecommunication Union (ITU), URL: https://www.itu.int//en/ITU-D/Statistics/Documents			
Mobile phone subscriptions	per 100 inhabitants	2013	http://.../ statistics/2015/Mobile_cellular_2000-2014.xls
Individuals using Internet	%	2013	http://.../ statistics/2015/Individuals_Internet_2000-2014.xls
Households with Internet access at home	%	2013	http://.../net4/itu-d/icteye/CountryProfile.aspx
Fixed broadband Internet subscriptions	per 100 inhabitants	2013	http://.../ statistics/2015/Fixed_broadband_2000-2014.xls
Mobile broadband subscriptions	per 100 inhabitants	2013	http://.../net4/itu-d/icteye/CountryProfile.aspx
Source: WEF, URL: http://reports.weforum.org/global-information-technology-report-2015/downloads/			
Importance of ICTs to government vision	1-7 (best)	2015, 2014 (Bosnia and Herzegovina)	
Government Online Service Index	0-1 (best)	2015, 2014 (Bosnia and Herzegovina)	
WEF Network Readiness Index	1-7 (best)	2015, 2014 (Bosnia and Herzegovina)	http://www3.weforum.org/docs/WEF_NRI_2012-2015_Historical_Dataset.xlsx
Availability of latest technologies	1-7 (best)	2015, 2014 (Bosnia and Herzegovina)	
Capacity for innovation	1-7 (best)	2015, 2014 (Bosnia and Herzegovina)	

Table 20.

Main indicators of countries of the Region by sub-regions

Country	WEF Network Readiness index	GDP per capita	Agriculture. value added (% of GDP)	Land use %	Mobile phone subscrip-tions/100 pop.	Individuals using Internet	Mobile network coverage	Government Online Service Index 0–1 (best)
EU 1.	**5.323**	**53 548.467**	**1.626**	**43.941**	**126.059**	**82.312**	**99.452**	**0.738**
FINLAND	5.995	49 541.288	2.808	7.519	171.700	91.500	99.500	0.772
SWEDEN	5.836	58 887.252	1.420	7.484	124.400	94.800	99.990	0.701
NETHERLANDS	5.804	51 590.049	1.992	54.617	113.700	94.000	100.000	0.929
NORWAY	5.758	97 363.093	1.676	2.715	116.500	95.100	100.000	0.756
SWITZERLAND	5.682	84 732.957	0.707	38.686	133.800	86.700	100.000	0.504
UNITED KINGDOM	5.624	45 603.292	0.610	71.021	123.800	89.800	99.700	0.898
LUXEMBOURG	5.616	110 664.840	0.342	50.741	148.600	93.800	99.900	0.622
GERMANY	5.508	47 627.392	0.751	47.811	119.000	84.000	99.000	0.669
DENMARK	5.505	60 634.394	1.267	61.843	127.500	94.600	97.000	0.661
AUSTRIA	5.394	51 127.076	1.335	38.345	156.200	80.600	99.000	0.748
BELGIUM	5.293	47 516.521	0.738	44.022	110.900	82.200	99.900	0.677
IRELAND	5.239	53 313.612	1.558	65.801	102.800	78.200	99.000	0.677
FRANCE	5.200	42 736.159	1.675	52.668	98.500	81.900	99.000	1.000
PORTUGAL	4.910	22 080.892	2.293	39.699	113.000	62.100	99.000	0.638
SPAIN	4.732	30 262.226	2.492	54.050	106.900	71.600	99.800	0.945
ITALY	4.321	34 960.295	2.175	46.673	158.900	58.500	100.000	0.748
GREECE	4.072	21 682.598	3.808	63.305	116.800	59.900	99.900	0.606
EU 2.	**4.547**	**17 203.726**	**3.524**	**38.373**	**127.669**	**68.292**	**99.746**	**0.510**
ESTONIA	5.345	19 719.844	3.674	22.552	159.700	80.000	99.990	0.772
MALTA	4.906	22 776.195	1.919	32.188	129.800	68.900	100.000	0.402
LITHUANIA	4.863	16 444.838	3.460	45.349	151.300	68.500	100.000	0.756
LATVIA	4.750	16 037.782	3.448	29.608	136.600	75.200	98.800	0.701
CYPRUS	4.654	27 194.392	2.352	13.517	95.200	65.500	99.980	0.472
SLOVENIA	4.642	23 962.576	2.151	23.818	110.200	72.700	99.700	0.425
CZECH REPUBLIC	4.503	19 553.930	2.616	54.707	131.300	74.100	99.800	0.370
POLAND	4.384	14 422.838	3.303	47.446	150.000	62.800	99.540	0.543
HUNGARY	4.337	13 902.705	4.373	58.964	116.400	72.600	99.000	0.559
CROATIA	4.335	13 507.359	4.141	23.726	114.500	66.700	100.000	0.465
SLOVAKIA	4.235	18 416.542	3.742	40.081	113.900	77.900	100.000	0.488
ROMANIA	4.151	9 996.670	5.362	59.704	105.600	49.800	99.900	0.441
BULGARIA	4.007	7 712.764	5.267	47.190	145.200	53.100	99.990	0.236

Country	WEF Network Readiness index	GDP per capita	Agriculture. value added (% of GDP)	Land use %	Mobile phone subscrip-tions/100 pop.	Individuals using Internet	Mobile network coverage	Government Online Service Index 0–1 (best)
SEE	**4.117**	**5869.488**	**11.947**	**51.014**	**113.143**	**56.071**	**99.773**	**0.439**
MACEDONIA	4.416	5370.698	10.231	50.238	106.200	61.200	99.900	0.244
TURKEY	4.410	10542.806	8.034	49.903	93.000	46.200	100.000	0.559
MONTENEGRO	4.319	7370.857	10.200	38.141	160.000	56.800	100.000	0.528
MOLDOVA	4.031	2233.771	15.232	74.863	106.000	48.800	99.000	0.528
BOSNIA AND HERZEGOVINA	3.985	4796.208	7.571	42.333	91.200	67.900	99.800	0.373
SERBIA	3.954	6152.867	9.689	57.775	119.400	51.500	99.710	0.394
ALBANIA	3.703	4619.211	22.671	43.843	116.200	60.100	100.000	0.449
EEC	**4.259**	**6509.877**	**10.239**	**46.666**	**124.117**	**50.917**	**98.800**	**0.524**
RUSSIA	4.532	12735.918	3.950	13.089	152.800	61.400	95.000	0.709
AZERBAIJAN	4.280	7884.190	5.692	57.687	107.600	58.700	100.000	0.433
ARMENIA	4.247	3646.663	21.935	59.115	112.400	46.300	100.000	0.614
GEORGIA	4.226	3669.981	9.203	35.473	115.000	43.100	99.100	0.598
UKRAINE	4.009	3082.461	11.788	71.285	138.100	41.800	99.900	0.268
BELARUS		8040.048	8.867	43.349	118.800	54.200		
CA	**3.762**	**5142.759**	**16.525**	**60.367**	**116.980**	**28.240**	**96.300**	**0.362**
KAZAKHSTAN	4.544	12276.393	4.607	77.036	180.500	54.000	95.000	0.748
KYRGYZSTAN	3.539	1269.139	17.258	55.221	121.400	23.400	97.600	0.276
TAJIKISTAN	3.204	1099.023	27.414	34.831	91.800	16.000		0.063
TURKMENISTAN		9031.540	14.549	72.006	116.900	9.600		
UZBEKISTAN		2037.699	18.798	62.741	74.300	38.200		

Table 21.

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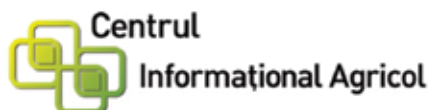IT manager
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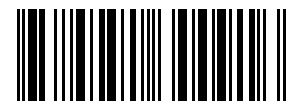*MR FRANCIS WANJOHI*
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This publication is a follow-up review based on the experience of participants and the outcome of the Regional Capacity Development Workshop on National e-agriculture Strategies in Europe and Central Asia, organized jointly by the FAO Regional Office for Europe and Central Asia and GAK, Szent István University in Hungary between 22 and 24 June 2015. The paper focuses in particular on the situation in transition economies and would serve policy makers and stakeholders in the agricultural sector in developing improved approaches and strategies to leverage agriculture through the use of Information and Communication Technologies (ICTs).