Sustainable ICTs for Agriculture
& Global Trends

Presented at
agriculture
SOLUTIONS FORUM 2018
15-17 Nov 2018
Nanjing, China
The state of agriculture, food security and nutrition in the world

The role of digital technologies in agriculture

Achieving more through cross-sectoral partnerships
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SUSTAINABLE DEVELOPMENT GOALS

17 Goals.
169 targets to achieve within the next 12 years!
AGRICULTURE & FOOD SECURITY

There is more than enough food produced today to feed everyone in the world, yet close to 821 (2017) million are chronically hungry.

A third of farmland is degraded, up to 75 percent of crop genetic diversity has been lost and 22 percent of animal breeds are at risk.

One in nine people on the planet still suffer from hunger

Every year, the world loses or waste about a third of the food it produces

Women make up almost half the agricultural workforce, but they own less land and lack access to resources.

Average age of farmers is increasing

The number of hungry people has barely changed during the past 2 years

Multiple burden of malnutrition despite decades of economic growth.

Increasingly impacted by climatic shocks
Asia and the Pacific Regional Overview of Food Security and Nutrition

- **Continued stagnation** in hunger levels in Asia and the Pacific. Rise in some sub-regions

- **Slow down of reduction of undernutrition** - changing food systems in the region - double burden of malnutrition in all countries. Unacceptably high prevalence of undernutrition in young children + **rising overweight and obesity** in children and adults.

- Need for shared actions implemented through **multi-sectoral approaches**

- **Growing incidence of and damage from climate-related disasters** negatively affecting food security and nutrition.

- **Urban malnutrition** – New challenges and need for new nutrition partners and policy advocates.
UNDERNOURISHMENT IN ASIA-PACIFIC

![Graph showing the prevalence of undernourishment and the number of undernourished individuals from 2005 to 2017.](image)

Prevalence of Undernourishment (Percent)

- 2005: 17.7%
- 2006: 16.8%
- 2007: 15.7%
- 2008: 15%
- 2009: 14.4%
- 2010: 13.8%
- 2011: 13.4%
- 2012: 13%
- 2013: 12.6%
- 2014: 12%
- 2015: 11.6%
- 2016: 11.5%
- 2017: 11.4%

Number of Undernourished (Million)

- 2005: 667.1 million
- 2006: 639.5 million
- 2007: 605.4 million
- 2008: 583.6 million
- 2009: 567.5 million
- 2010: 550.2 million
- 2011: 539.6 million
- 2012: 529.7 million
- 2013: 515.3 million
- 2014: 497.5 million
- 2015: 486.8 million
- 2016: 486.5 million
- 2017: 486.1 million
CLIMATE CHANGE & AGRICULTURE

Share of agriculture in total damage and loss

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>Floods (2011)</td>
<td>49.3</td>
</tr>
<tr>
<td>Philippines</td>
<td>Typhoon (2013)</td>
<td>48.1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Floods (2016)</td>
<td>46</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Floods (2014)</td>
<td>37</td>
</tr>
<tr>
<td>Nepal</td>
<td>Floods (2017)</td>
<td>29</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Typhoon (2011)</td>
<td>28</td>
</tr>
<tr>
<td>Fiji</td>
<td>Cyclone (2016)</td>
<td>18</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Floods (2017)</td>
<td>17</td>
</tr>
</tbody>
</table>

Climate is changing.
Food and agriculture must too.
Climate-related events are negatively impacting agricultural livelihoods in the region.
RAPID URBANIZATION

- The graph illustrates the rapid increase in urban population compared to rural population from 1950 to 2050.
- Urban population is projected to exceed rural population by 2030.
# BROAD CATEGORIES OF CHALLENGES

| The coping strategies of farmers and their resilience in the face of droughts |
|-----------------------------|-----------------|
| Lack of farmers capacity and knowledge to adopt newer farming practices |
| Population growth and diverse food habits |
| Shrinking access to arable land |
| Youth in agriculture, average age of farmers |
| Lack of access to quality agricultural inputs |
| Lack of farm/agriculture mechanization adaptation |
| Lack of access to water resources |
| Inadequate supplies of improved crop varieties and certified seeds |
| Insufficient access to credit by the farmers |
| Inadequate extension support to farmers |
| Poor on-farm management of water, crops, and pests |
| Lack of post harvest storage & logistics infrastructure access by farmers resulting in post harvest losses |
| Disaster management and early warning |
| Marketing, channels, access to markets and linkages |
| Production and post production processing |
| Social and gender issues |
| Food quality standards and monitoring |
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DIGITAL TRANSFORMATION & SDGs

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Life on Land
14. Life below Water
15. Peace and Justice
16. Prosperity and Peace
17. Partnerships for the Goals

ICTs integrate and facilitate all SDGs through innovative collaboration and scaled up capacity building.

Financial inclusion: Mobile access to financial services for the world’s two billion unbanked.

e-Agriculture: Access to market updates, and weather forecasts increases rural business productivity.

e-Health: Be Healthy, Be Mobile. Direct patient interaction, health informatics and telemedicine.

e-Learning: Access to knowledge to all people no matter where they live or how much they earn.

ICTs support greener lifestyles, climate monitoring, forecasting and early warning systems.

Satellite oceanic observation and monitoring increases scientific knowledge of the oceans.

Open data increases transparency, empowers citizens and drives economic growth.

Satellite observation of terrestrial ecosystems help to protect biodiversity.

ICTs enable sustainable production and consumption through smart grids, smart metering and cloud computing.

Smart sustainable cities, intelligent transport systems, 5G and the Internet of Things.

Narrow the digital divide and empower communities.

Provide universal and affordable access to the internet. ICTs are essential for a resilient 21st century infrastructure and access to services and applications.

Promoting the digital economy, e-commerce, tech-IMEs, entrepreneurship and cybertrust.

ICTs are an essential pathway to gender equality and empowerment.

Smart water management systems, sanitation and hygiene.

Energy efficient, smart grids, green standards and technology for sustainable energy.
Bayu is tracking land-use in near-real time.

Find out how ICTs can enable you to see the bigger picture!

<table>
<thead>
<tr>
<th>Satellite Imagery</th>
<th>Mobile Broadband</th>
<th>Cloud, Database</th>
<th>Mobile e-application</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS, Drones, IOTs</td>
<td>Satellite, Fixed / Fibre</td>
<td>Digital Platform and Analytics, DLT / Blockchain</td>
<td></td>
</tr>
</tbody>
</table>

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[Image of a green background with a man using a laptop, alongside a colorful wheel and text about SDG targets.]
<table>
<thead>
<tr>
<th>IOTs</th>
<th>Mobile Broadband</th>
<th>Cloud Computing</th>
<th>Mobile e-application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors</td>
<td>Wireless Networks</td>
<td>Database</td>
<td>Displays</td>
</tr>
<tr>
<td>Smart Meters</td>
<td>Smart Grids</td>
<td>Digital Platform and Analytics</td>
<td></td>
</tr>
<tr>
<td>EV Charging</td>
<td>Home Energy Gateway And Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOTs (e.g. RFIDs /Health Sensors /Wearables)</td>
<td>Mobile Broadband</td>
<td>Cloud computing</td>
<td>Mobile e-application</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------------</td>
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<td>---------------------</td>
</tr>
<tr>
<td>Location</td>
<td>Home Wireless</td>
<td>Database</td>
<td>Remote monitoring</td>
</tr>
<tr>
<td></td>
<td>Satellite</td>
<td>Digital Platform and Analytics</td>
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</tr>
<tr>
<td></td>
<td>Fixed / Fiber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SUSTAINABLE SMART CITY

Source: ITU – Focus Group on Smart Sustainable Cities
MOBILE COVERAGE & BROADBAND

**Broadband prices as a percentage of GNI per capita, 2016**

Mobile broadband is more affordable than fixed-broadband services in most developing countries. However, mobile-broadband prices represent more than 5% of GNI per capita in most LDCs and are therefore unaffordable for the large majority of the population.

Source: ITU.
Note: Based on data available for 169 countries. Prices are based on entry-level plans with a minimum data allowance of 1 GB per month.
Realizing the potential of digital technologies, countries and entities have embarked on digital nation, smart city, digital transformation programs.
### EXISTING AND IOT POTENTIAL SERVICES

#### IoT Segment

<table>
<thead>
<tr>
<th>IoT Segment</th>
<th>Global share of IoT projects</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connected Industry</strong></td>
<td>![Bar Chart showing 22%]</td>
<td>Americas: 43%, Europe: 30%, APAC: 20%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Smart City</strong></td>
<td>![Bar Chart showing 20%]</td>
<td>Americas: 31%, Europe: 47%, APAC: 15%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Smart Energy</strong></td>
<td>![Bar Chart showing 13%]</td>
<td>Americas: 49%, Europe: 24%, APAC: 25%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Connected Car</strong></td>
<td>![Bar Chart showing 13%]</td>
<td>Americas: 43%, Europe: 33%, APAC: 17%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>![Bar Chart showing 8%]</td>
<td>Americas: 46%, Europe: 33%, APAC: 13%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Smart Agriculture</strong></td>
<td>![Bar Chart showing 6%]</td>
<td>Americas: 48%, Europe: 31%, APAC: 17%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Connected Building</strong></td>
<td>![Bar Chart showing 5%]</td>
<td>Americas: 48%, Europe: 33%, APAC: 12%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Connected Health</strong></td>
<td>![Bar Chart showing 5%]</td>
<td>Americas: 61%, Europe: 30%, APAC: 6%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Smart Retail</strong></td>
<td>![Bar Chart showing 4%]</td>
<td>Americas: 52%, Europe: 30%, APAC: 13%, Trend: ↑</td>
</tr>
<tr>
<td><strong>Smart Supply Chain</strong></td>
<td>![Bar Chart showing 4%]</td>
<td>Americas: 57%, Europe: 35%, APAC: 4%, Trend: ↑</td>
</tr>
</tbody>
</table>

1. Based on 640+ publicly known enterprise IoT projects (not including consumer IoT projects e.g., Wearables, Smart Home). 2. Trend based on IoT Analytics’s Q2/2016 IoT Employment Statistics Tracker. 3. Not including Consumer Smart Home Solutions.  
Source: IoT Analytics 2016 Global overview of 640 enterprise IoT use cases (August 2016)
IOT TECHNOLOGIES

Fixed & Short Range

- RFID
- Bluetooth
- Zigbee
- WiFi

Long Range

Non 3GPP Standards

SIGFOX
Weightless
Others

3GPP Standards

LTE-M
EC-GSM
NB-IOT
5G
LoRaWAN

83
Network Operators

57
Alliance Member Operators

49
Countries operating in

95
Countries with LoRaWAN Deployments

https://www.lora-alliance.org/
Sigfox

https://www.sigfox.com/en/coverage
### LTE AND NB-IOT

- **865 operators** investing in LTE, including pre-commitment trials.
- **681 commercially launched LTE** or LTE-Advanced networks in 208 countries, including those using LTE for FWA services, as well as 114 LTE-TDD (TD-LTE) networks launched in 60 countries.
- **156 commercial VoLTE** networks in 76 countries and 229 operators investing in VoLTE in 107 countries.
- **261 launched networks** that are LTE-Advanced in 119 countries.
- **690–700 anticipated commercially launched LTE networks by end-2018** (GSA forecast).
- **60 NB-IoT and 18 LTE-M/Cat-M1** networks commercially launched with 57 other operators investing in NB-IoT and 26 other operators investing in LTE-M/Cat-M1 in the form of tests, trials or planned deployments.
- **154 operators** that have been engaged in, are engaged in, plan to engage in, or have been licensed to undertake 5G demos, tests or trials of one or more constituent technologies.
- **67 telecom operators in 39 countries** have announced intentions of making 5G available to their customers between 2018 and 2022.

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**Report:**
*Evolution from LTE to 5G, GSA*

https://gsacom.com/
5G – vision of a more connected services

5G usage scenarios from the ITU-R IMT-2020 Vision Recommendation

- Enhanced mobile broadband
  - Gigabytes in a second
  - 3D video, ultra-high definition (UHD) screens
- Smart home/building
  - Work and play in the cloud
- Voice
  - Augmented reality
- Smart city
  - Industry automation
- Future IMT
  - Mission critical applications, e.g. e-health
  - Self-driving car

Massive machine type communications

Ultra-reliable and low latency communications
## HIGH SPEED BROADBAND AND IOT

![Graph showing IMT-2020 and IMT-advanced requirements for different parameters like Peak data rate, User experienced data rate, Spectrum efficiency, Mobility, Network energy efficiency, Area traffic capacity, and Connection density vs Latency.](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1G</th>
<th>2G</th>
<th>3G</th>
<th>4G</th>
<th>5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate deployment date</td>
<td>1980s</td>
<td>1990s</td>
<td>2000s</td>
<td>2010s</td>
<td>2020s</td>
</tr>
<tr>
<td>Theoretical download speed</td>
<td>2kbit/s</td>
<td>384kbit/s</td>
<td>56Mbit/s</td>
<td>1Gbit/s</td>
<td>10Gbit/s</td>
</tr>
<tr>
<td>Latency</td>
<td>N/A</td>
<td>629 ms</td>
<td>212 ms</td>
<td>60-98 ms</td>
<td>&lt; 1 ms</td>
</tr>
</tbody>
</table>
5G TIMELINES: ITU-R AND 3GPP

External events impacting 5G timelines:
- 2018 Winter Olympics (Korea, 2018Q1)
- 2020 Summer Olympics (Tokyo) Expo 2020 (Dubai)
SERVICES THAT 5G WOULD ENABLE

Source: GSMA Intelligence, 2015.
Key technology driver for the development of the financial industry.

Source: Dr. Han Han, Senior Engineer, China Academy of ICT
DIGITAL TECHNOLOGIES IN AGRICULTURE

Source: FAO-ITU E-agriculture Strategy Guide
DISTRIBUTED LEDGER TECHNOLOGIES

Technologies: Used To Create Applications

Applications: Crypto-currency as a ‘means of payment’ and/or a ‘digital asset’

Source: Leon Perlman, ITU Asia-Pacific CoE Training on Distributed Ledger Technologies (Blockchain) Ecosystem and Decentralization
DLT BUSINESS ECOSYSTEM

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ROLE OF ICTS IN AGRICULTURE

ICTs assist with implementing regulatory policies, frameworks and ways to monitor progress.

ICTs bridge the gap between agricultural researchers, extension agents and farmers thereby enhancing agricultural production.

ICTs improve access to climate-smart solutions as well as appropriate knowledge to use them.

ICTs provide actionable information to communities and governments on disaster prevention, in real-time, while also providing advice on risk-mitigation techniques.

ICTs help deliver more efficient and reliable data to comply with international traceability standards.

ICTs facilitate market access for inputs as well as product marketing and trade in a variety of ways.

Source: FAO-ITU
E-agriculture Strategy Guide
E-AGRICULTURE SERVICE CATEGORIES

CONNECTED
Integrated natural resources management system (weather information, soil health, land use), traceability, seed verification

TRANSACTIONAL
Mobile payment, trading floors

INTERACTIVE
E-government services, e-extension services

PUSH
Market price information, government announcements, marketing
ADDRESSING KEY BUILDING BLOCKS

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

- Digital Literacy
- Gender-Digital Divide
- Data Analytics
- Capacity Development
- Support to Innovations
FAO-ITU technical assistance to countries in developing their National E-Agriculture Strategy

- **2015-2016**: Bhutan and Sri Lanka
- **2016**: Lao PDR ICT Masterplan
- **2017**: Myanmar’s agriculture extension modernization strategy
- **2017-2018**: Afghanistan
- **2018-2019**: Pakistan
E-AGRICULTURE STRATEGY

Bhutan E-RNR Master Plan

Sri Lanka E-agriculture Strategy
June 2016

Fiji E-agriculture Strategy
November 2017

Afghanistan E-Agriculture Strategy

Papua New Guinea E-agriculture Strategy

Philippines e-Agriculture Strategy

By 2023, ICT will contribute to growth of agriculture sector through increased productivity, increased income, employment, and poverty alleviation.

By 2022, sustainable ICT solutions will bring about transformative change in agriculture, thereby promoting food and nutritional security, knowledge gap reduction, sustainable and balanced economic growth and improvement of Afghan rural and urban landscapes.

"The Papua New Guinea agriculture sector transformed by innovative information and communication technologies. By 2023."

March 2018

"By 2022, Philippine agriculture sector will be technology driven and globally competitive, having production, progressive and resilient farmers and fisher folk empowered by ICT."

Driven by:

With a mission to:

E-AGRICULTURE STRATEGY

"Intensive Information and Communications Technologies for" Boosting a Better and Better Agriculture. Poverty and food insecurity in Fiji by 2025"
E-AGRICULTURE SOLUTIONS/SERVICES IDENTIFIED

CATEGORIES

Online Content
Disaster Management
Data Collection, Data Bases, Data Analytics, Modeling
Capacity Building
Communication
ICT Infrastructure Connectivity
Banking, Trading, Insurance
Services, Logistics, Climate Change and Monitoring
DOCUMENTING CASE STUDIES


http://www.fao.org/3/a-i6972e.pdf

http://www.fao.org/3/a-i5477e.pdf

http://www.fao.org/3/a-i6733e.pdf

COMING SOON

E-AGRICULTURE IN ACTION
Blockchain for Agriculture: Opportunities and Challenges


BRINGING SOLUTION SEEKERS AND PROVIDERS TOGETHER

agriculture SOLUTIONS FORUM 2016

Bangkok, Thailand
29-31 August 2016

agriculture SOLUTIONS FORUM 2018

Nanjing, China
15-17 November 2018
DIGITAL SERVICES PORTFOLIO @ FAO

• **FAO Digital Services Portfolio**: mobile technology
• **Agro-Met Services**: capacity development assisting countries to offer agrometeorological services
• **FishID**: machine learning & image recognition
• **Blockchain** for food security and traceability
• **#HackAgainstHunger**: digital innovation and youth entrepreneurship
• **Innovative Partnerships**: UNIN, GEE, WMO, ITU & Telefonica

• **Digital Innovation Ecosystem**: FAO Accelerators and Incubators
THANK YOU

Digital technologies are creating opportunities to improve how we produce, distribute and manage food and feed people, creating a major driver for economic growth and an accelerator for innovation and change.

José Graziano da Silva
Director-General, FAO

Without more innovative PPPs and leadership, we will miss our opportunity to fast-forward progress on the SDGs.

Houlin Zhao
Secretary-General, ITU

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