Food and Agriculture Organization of the United Nations

Artificial Intelligence (AI) for e-Services:
Example of use cases in agriculture

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25 March 2019 - Budapest, Hungary

Challenges in Europe and Central Asia and SDGs

Rural livelihoods and rural poverty
- **62% of poor live in rural areas**
- **Migration from rural areas**

Farm structure
- 97% of farmers in Europe and 70% in Central Asia are smallholders

Sustainability of food production and food systems and climate change
- Land degradation and increase of natural disasters in the region
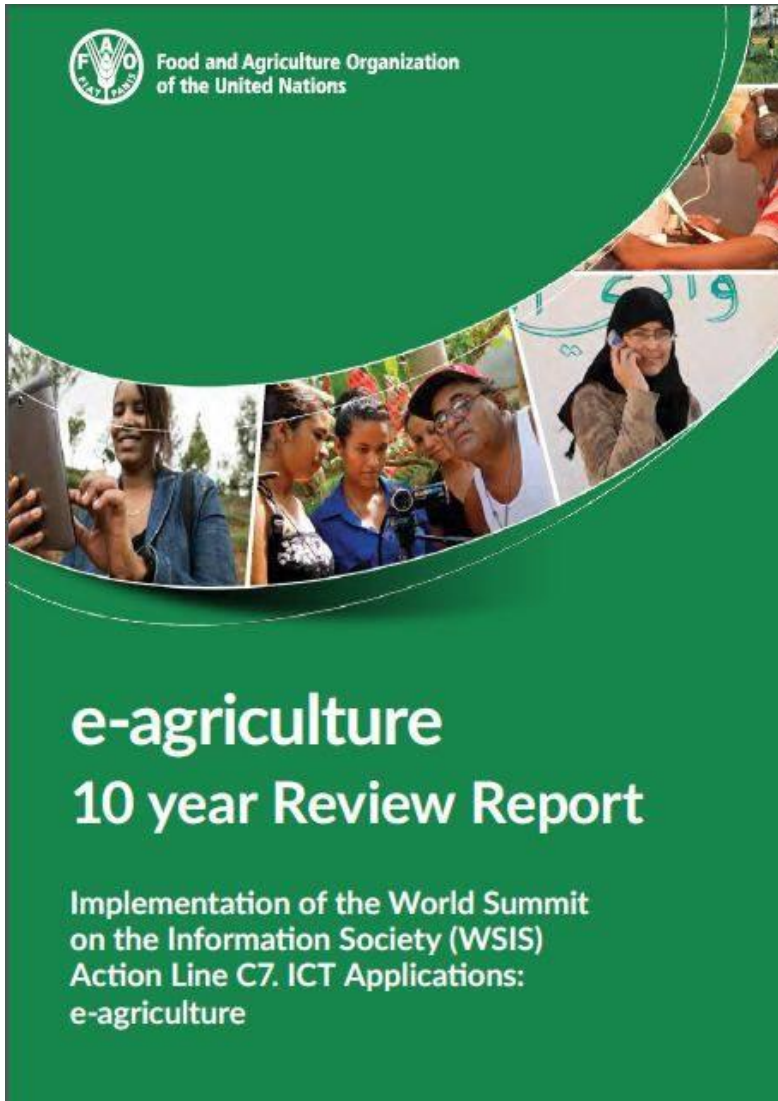- Transboundary diseases

Food Security and malnutrition
- Triple burden of malnutrition:
  undernutrition – obesity – micronutrient deficiencies

Agrifood Trade
- Potential for export promotion, implementation of trade agreements
- Capacity Development in WTO
- Growing demand for updating the SPS

FAO international mandate

e-agriculture
10 year Review Report

Implementation of the World Summit on the Information Society (WSIS) Action Line C7. ICT Applications: e-agriculture

www.fao.org/3/a-i4605e.pdf

World Summit on the Information Society (WSIS)

Geneva, December 2003

Tunis, November 2005

Geneva Plan of Action
WSIS Action Line

C7. ICT applications: benefits in all aspects of life 'e-agriculture'

How digital technologies can support smallholders?

As a result of land reforms in the 1990s, Europe and Central Asia is largely a region of smallholders.

In some countries, large commercial farms exist side-by-side with many economically unprofitable smallholders. Yet small farms can achieve high levels of productivity and income – through improved organization, intensified and sustainable production, and integration into agri-food chains.

With appropriate support, family farms can be a model for achieving sustainable growth, ensuring food security and mitigating rural poverty.

Applications of e-agriculture

Video

https://www.dropbox.com/s/n2c9gaq97udqn5f/e-agriculture%20full%20EN%20vo%20green%20FINAL.mp4?dl=0

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New generation of ICTs

Big data are large volumes of information that can come from different sources such as telecom records, social media, sensors, point-of-sale terminals, Global Positioning System (GPS) devices, and so forth. Using innovative tools, these large volumes of granular data can be analysed to produce meaningful information serving agricultural and food sectors, livestock, fisheries, etc. This can continuously provide information in real time and at a lower cost.

Machine- to-machine (M2M) refers to direct communication between devices using any communications channel, including wired and wireless. M2M communication can include industrial instrumentation, enabling a sensor or meter to communicate the data it records to application software that can use it.

Internet of Things (IoT) is a combination of sensors and various tiny devices embedded in physical objects and linked through wired and wireless networks that generate huge data volumes (often big data) analysed in dedicated applications. IoT offers an advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications and covers a variety of protocols, domains, and applications.

Artificial intelligence (AI) is intelligence demonstrated by machines that become increasingly capable of replacing human operations. AI in agriculture is emerging in three major categories: (i) agricultural robotics, e.g. next generation of drones; (ii) soil and crop monitoring; and (iii) predictive analytics.

Cloud computing is an information technology paradigm that enables universal access to shared pools of configurable system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet.

FUTURE FARMS
small and smart

SURVEY DRONES

Aerial drones survey the fields, mapping weeds, yield and soil variation. This enables precise application of inputs, mapping spread of pernicious weed blackgrass could increasing Wheat yields by 2-5%.

FLEET OF AGRIBOTS

A herd of specialised agribots tend to crops, weeding, fertilising and harvesting. Robots capable of microdot application of fertiliser reduce fertiliser cost by 99.9%.

FARMING DATA

The farm generates vast quantities of rich and varied data. This is stored in the cloud. Data can be used as digital evidence reducing time spent completing grant applications or carrying out farm inspections saving on average £5,500 per farm per year.

TEXTING COWS

Sensors attached to livestock allowing monitoring of animal health and wellbeing. They can send texts to alert farmers when a cow goes into labour or develops infection increasing herd survival and increasing milk yields by 10%.

SMART TRACTORS

GPS controlled steering and optimised route planning reduces soil erosion, saving fuel costs by 10%.
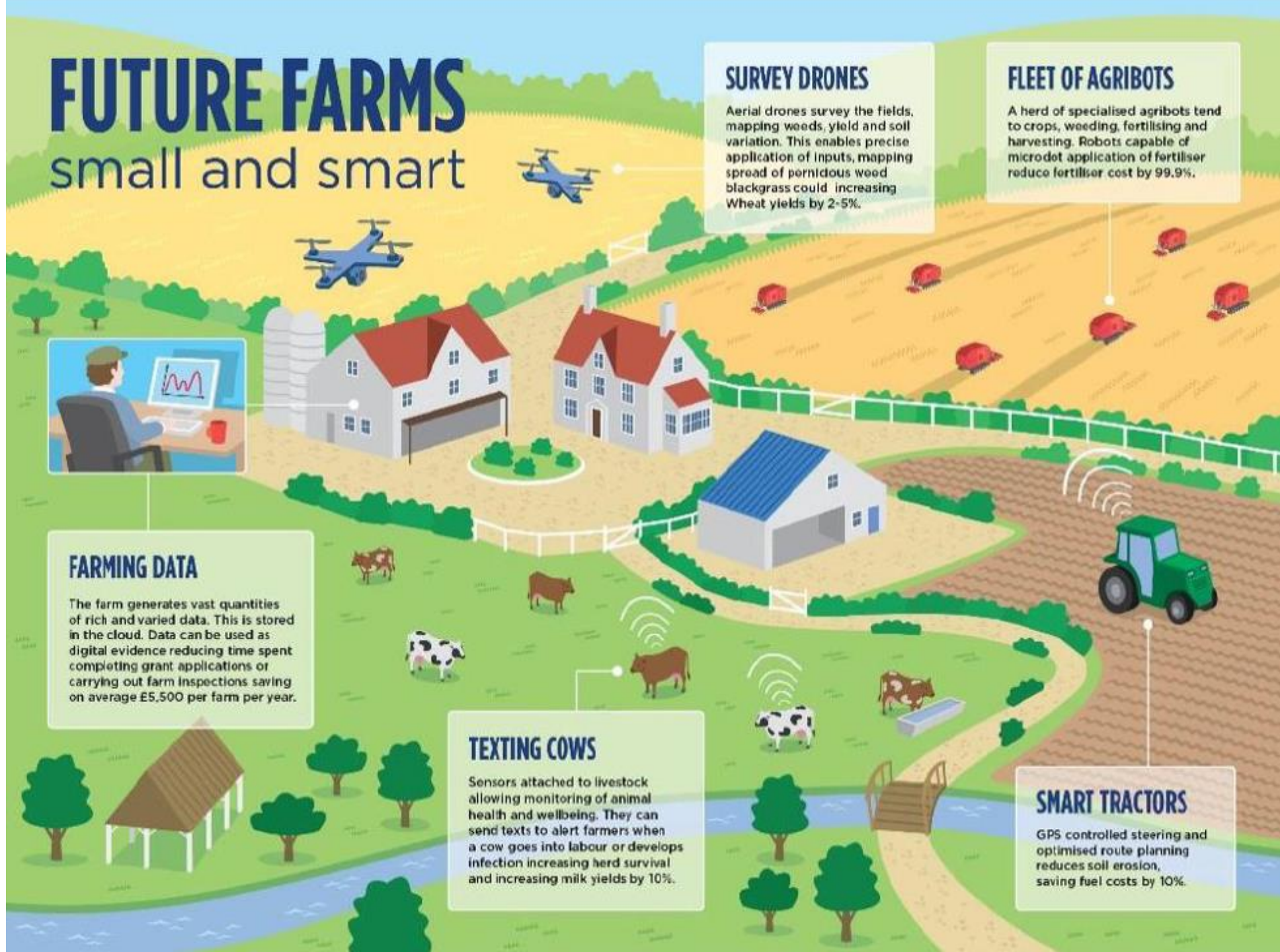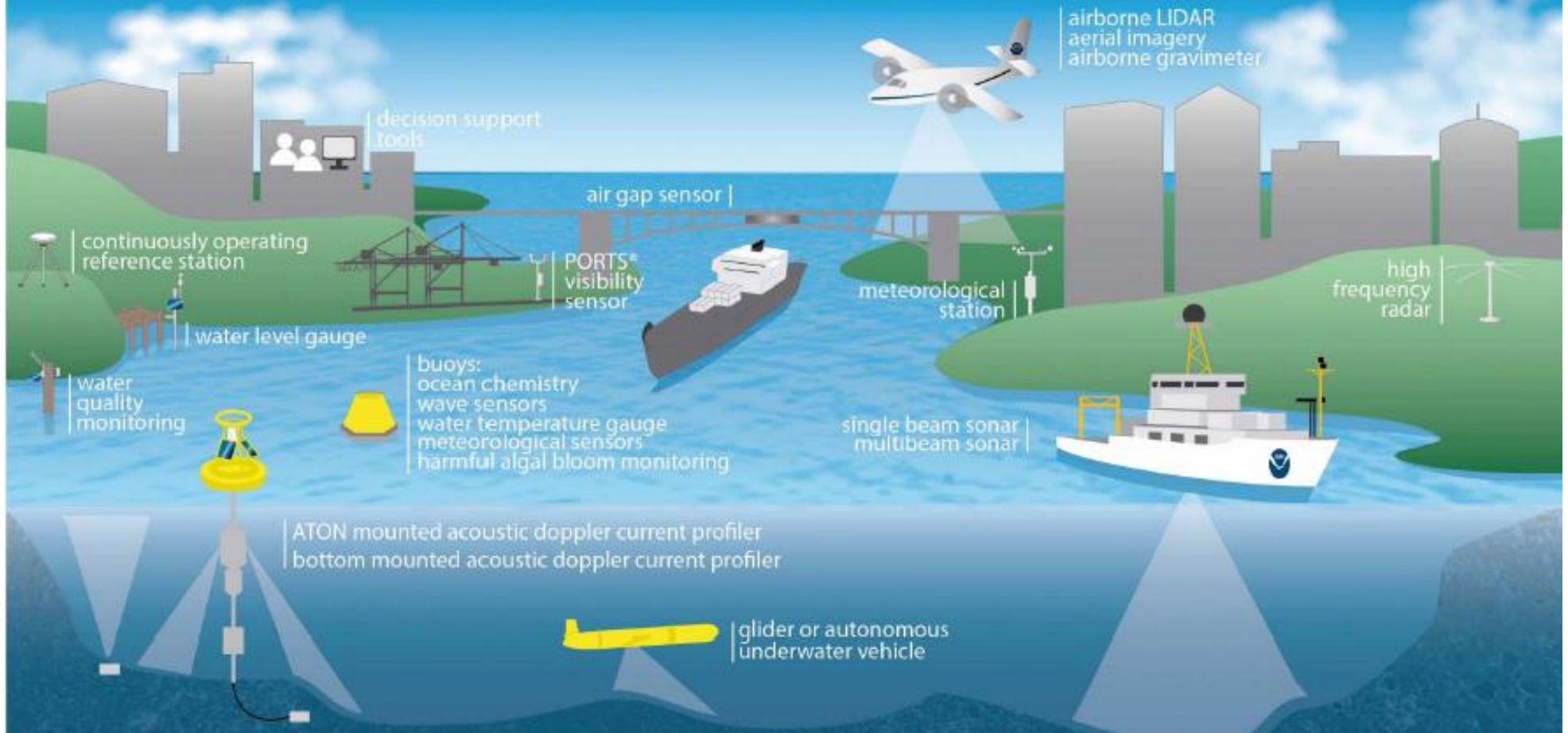
The role of spatial technologies

COASTAL INTELLIGENCE

Helping decision makers along the coast make the best choices for their communities.

Satellite Communications and Remote Sensing

airborne LIDAR
aerial imagery
airborne gravimeter

decision support tools

air gap sensor

continuously operating reference station

PORTS® visibility sensor

meteorological station

high frequency radar

water level gauge

water quality monitoring

buoys:
ocean chemistry
wave sensors
water temperature gauge
meteorological sensors
harmful algal bloom monitoring

single beam sonar
multibeam sonar

ATON mounted acoustic doppler current profiler
bottom mounted acoustic doppler current profiler

glider or autonomous underwater vehicle

www.openforis.org

NASA and FAO launch next-generation geospatial tool

Collect Earth Online allows anyone to track land-use and landscape changes anywhere

CEO allows anyone to track land-use and landscape changes anywhere.

www.fao.org/news/story/en/item/1173756/icode/

The Fall Armyworm

Fall Armyworm (FAW), or *Spodoptera frugiperda*, is an insect that is native to tropical and subtropical regions of the Americas. In the absence of natural control or good management, it can cause significant damage to crops. It prefers maize, but can feed on more than 80 additional species of crops, including rice, sorghum, millet, sugarcane, vegetable crops and cotton. FAW was first detected in Central and Western Africa in early 2016 and has quickly spread across virtually all of Sub-Saharan Africa. In July 2018 it was confirmed in India and Yemen. Because of trade and the moth's strong flying ability, it has the potential to spread further. Farmers will need great support through Integrated Pest Management to sustainability manage FAW in their cropping systems.

www.fao.org/fall-armyworm/en/

©G. Goergen, IITA

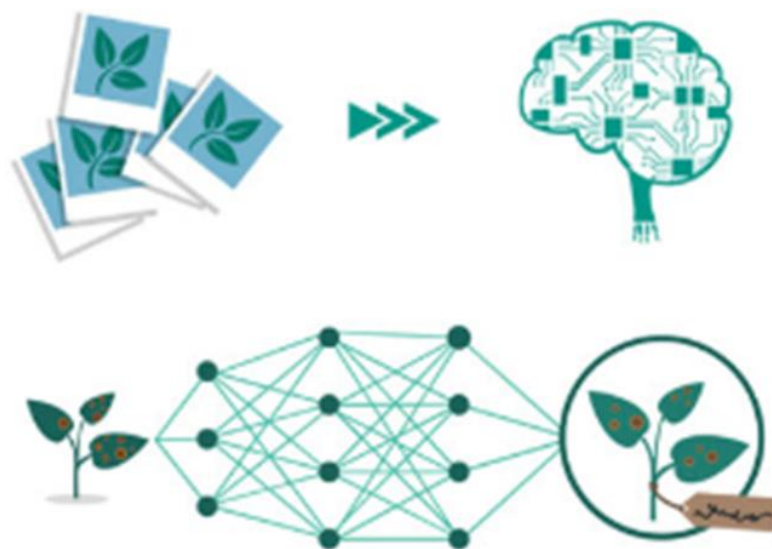# AI pest recognition mobile phone app

FAO response

Nuru is a great example of a mobile-deployed, artificial-intelligence model that brings an interactive app to users

Nuru is an app that uses cutting-edge technologies involving machine learning and artificial intelligence. It runs inside a standard Android phone and can work also offline.

www.fao.org/fall-armyworm/en/

Plant disease diagnosis app

Crop Detected — Capsicum & Chili

Matched diagnosis
Chilli Cercospora Leaf Spot
Fungus — UNMATCH

In a Nutshell
- Numerous brownish spots on leaves.
- Circular brown spots with dark rings and yellowish margins.
- Greyish centers with black spores.
- Frog-eye appearance of spots.

Biological Control
Seed treatment with hot water at 52°C for 30 minutes is a way to reduce the presence on t...

AI-powered farmer support

Each disease reveals itself via a certain pattern on the leaves. AI-based image recognition enables Plantix to recognize these patterns. Through the latest machine learning innovations and an average input of 14.000 pictures per day, Plantix increases its diversity and becomes more accurate with each single upload

https://plantix.net/en

AI for intelligent autonomous weed killer robot
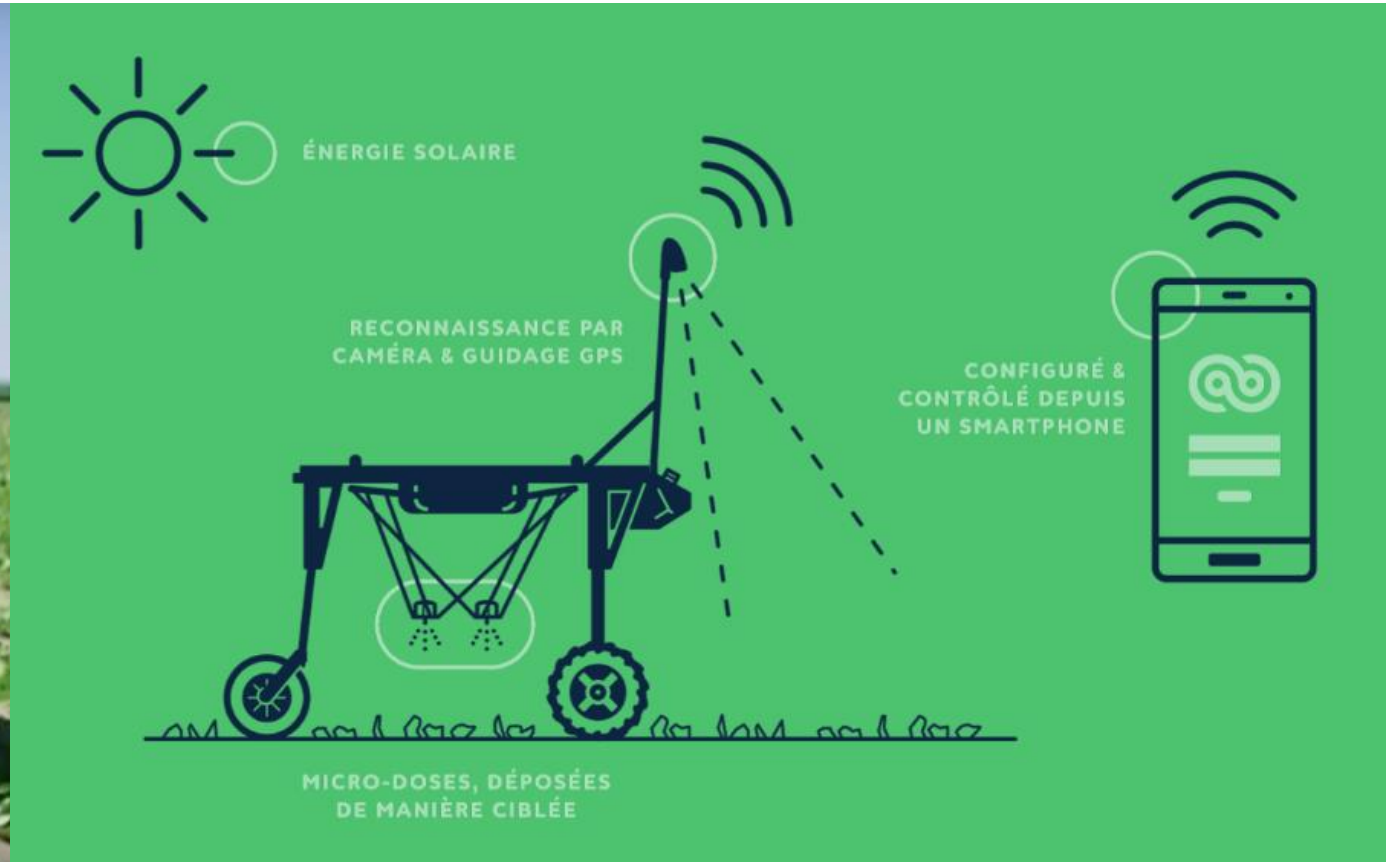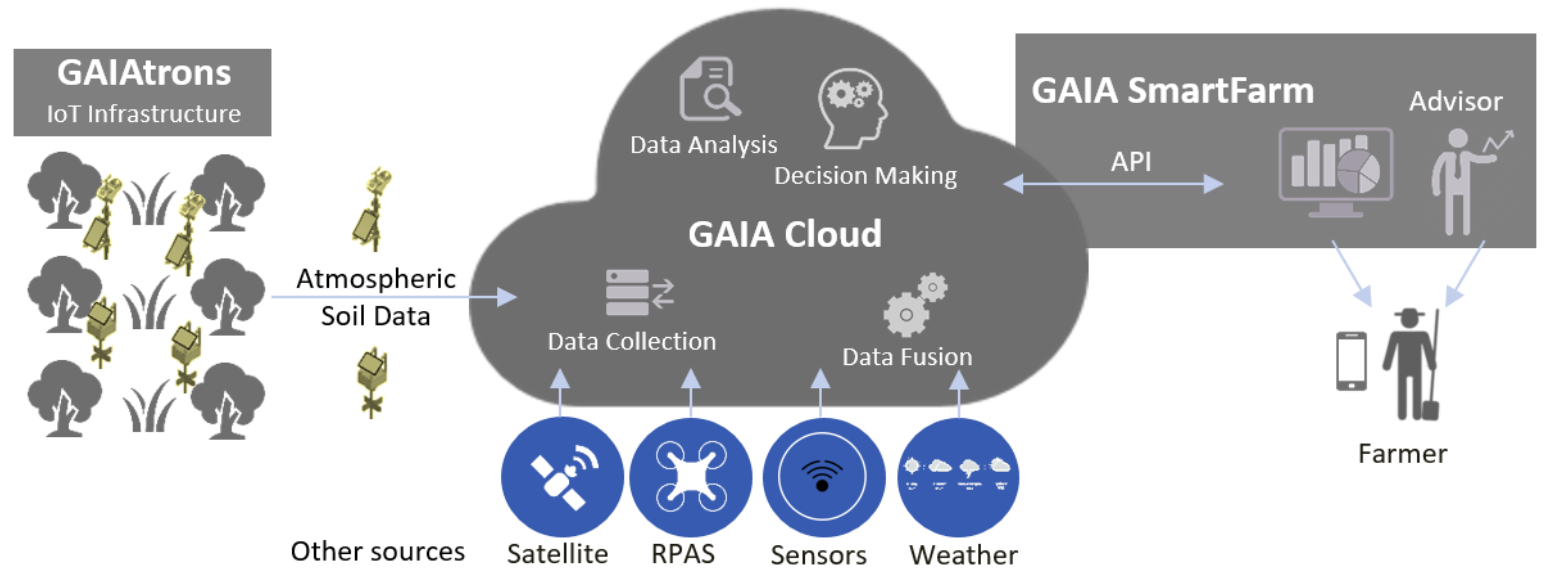

Source: ecoRobotix

Drones

senseFly

BBC

Monitoring soil, meteo, irrigation

Reduce the triple divide : digital, rural and gender

7 factors of success

Success factor 1: Content

Success factor 2: Capacity development

Success factor 3: Gender and diversity

Success factor 4: Access and participation

Success factor 5: Partnerships

Success factor 6: Technologies

Success factor 7: Sustainability

9 principles for digital development

Design With the User

Understand the Existing Ecosystem

Design for Scale

Build for Sustainability

Be Data Driven

Use Open Standards, Open Data, Open Source, and Open Innovation

Reuse and Improve

Address Privacy & Security

Be Collaborative

A's questions

Available	**Accessible**
Affordable	**Appropriate - adapted**
Allowed	**Ability**
Addicted	

Information silos of today's farm

Data

"Data is the building blocks of AI; sometimes simple data algorithms, but increasingly also more complex threads of multiple datasets combined into every longer code. "

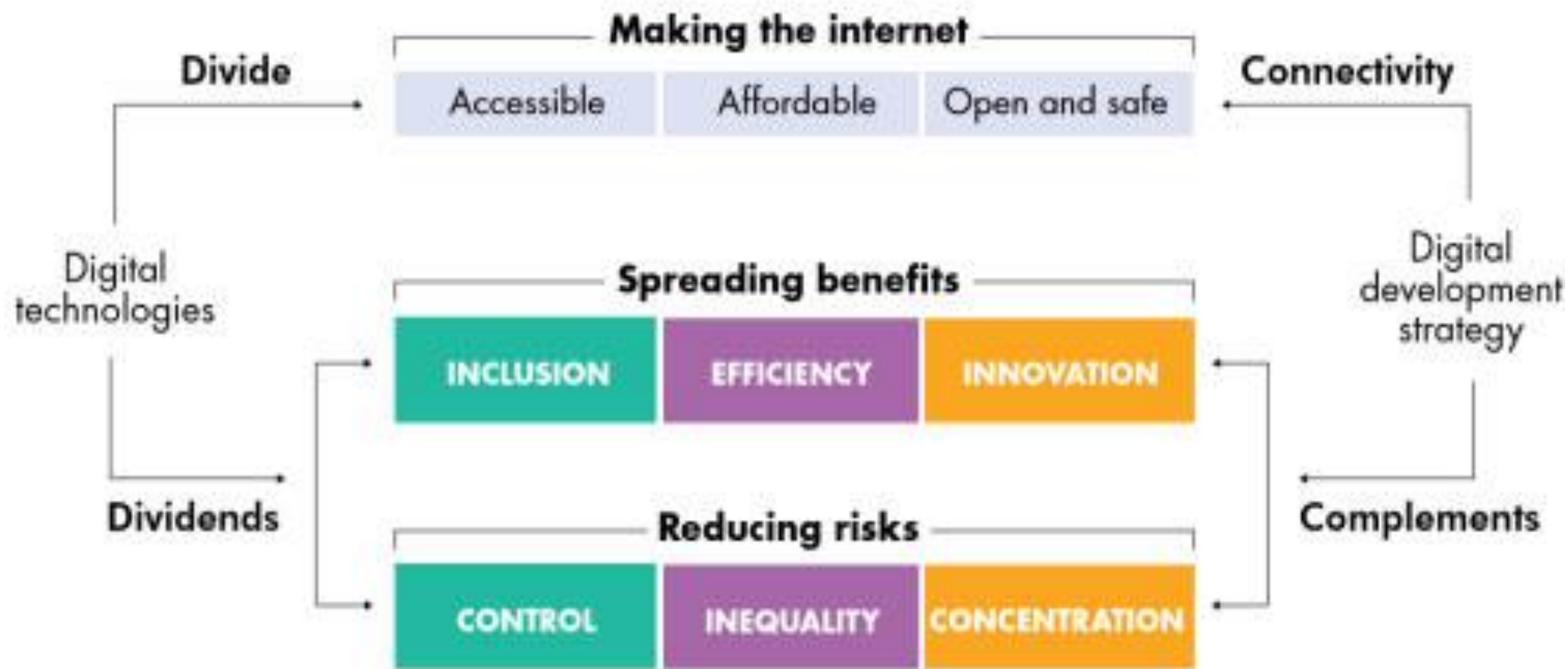|	
Data ownership	Data sovereignty
Data security	Data reliability
Data interoperability	Open-access data

FAO Regional mandate
Conference for Europe (ERC) 41st session
May 2018 – Voronezh, Russian Federation

FAO member countries in Europe and Central Asia encouraged FAO to continue its efforts on knowledge sharing on **policies** and **good practices**, in particular with focus on **smallholders and family farmers** and provide a **neutral regional platform** on which to **share knowledge** and support the implementation of **national e-agriculture strategies** for countries in Europe and Central Asia.

FAO REGIONAL CONFERENCE
FOR EUROPE

Thirty-first Session

Voronezh, Russian Federation, 16-18 May 2018

E-agriculture: the Use of Information and Communication Technologies (ICTs) for the Development of Sustainable and Inclusive Food Systems and Trade Integration

Executive Summary

Traditional and innovative information and communication technologies (ICTs) offer unprecedented opportunities for accelerating agricultural development towards more sustainable and integrated agriculture and food systems and achieving United Nations (UN) Sustainable Development Goals (SDGs), including food and nutrition security. ICTs bring new models for service delivery, fair and inclusive trade, and social and financial inclusion, among others. However, digital technology dividends are not automatic; in order to allow everyone to benefit from the technologies at minimized risk, FAO advocates for a participatory e-agriculture strategy formulation and implementation at the national level.

This paper aims at discussing practical methods, concrete policy options and priority actions related to the digital transformation of the food and agricultural sectors in the region, while enhancing exchange on benefits and challenges in applying ICTs in agriculture, food livestock, forestry and fisheries. Members will be called upon to provide guidance, to share good practices with a focus on strategy formulation, identify policy options and specify needs for FAO support in e-agriculture.

This background paper defines the terms related to e-agriculture, presents its multiple benefits against the technology challenges in Europe and Central Asia, and builds the case for a national e-agriculture strategy. Policy options are identified, and areas for FAO assistance are proposed.

This document can be accessed using the Quick Response Code on this page;
an FAO initiative to minimize its environmental impact and promote greener communications.
Other documents can be consulted at www.fao.org

MW106

ERC31

E-agriculture: the Use of Information and Communication Technologies (ICTs) for the Development of Sustainable and Inclusive Food Systems and Trade Integration
and web Annex for document ERC/18/3:

In English:
www.fao.org/3/MW106EN/mw106en.pdf +
www.fao.org/3/MW402EN/mw402en.pdf
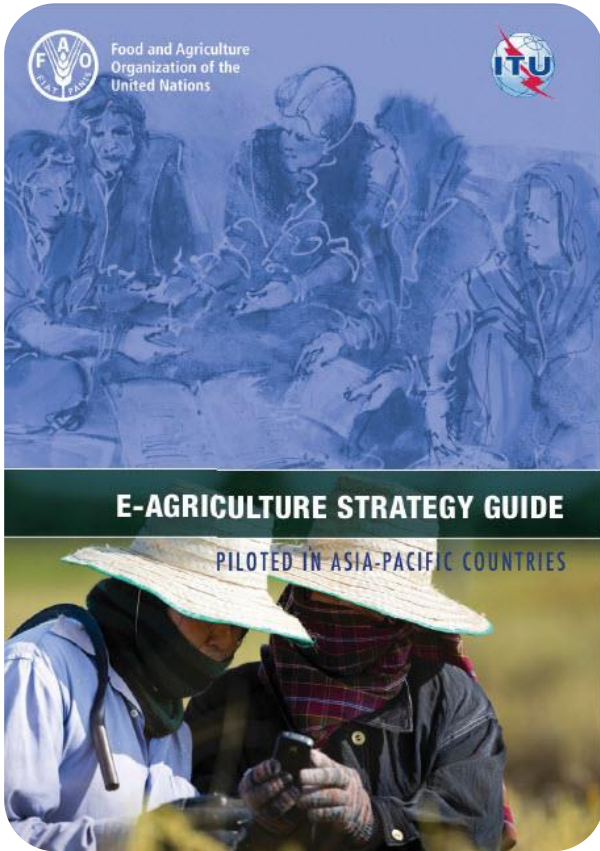
In Russian: www.fao.org/3/MW106RU/mw106ru.pdf +
www.fao.org/3/MW402RU/mw402ru.pdf

E-agriculture strategy guide

СТРАТЕГИЯ ПО НАЦИОНАЛЬНОМУ ЭЛЕКТРОННОМУ СЕЛЬСКОМУ ХОЗЯЙСТВУ

Руководство по стратегии электронного сельского хозяйства является основой для оказания помощи странам в формировании их стратегии по электронному сельскому хозяйству, а также определении и разработке устойчивых услуг и решений на основе использования информационно-коммуникационных технологий (ИКТ) в сельском хозяйстве.

Food and Agriculture Organization of the United Nations

This framework is used to assist countries to identify, design and develop sustainable ICT solutions/services to overcome challenges faced in agriculture or to accelerate achieving national agricultural goals.

English: www.fao.org/3/a-i5564e.pdf
Russian: www.fao.org/3/I9515RU/i9515ru.pdf

The issues

Government /organization
cannot address all SDG

Difficult to monitor,
manage and aggregate

Duplication
Redundancy

Inability to consider
user journey

Re-inventing
the wheel

Limited system impact

High-cost of
scaling up

No economies of scale

Partial view of user's needs

Non-interoperable

**E-Agriculture
Applications**

"Solution" mindset
No System thinking

Limited/no re-use
No building on each other
capabilities

Uncoordinated
investments

ICT is ad hoc and
not strategic tool

Developing national e-agriculture strategy

Ministry of Agriculture

Agriculture Policy

Department of Agriculture, Livestock, Fisheries, Forestry

Ministry of Communication and Information Technology

IT/Digital or e-Governance Policy

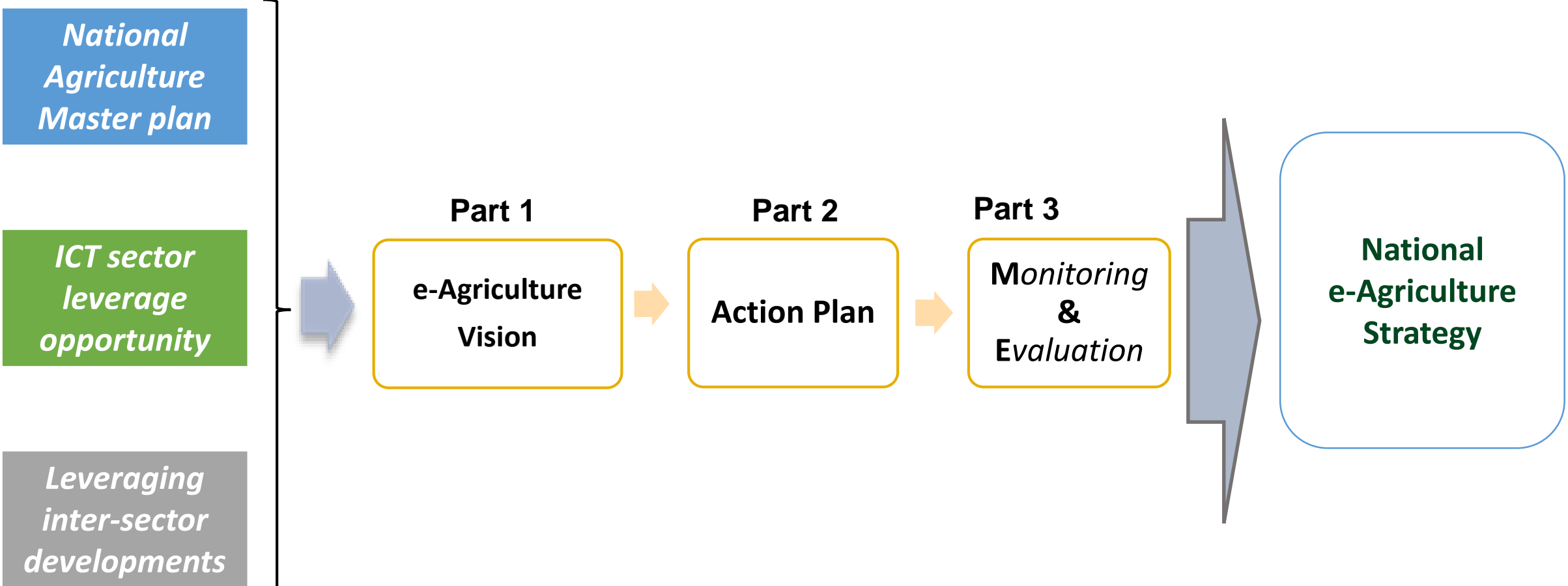Department of Telecom, IT, telecom regulator, e-Governance agency

National e-agriculture strategy
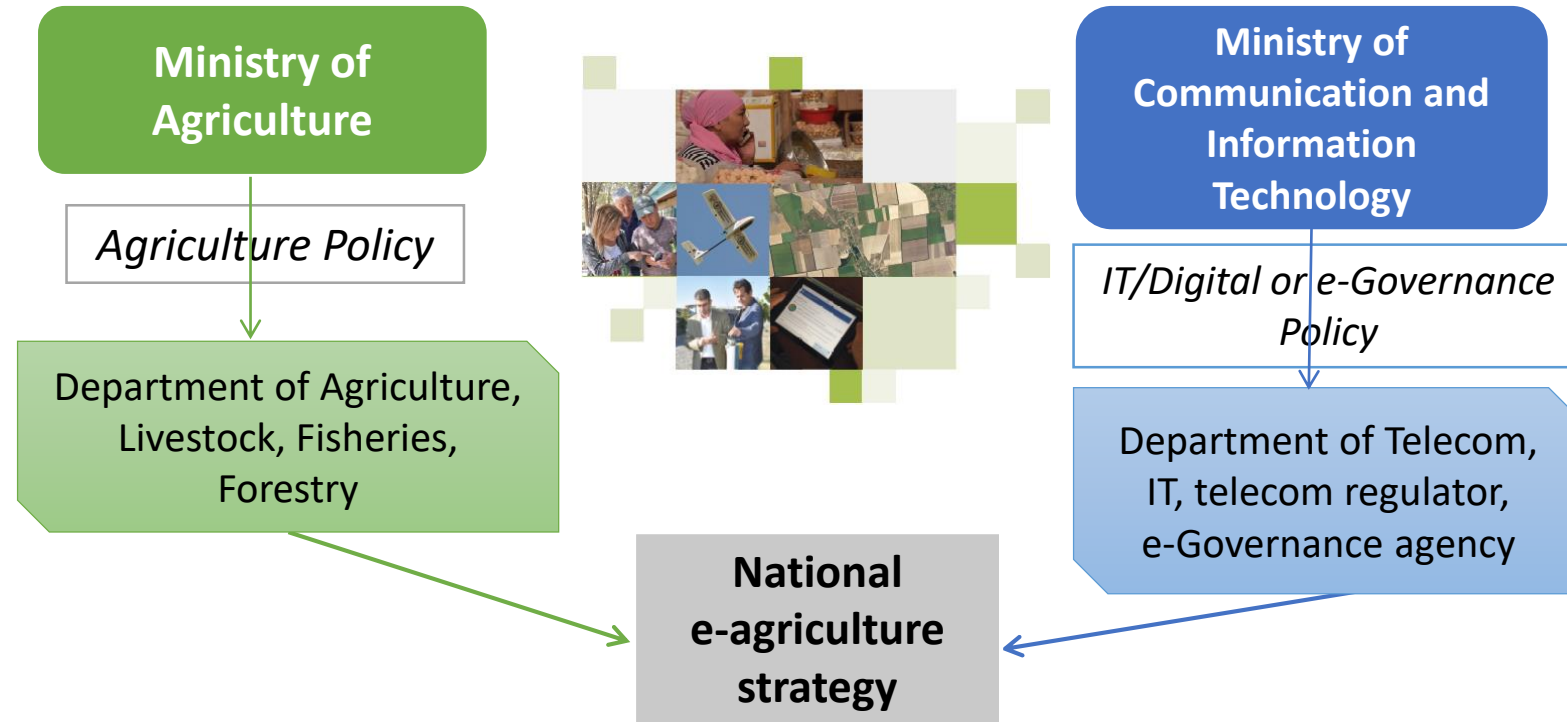
National e-agriculture strategy

is a comprehensive framework to develop sustainable e-agriculture services and solutions

# Approach to develop a national e-agriculture strategy

National Agriculture Master plan

ICT sector leverage opportunity

Leveraging inter-sector developments

Part 1
e-Agriculture Vision

Part 2
Action Plan

Part 3
Monitoring **&** **E**valuation

National e-Agriculture Strategy

The final outcome is a National Strategy on e-Agriculture comprising of three parts.

Addressing key building blocks

Leadership and Governance | Strategy and Investment | Services and Applications | Infrastructure | Standards and Interoperability | Content, Knowledge Management and Sharing | Legislation, Policy and Compliance | Workforce and Capacity Development

Identifying required e-agriculture components

- Infrastructure
- Interoperability
- Reliable Data
- Data sharing/ privacy
- Policies and Regulations

- Digital Literacy
- Gender-Digital Divide
- Data Analytics
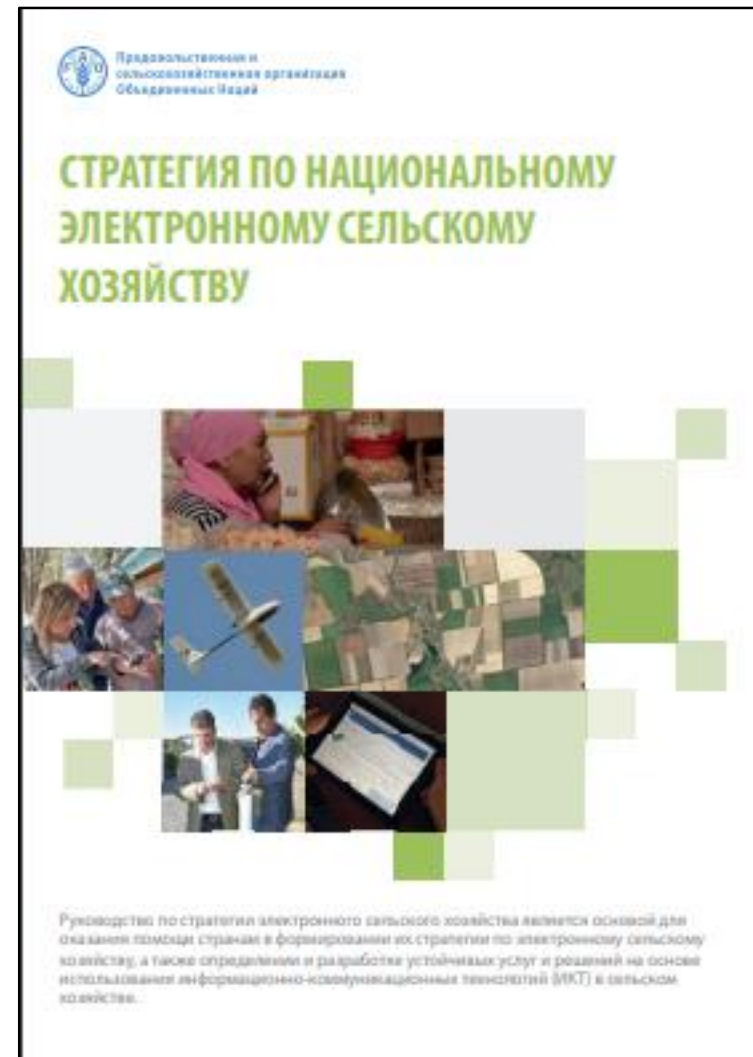- Capacity Development
- Support to Innovations
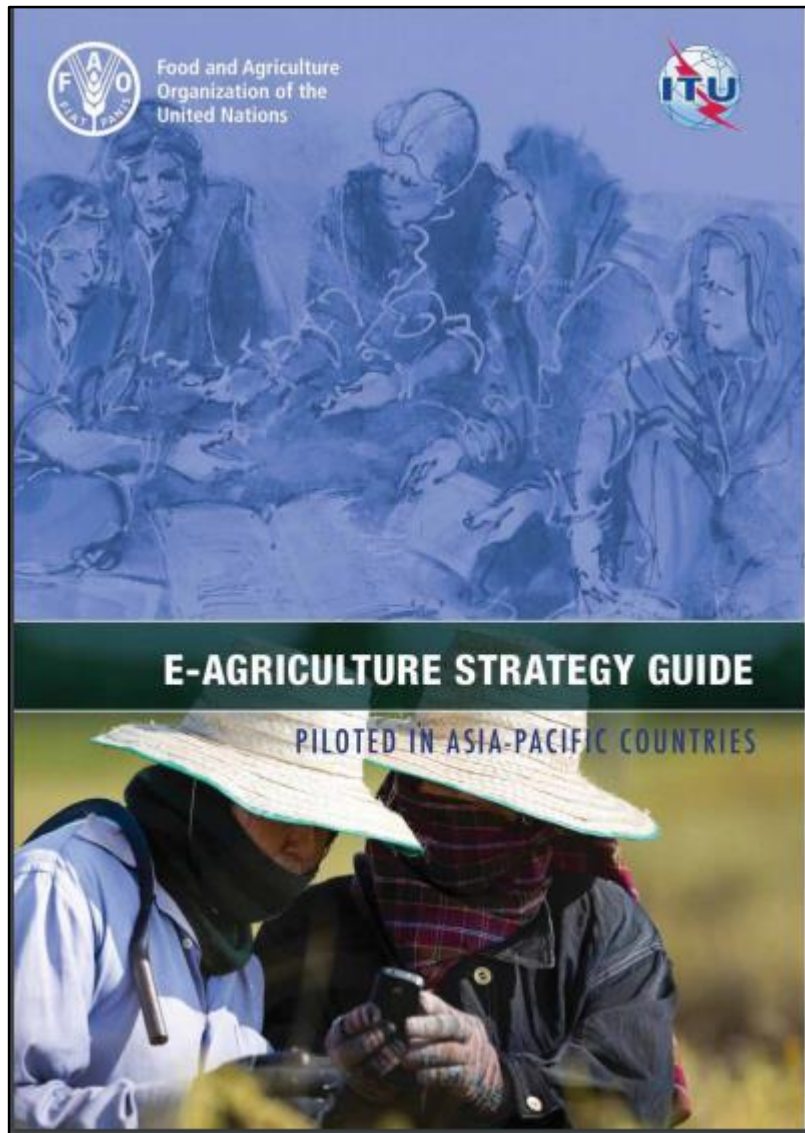
www.fao.org/3/a-i5564e.pdf

www.fao.org/3/I9515RU/i9515ru.pdf
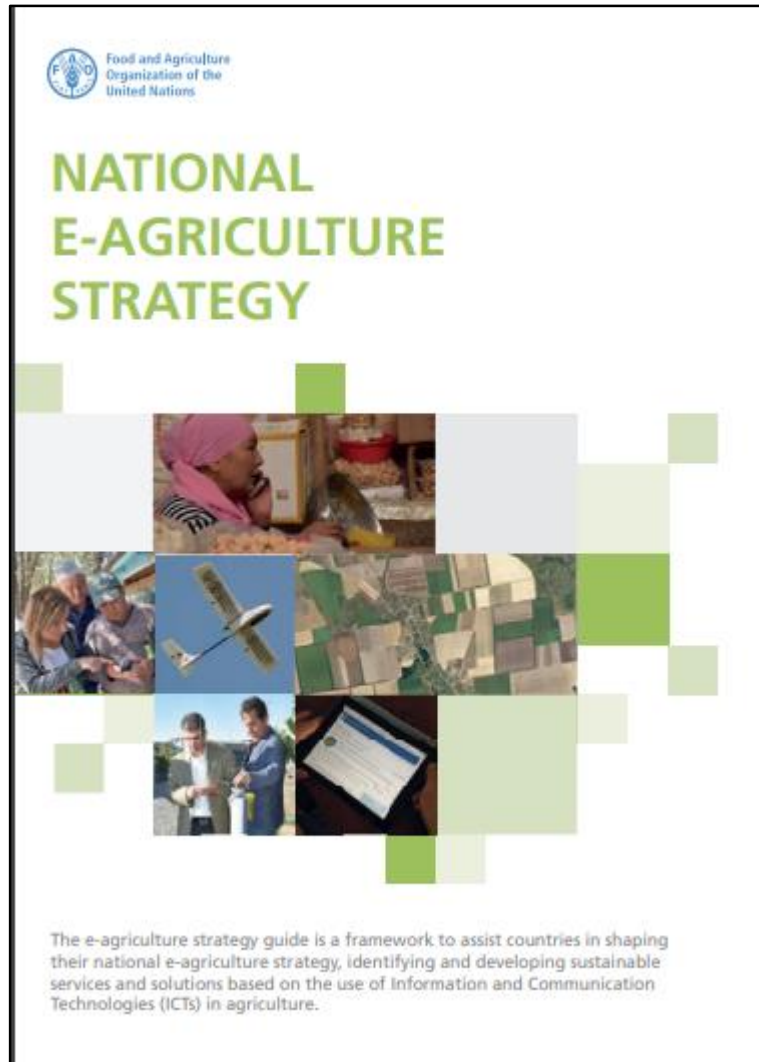
www.fao.org/3/i8133en/I8133EN.pdf

www.fao.org/3/i8133ru/I8133RU.pdf

http://www.fao.org/3/I8303EN/i8303en.pdf

http://www.fao.org/3/i8670en/I8670EN.pdf

Call on digital innovations

Call on digital innovations for agriculture in the Europe and Central Asia region

FAO has launched a call on digital innovations for agriculture in the Europe and Central Asia region. The call aims at collecting lessons learned and recommendations for the use of information and communication technologies (ICTs) or digital innovations in the sectors of agriculture, livestock, fisheries, forestry or rural development.

Selected innovations will be disseminated on online platforms, social media and will be part of an online FAO publication on the use of digital technologies for agriculture in Europe and Central Asia.

Topic

The innovations you wish to document should be about the use of ICTs, digital innovations for agriculture, livestock, fisheries, forestry or rural development. They can cover a wide range of topics such as the advisory services, value chain, agrometeorological information, or precision agriculture. The proposed ICT for agriculture innovations should be useful and accessible for smallholder farmers. We pay attention to gender issues and suggest taking them into account in the documentation. This call is focussing on innovations from Europe and Central Asia.

Template for the call innovations on the use of ICTs for agriculture in Europe and Central Asia

Contact

- sophie.treinen@fao.org for the submissions in **English**

- daniil.bobkov@fao.org для представления инноваций **на русском языке**

Digital tools for an organic farm

Photo story of a farmer in North Macedonia

Deadline

The deadline for submission of digital innovations: **8 April 2019.**

www.fao.org/europe/resources/call/en/

www.fao.org/europe/resources/konkurs/ru/

Thank you

For more information

www.fao.org/europe/resources/e-agriculture/en/

sophie.treinen@fao.org

Food and Agriculture Organization
of the United Nations