#SMARTer2030

ICT Solutions for 21st Century Challenges

GeSI
GLOBAL e-SUSTAINABILITY INITIATIVE

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3.4 Food – Produce more and waste less

Emergence of Smart Agriculture – The Context

By 2030, around 8.3 billion people will require water, food and shelter, placing increasing strains on a finite amount of land, fresh water reserves, and other natural resources. While modern agricultural methods increase crop yield, they often harm land, biodiversity and local water sources. In addition to this, the agri-industry is responsible for a large proportion of global emissions.

Our key challenge is to feed a growing population from a limited amount of land, water and other resources while reducing negative environmental impacts and food waste.

Exacerbating these challenges is the fact that over one third of all food produced worldwide is wasted, either during production and distribution, or after sale. Food waste does not only cost us $750 billion a year, it also reduces the amount of food available to people worldwide.

To further complicate the picture, increasing occurrences of climate change-related extreme weather events have the potential to cause severe shocks to global food production, creating a growing need for resilient and environmentally responsible agriculture, as the World Bank has outlined in its path-breaking report “Turn Down the Heat”.

In dealing with these challenges, ICT has a very important role to play. Use of technologies like satellite imaging, geographic mapping, sensor-based technologies and advanced data analytics could lead to practices that are more productive, sustainable and precise. Some of these technologies are already transforming the agricultural sector while others, when scaled up, have the potential to truly revolutionize how our food is grown, distributed and consumed.

What is Smart Agriculture?

Smart Agriculture is about making farming more efficient, through techniques like geographic mapping, sensors, machine to machine connectivity, data analytics and smart information platforms. Feeding more people while wasting fewer resources requires traditional agricultural methods to become more intelligent, productive and sustainable using ICT.

Smart Agriculture means using disruptive ICT solutions to make food production more efficient by increasing crop yield, reducing waste and easing access to markets.

While many Smart Agriculture technologies are game changing, not all are available at commercial scale yet. According to research by Accenture for Vodafone’s *Connected Agriculture* report in 2012[1], most Smart Agriculture applications are currently only partly implemented, if at all, and mainly in developed countries by large farms. The vast majority of smallholders are yet to gain access to these technologies. However, we expect that in a decade’s time, these and many other technologies will penetrate deeper into global food supply chains.

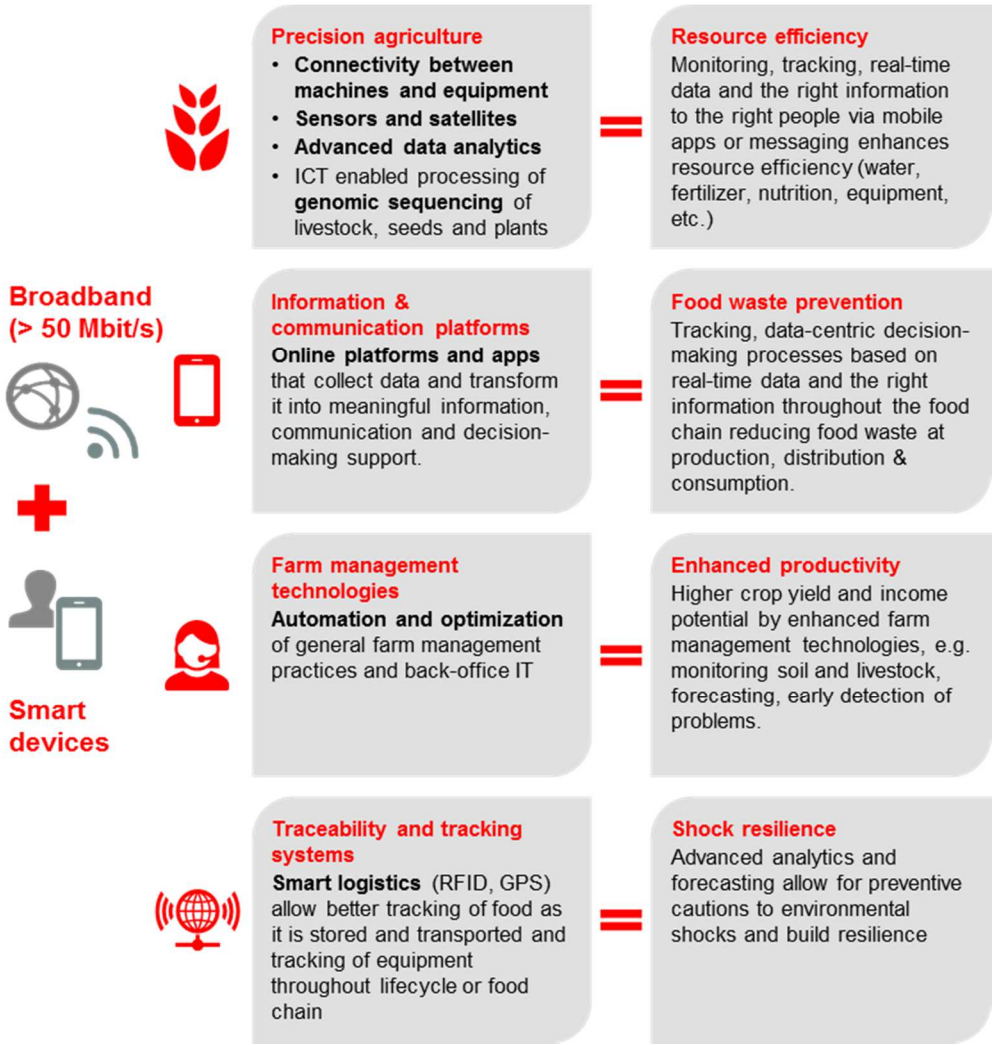
Future of Smart Agriculture

What we need, to facilitate global Smart Agriculture, is comprehensive access to high-speed internet and to affordable smart devices. Although not available everywhere today, these technologies are expected to be near ubiquitous by 2030.

ICT will allow farmers to increase resource efficiency, productivity and resilience and will help reduce food waste along the supply chain.

While these technologies are basic requirements, Figure 22 lists disruptive technologies in four key areas that will drive transformation, from enhancing productivity and resource efficiency, to building shock resilience and reducing global food waste.

Figure 1: Food – Future of Smart Agriculture: Technology Vision for 2030



Precision agriculture

Precision agriculture technologies help farmers to ascertain the exact amount of water, fertilizer, or other input that is needed for specific crops or patches of land at any point in time. This is enabled through Machine-to-Machine connections, sensors and satellites, and strengthened further through the genomic sequencing of plants and seeds.

Data and information management

Advanced analytics on weather data and real-time information platforms will be indispensable in informing farmers of potential weather changes or threats, and can raise early alarm signals of environmental shocks. Real-time information communicated to them through dashboards on their smart device can enable farmers to respond and build resilience by proactively managing detailed weather information.

Automated farm management

Advanced farm management technology, meanwhile, brings us closer to almost fully automated farm management and the optimization of processes from back-office administration, to automated adjustments in irrigation and fertilizer. The automation of conventional farm management enhances productivity, as it frees up more time and increases resource efficiency through better response rates to incoming data.

Reducing food waste

ICT is also having a major impact on the ability of farmers, consumers and buyers alike to trace the food they buy and sell. To optimize processes and reduce food waste at all stages, tracking and tracing systems (like RFID and GPS) allow for remote and real-time tracking of food as it is produced, stored and transported. In developing countries, digital markets and real-time information will help farmers to match demand with supply and – thereby – to reduce food waste at its source. By 2030, all food products could be individually tagged, allowing for customized expiration dates based on real-time information on a single product's location, freshness, and source.

Sustainability Impacts of Smart Agriculture

By increasing resource and energy efficiency across applications, Smart Agriculture technologies and practices show strong potential in terms of emissions abatement. By 2030, we estimate the amount of CO_{2e} that could be avoided through Smart Agriculture at **2.0Gt CO_{2e} per year.** This is composed mainly from energy savings and the more efficient use of water and fertilizers.

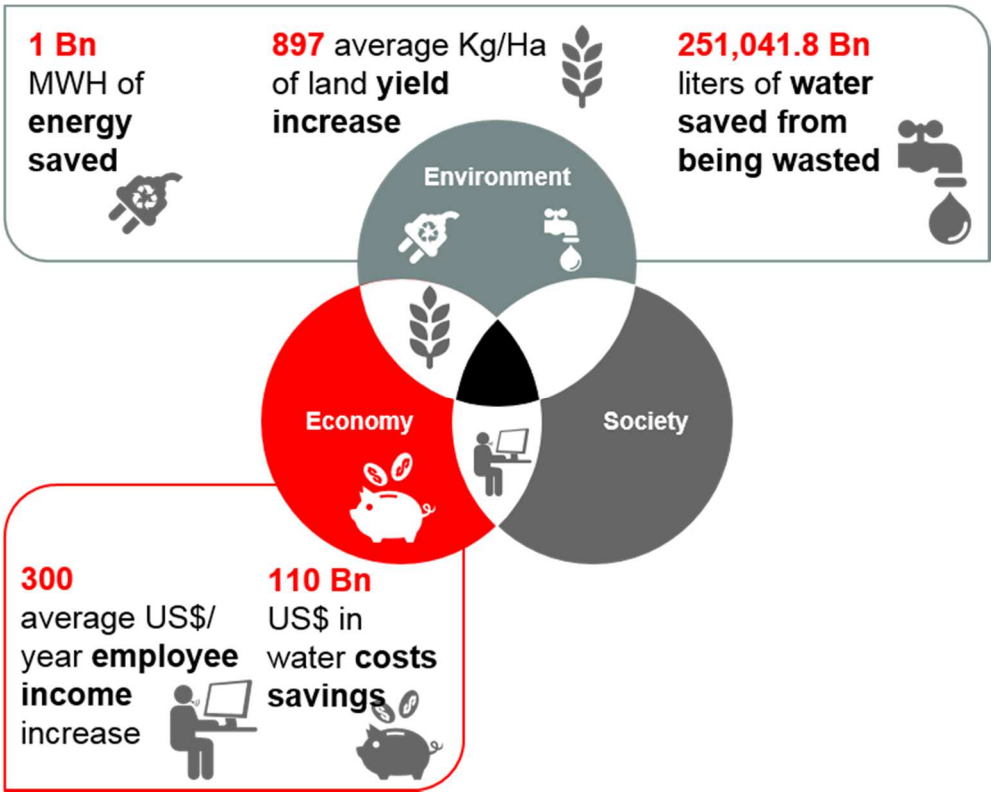
Smart Agriculture also provides significant economic and social benefits, mainly through additional revenue opportunities and cost savings. For example:

- Smart Agriculture solutions could generate almost $2 billion of additional revenues to companies across the sector and increase the average annual income of farmers by $300 by 2030.
- Cost savings through reduced water usage could also amount up to $110 billion by 2030.

The diagram below depicts the types of benefits that Smart Agriculture practices can help accrue across environment, economy and society.

ICT-enabled agricultural practices provide a variety of environmental, social and economic benefits, ranging from resource efficiency to resilient systems and increased food security.

Figure 2: Food - Benefits of Smart Agriculture



Farm Cloud Computing - Transforming farming by exploiting ICT

Aeon Agri Create is an 'ICT Farming' enterprise, created in partnership with Fujitsu, managing 15 farms covering over 200 locations across Japan. Aeon Agri Create was established with the aim to apply ICT to develop and share farming expertise so that people without much farming experience could deliver results. The Aeon farms use Fujitsu's Akisa Cloud Computing service as the basis of their daily farm operation and monitoring. Workers are supplied with smart devices from which they can check operations, monitor crops, or check pesticide or fertilizer use while also keeping track of operational costs. Through GPS technology the collected data can be connected to a specific farm and a specific patch of land within the farm, allowing workers to detect and record abnormalities, insect damages, pests or diseases.

Farming plans, crop yield forecasts, observations, harvest data and other relevant information is integrated into a central database, used to analyze and improve productivity. For example, collected data on the Japanese mustard spinach plant suggested that crop yields per hectare could be improved by up to 33% through optimal harvesting time and applying the right amount of sunlight and heat. This applied use of farm-generated data helps the company to support strategic crop planting, optimize production, and reduce the required energy and resources. In fact, time savings of up to 80% can be achieved using the cloud computing service. Moreover, as the data generated is sharable, Aeon Agri Create aims to extend its application of ICT farming to 3000 subcontracted farmers, forging win-win relationships with its partners.

Robust Agriculture – Achieving resilience through ICT

Recent years have shown an increase in climate-change related extreme weather events with negative impacts on sectors such as agriculture. Developing agricultural farms and practices that are resilient to these events is essential in feeding a growing population. ICT-enabled solutions can significantly contribute to developing such resilience by allowing for timely response to changes in climate and weather conditions. Fujitsu's Akisai Food and Agriculture Cloud solution is a good example of a data-driven solution that can support farmers by making the farming environment and production processes more visible through ICT. The solution uses sensors and cloud technology to measure and control the environment in fields and in greenhouses.

In Japan, Fujitsu has built a fully enclosed factory for growing plants using the Akisai cloud solution. Through data-driven knowledge and insights, the solution allows for seasonal crops to be grown year

round, growing of vegetables without chemicals or pesticides, and contributing to a more stable and efficient farm environment that is not at the mercy of nature. By aggregating, analyzing and using diverse data from farms worldwide, ICT solutions such as Fujitsu's Akisai, can help resolve global-scale food shortages and improve efficiency and resilience in the agricultural sector.

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About GeSI

The Global e-Sustainability Initiative (GeSI) is a strategic partnership of Information and Communication Technology (ICT) companies and organizations committed to creating and promoting technologies and practices to foster economic, environmental and social sustainability. Formed in 2001, GeSI's vision is a sustainable world through responsible, ICT-enabled transformation. GeSI fosters global and open cooperation, informs the public of its members' activities to improve their sustainability performance, and promotes innovative technologies for sustainable development. GeSI's membership includes over 30 of the world's leading ICT companies; the organization also collaborates with a range of international stakeholders committed to ICT sustainability objectives. These partnerships include the United Nations Environment Program (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), the International Telecommunications Union (ITU), and the World Business Council for Sustainable Development (WBCSD). Such collaborations help shape GeSI's global vision on evolution of the ICT sector, and how it can best meet the challenges of sustainable development. For more information, see www.gesi.org.

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