



Food and Agriculture
Organization of the
United Nations

SUSTAINABLE
DEVELOPMENT
GOALS

working for Zero Hunger

FAO'S WORK ON AGRICULTURAL INNOVATION

Sowing the seeds
of transformation to
achieve the SDGs

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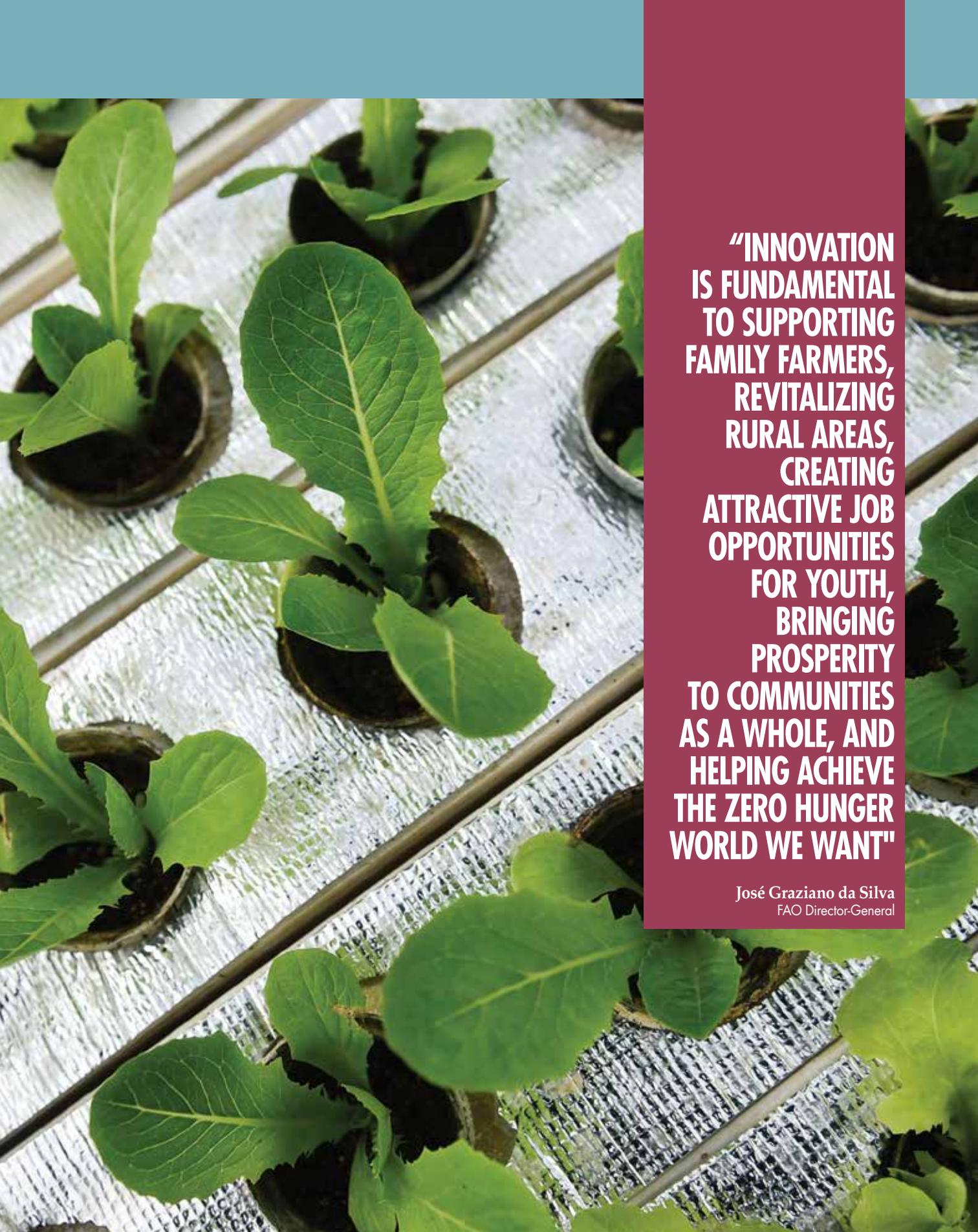
WAY FORWARD

Cover photo: FAO has developed four new apps to provide farmers with real-time information on weather, livestock care, markets and nutrition. ©FAO/Alioune Ndiaye



EGYPT

The use of non-conventional water in support to sustainable agri-aquaculture development in desert and arid lands.
©FAO/Khaled Desouki



**“INNOVATION
IS FUNDAMENTAL
TO SUPPORTING
FAMILY FARMERS,
REVITALIZING
RURAL AREAS,
CREATING
ATTRACTIVE JOB
OPPORTUNITIES
FOR YOUTH,
BRINGING
PROSPERITY
TO COMMUNITIES
AS A WHOLE, AND
HELPING ACHIEVE
THE ZERO HUNGER
WORLD WE WANT”**

José Graziano da Silva
FAO Director-General

INTRODUCTION

INNOVATION IS CENTRAL TO LIFTING FAMILY FARMERS OUT OF POVERTY, TACKLING UNEMPLOYMENT FOR YOUTH AND RURAL WOMEN, AND HELPING THE WORLD TO ACHIEVE FOOD SECURITY AND THE SUSTAINABLE DEVELOPMENT GOALS

While some products, processes and ways of organisation may already exist, they are new to the individuals or organisations who are bringing them into use in a given location and context for the first time

The world is facing unprecedented challenges that affect the sustainability of our food and agriculture systems. From an ever-increasing and urbanized world population to deteriorating natural resources and loss of biodiversity, to climate change impacts, these challenges combined threaten the livelihoods of millions of family farmers across the globe.

Hunger and malnutrition are on the rise. Today, about 821 million – 1 in 9 people – are chronically undernourished, 1 in 3 people are malnourished and 1 in 8 adults suffer from obesity. To meet growing food demand from a projected population of close to 10 billion people in 2050, agricultural output will need to increase by about 40 percent compared to 2012. The bulk of this rise must come from family





MOZAMBIQUE

A solar panel charging up a battery for household use at the home of a prominent farmer.
©FAO/Paballo Thekiso

farmers who manage about 90 percent of the world's farms, produce over 80 percent of the world's food but, paradoxically, are often poor and food insecure themselves.

While efforts in the past centred on boosting agriculture to produce more food, today's focus is to tackle the root causes of hunger and malnutrition through transformative changes

to our food system. The way we produce, process, distribute and consume food must become wholly sustainable and contribute to healthy and affordable diets. As the driving force to transform food systems, innovation is central to lifting family farmers out of poverty, tackling unemployment for youth and rural women, and helping the world to achieve food security and the Sustainable Development Goals (SDGs).

Agricultural innovation is the process whereby individuals or organizations bring new or existing products, processes or ways of organization into use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability and thereby contribute to food security and nutrition, economic development or sustainable natural resource management. ■

KEY MESSAGES



Family farmers are innovators.

Family farmers have been innovating since the dawn of agriculture. Fostering the capacity of the millions of family farmers to innovate is especially crucial today as they face unprecedented challenges that affect their livelihoods as well as the sustainability of the world's food and agriculture systems.

MEXICO

Farmers working in their greenhouse.
©Alex Webb/Magnum Photos for FAO



Innovation is more than technology.

Going beyond apps, drones or farm machinery, innovation in agriculture involves different social, organizational or institutional processes, ranging from access to markets, credit or extension services to marketing produce in a new way.

PAKISTAN

Farmer fields schools provide hands-on group learning to increase preparedness and response plans.
©FAO/Farooq Naeem



Innovation is a complex process where multiple actors play different roles.

Governments and other key stakeholders, including civil society, farmer organizations, research bodies and the private sector, all have a role to play in creating an environment that enables innovation in agriculture to flourish and generate solutions. Success hinges on connecting the drivers that influence innovation uptake.

KENYA

Participatory decision-making and information sharing at the country level is fundamental.
©Michael Benanav

ZIMBABWE

Strengthening controls of food safety threats, plant and animal pests and diseases.

©FAO/Jekesai Njikizana



We need to increase the pace of innovation to overcome the challenges of the 21st century.

Accelerating and scaling up innovation in agriculture can trigger the transformation needed to respond to feeding a growing and increasingly urbanized population, climate change impacts and to achieve the Sustainable Development Goals. As the decade of family farming kicks off, the time is now to bring stakeholders together to share knowledge, invest and unlock the policy, pathways and business models aimed at promoting innovation in agriculture.



CAMBODIA

Drip irrigation watering a crop belonging to a Farmer Field School.
©FAO/A.K. Kimoto

INNOVATION AND THE 2030 AGENDA



YEMEN

Water Use Management
in the Sana'a Basin.
©FAO/Soliman Ahmed

The 2030 Agenda explicitly refers to innovation as a critical means of implementation, acknowledging its role in accelerating the achievement of the SDGs.

With the adoption of the 2030 Agenda for Sustainable Development, countries have committed themselves to a universal set of transformative goals and targets. The SDGs recognize that ending poverty must go hand-in-hand with strategies that build inclusive economic growth and create job opportunities, address social needs including education and health, and protect the environment and the planet's natural resources – all while responding to climate change. Actions should be committed to leaving no one behind.

The 2030 Agenda explicitly refers to innovation as a critical means of implementation, acknowledging its role in accelerating the achievement of the SDGs. It calls for:

- enhanced cooperation and knowledge sharing to improve access to technology and innovation;
- underlines the urgency for the development, transfer, dissemination and diffusion of environmentally sound technologies; and
- points to the need for capacity building mechanisms for least developed countries. ■

UNLOCKING THE POTENTIAL



SUCCESS HINGES ON UNDERSTANDING AND PUTTING IN PLACE THE INNOVATION DRIVERS AND PROCESSES

SRI LANKA

A GPS device is used by veterinarians to track and document locations of cattle herds tested for rinderpest.
©FAO/Ishara Kodikara

Many developing countries are yet to harness the full potential of agricultural innovation. Success hinges on understanding and putting in place the innovation drivers and processes that are critical to unlocking the promise of innovation and triggering transformative change.

It is necessary to remove barriers and address constraints – including technological, social, institutional, organizational and policy – that stifle the capacity of family farmers, and others, to innovate.

While much has been learned about innovation in recent years, policy options for strengthening inclusive agricultural innovation systems still need to be developed further. By analyzing good practices and lessons learned from different parts of the world, more effective policies can be shaped and implemented.

Food security, climate change adaptation, poverty alleviation and sustainable management of natural resources rely on innovation processes in which small-scale producers are protagonists.

Scaling up innovation requires stakeholders and decision-makers to develop a better understanding of impact pathways, new partnerships and business models involving the public and private sectors, civil society and farmer organizations. Governments – working with civil society, farmer organizations and the private sector – must create conditions that will enable innovation to flourish, linking these various actors, fostering the capacity of farmers and other stakeholders, and providing incentives for them to innovate. Research and extension play a central role in these innovation pathways . ■

IN ACTION

FAO advocates a shift from interventions focusing on single components of agricultural innovation towards a system-approach aimed at strengthening institutions and stakeholders' networks that better respond to the needs of smallholder farmers.

The below examples illustrate some of FAO contributions and its role in promoting agricultural innovation.

TECHNOLOGIES AND PRACTICES FOR SMALL AGRICULTURAL PRODUCERS (TECA)

TECA is a global, web-based platform for knowledge exchange, documenting and sharing practical information on agricultural technologies and practices to help smallholder farmers in the field. It combines this knowledge base with a forum of exchange groups for interactions, identification of needs and joint learning between various actors of the agricultural innovation systems. Aimed at making demand-driven information available on production and protection of plants and animals (including fish) and to better manage natural resources, while adapting to climate change and reducing risks of natural disasters, TECA is also designed to improve nutrition from agriculture and to allow

smallholders and other users to better access markets. Apart from small agricultural producers, users include professionals from rural extension and advisory services, producer organizations, NGOs, research organizations, universities, and the private sector.

e-AGRICULTURE

A FAO-led global Community of Practice e-Agriculture is made up of over 12,000 members from 170 countries and territories. It serves as a platform where members exchange information, ideas and resources related to the use of information and communication technologies (ICT). It aims to improve decision-making on the vital role of ICTs in empowering rural communities, improving rural livelihoods, and building sustainable agriculture and food security. The platform is all about knowledge exchange between UN agencies, governments, universities, research organizations, NGOs, farmers' organizations, private

INNOVATION IN AGRICULTURE CUTS ACROSS ALL DIMENSIONS OF THE PRODUCTION CYCLE ALONG THE ENTIRE VALUE CHAIN – FROM CROP, LIVESTOCK PRODUCTION, FORESTRY OR FISHERY TO THE MANAGEMENT OF INPUTS AND RESOURCES, TO ORGANIZATION AND MARKET ACCESS



SENEGAL

A community dedicated to the fishing industry has increased market access thanks to a growing network of trucks hauling the catch. ©FAO/Marco Longari

sector, and the wider community. Recognizing that knowledge exchange relies on constructive dialogue, one of the most popular activities is the e-Agriculture Forum Discussions where topics are demand-driven and led by partner institutions specialized in different areas of e-agriculture.

DIGITAL SERVICES IN AFRICA

Over 60 percent of Africa's estimated 1.2 billion people are under the age of 25; yet with little job creation in the rural areas where the majority of the

population resides, there is a growing uncertainty over the continent's preparedness to tap into this resource. Digital innovation and the use of ICTs will prove essential to unlock Africa's agri-business, to bridge the rural divide, to support smallholders and family farmers, fishers, pastoralists, and forest-dwellers. Innovative technologies and approaches can increase productivity and profitability, improve consumption of nutritious food, empower youth and women access to information,

technology and markets and ensure that agriculture practices are environmentally sustainable for future generations.

FAO and partners work together to develop, promote and implement digital inclusion initiatives and the scaling up of innovative digital services. Bringing solutions closer to the needs of poor households in Africa and other regions is a direct contribution to poverty reduction and food security. ICTs help maximize the impact of existing rural advisory services, ►

IN ACTION

financial services, social protection programmes. ICTs facilitate access to markets, information and entrepreneurship opportunities. Digital inclusion initiatives address the barriers to mobile internet adoption through infrastructure and policy, affordability, digital literacy and availability of local content.

TROPICAL AGRICULTURE PLATFORM: AGRICULTURAL INNOVATION SYSTEMS

To bring capacity development up to speed with the challenges facing agriculture in the 21st century, the partners of the Tropical Agriculture Platform (TAP) have adopted a new approach, the so-called Agricultural Innovation Systems (AIS) perspective, which recognizes that agricultural innovation is a process involving many different actors and factors and that it can only take off if it meets the demands of its principal users. The AIS is a network of individuals, organizations and enterprises, together with supporting institutions and policies in the agricultural and related sectors that bring existing or new products, processes and forms of organization into social and economic use. Policies and institutions (formal and informal) shape the way that these actors interact, generate, share and use knowledge as well

as jointly learn. It is comprised of four main components: research and education, business and enterprises, bridging institutions, and the enabling environment.

MECHANIZATION

Sustainable agricultural mechanization covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. It takes 60 days to cultivate a hectare of land using a hand hoe, compared to about three days with draught animal power or less than a day if using a powered direct seeder. In many farming-based communities, women provide up to 80 percent of the total farm labour. Mechanization can ease and reduce hard labour and relieve labour shortages. In Zambia, for example, labour savings from the adoption of animal-powered equipment have been estimated to be from 25 to 35 percent. FAO aims to increase knowledge exchange on agricultural equipment and sustainable practices by fostering partnerships with public and private sector institutions that promote innovation and build on existing technology. FAO support governments to develop strategies that foster mechanization and works with small-scale enterprises, cooperatives and local



organizations to ensure smallholder farmers' have access to and use of mechanized services.

BLUE FASHION FOR BLUE GROWTH

Blue Growth strategies advocate ways to balance economic growth, social development food security and the sustainable use of marine and freshwater ecosystems. Sharing experiences and lessons learned is an important first step in promoting innovation and developing strong "blue" economies. FAO, through its Blue Growth Initiative, aims to promote greater collaboration and increased dialogue on successful



KENYA

Farmers use a combined planting and fertilizing machine near Nyahururu.
©FAO/Luis Tato

Based on a people-centred approach, AgLab Cx brings together actors involved in food and agricultural systems who must solve a problem with those who have the technical and financial capacity to solve it, for interdisciplinary collaboration and co-creation.

SYSTEM FOR EARTH OBSERVATIONS, DATA ACCESS, PROCESSING & ANALYSIS FOR LAND MONITORING (SEPAL)

SEPAL provides comprehensive image-processing capabilities and enables the detection of small-scale changes in forests, such as those associated with illegal or unsustainable timber harvesting. Users can query and process satellite data quickly and efficiently, tailor their products for local needs, and swiftly produce sophisticated and relevant geospatial analyses. Harnessing cloud-based supercomputers and modern geospatial data infrastructures (such as Google Earth Engine), SEPAL allows users to access and process critical historical satellite data as well as newer data from Landsat and Europe's Copernicus programme. SEPAL helps countries pave the way for improved climate change mitigation plans and better informed land-use policies. ►

practices that have spurred sustainable development, and to look at innovative industries and markets that can offer a competitive advantage. One interesting and creative example is using fish skin to create elegant fashion designs. The traditional fisheries and fish farming sectors generate enormous amounts of fish skin, too often perceived as a waste product. Seaweed cultivation is also on the rise across the North Atlantic. The innovative and increased use of aquatic resources in the fashion industry can increase the sustainability of both the fashion and fisheries sectors.

AgLab IN CHINA

FAO China has set up AgLab Cx, an innovation lab involving a variety of eclectic partners and expertise, including the Ministry of Agriculture of China, social innovators, academics and consumer groups to foster innovation in all areas of work. Providing a space for engaging the government, young people, technologists, private sector and civil society in problem solving, the lab is dedicated to experimenting, prototyping, and developing innovative projects in the field of sustainable agricultural development and food security.

IN ACTION

INNOVATION IS IMPORTANT TO REALISE THE PRODUCTIVE POTENTIAL OF FAMILY FARMERS, ESPECIALLY IN SMALL AND MEDIUM-SIZED FAMILY FARMS THAT OCCUPY A LARGE SHARE OF FARMLAND AND PRODUCE MUCH OF THE FOOD IN LOW AND MIDDLE-INCOME COUNTRIES

dLOCUST: POTENTIAL OF DRONES FOR LOCUST EARLY WARNING AND PREVENTIVE CONTROL

Vast areas of desert stretching from West Africa to India and including some of the world's poorest countries are regularly monitored for Desert Locust by national ground teams in vehicles. These areas have no mobile or internet coverage and may be several days' drive from the national locust centre. To speed things up, research and development is now underway to provide a fixed-wing drone solution. The drone would be capable of flying some 100 km while collecting data on the location of green vegetation and processing this imagery on board as a map. In turn, the map would guide ground survey teams to specific areas. Significant infestations could be safely and effectively sprayed by a control drone before the locusts form swarms. All the drones would have to be lightweight, portable, solar-powered, durable and easy to use and maintain locally. The "dLocust family" would be integrated with eLocust3, the hand-held tablet used by survey and control teams for recording observations and transmitting them in real-time by satellite. National locust centres would be responsible for managing and using dLocust.

NEGLECTED AND UNDERUTILIZED CROPS

Neglected and underutilized species have been overshadowed by those in greater demand. Of the 30,000 edible plant species available, a mere 30 are used to feed the world. Yet these crop species can help to increase the diversification of food production, adding new species to our diets that can result in healthier eating and provide better supply of particular nutrients, such as essential amino acids, fiber and proteins. In addition to diversifying the nutritional intake, these neglected and underutilized crops provide economic and environmental benefits. Farmers can grow them on their own, as part of crop rotation systems or inter-planted with other crops, protecting and enhancing agro-biodiversity in the fields. A larger number of species to choose in a crop rotation system allows farmers to have a more sustainable production system. In addition, changing species in a crop rotation system disrupts the cycle of some pests and diseases, reducing the probabilities of infestations.

SAVE FOOD INITIATIVE

One-third of food produced for human consumption is lost or wasted globally, amounting to about 1.3 billion tons per year.



PERU

If managed sustainably, agriculture can contribute to biodiversity conservation and important ecosystem functions.

©FAO/Liana John

The FAO-led Save Food initiative partners with international organizations, the private sector and civil society to look at innovative ways to reduce food loss and waste across the entire food supply chain in both the developing and the developed world. The magnitude and complexity of the problem requires the collaboration of all actors -

governments, research institutions, producers, distributors, retailers and consumers – to bring on solutions, take action and trigger positive change.

GLOBAL FORUM ON AGRICULTURAL RESEARCH AND INNOVATION (GFAR)

GFAR, hosted in FAO, is a multi-stakeholder global forum on agricultural research and

innovation enabling stakeholders across the agricultural spectrum – from researchers and organizations to farmers – to participate in collaborative discussion and action around the current and future state of agriculture. GFAR facilitates collaboration, partnerships and sharing of objectives along the complex pathways from research through to development outcomes. ■

BUILDING ON GLOBAL MOMENTUM

FAO had long been at the forefront of actions to make science, technology and innovation available to family farmers, applying latest knowledge to tools, practices and approaches in agriculture

In 2000 FAO launched the Biotechnology Forum to provide quality information on agricultural biotechnologies in developing countries and create a neutral platform available for people to exchange views and experiences on biotechnology. To date, it has hosted 19 moderated email conferences and published a series of documents. FAO also organized an International Technical Conference on *Agricultural Biotechnologies in Developing Countries* (ABDC-10), in Mexico in 2010; an International Symposium on *The Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition*, in Rome in 2016; and two regional meetings on agricultural biotechnologies, in Asia-Pacific and Sub-Saharan Africa, in 2017.

In collaboration with partners, FAO organized the *Youth Employment in Agriculture as a Solid Solution to ending Hunger and Poverty in Africa* Conference in Kigali, Rwanda in 2018. Its aim was to foster an exchange among stakeholders on knowledge and best practices regarding the interfaces between agriculture, youth employment, entrepreneurship, ICT innovations, leading to prioritizing interventions going forward. This laid out a broad

framework and course of action towards steering the course of future interventions.

The Committee on Agriculture – one of FAO's Governing Bodies providing overall policy and regulatory guidance on issues relating to agriculture, livestock, food safety, nutrition, rural development and natural resource management – emphasized FAO's role as a knowledge-based organization, continuing to keep abreast of scientific, technological, policy and other innovations that have been the main drivers in the evolution of agricultural systems. As such, FAO is assisting countries in developing their Agriculture Innovation System strategies through comprehensive diagnosis and needs assessments.

FAO convened in November 2018 *The International Symposium on Agricultural Innovation for Family Farmers: Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals* which recognized the central role of family farmers in agricultural innovation. It also recognized the unique role and potential of youth in agricultural innovation. As stated by the FAO Director-General in his closing remarks: "it is not possible to separate innovation from youth or youth from innovation".



Family farmers play an important role in feeding a growing global population. The UN General Assembly recently proclaimed 2019–2028 the United Nations Decade of Family Farming, recognizing the success of its International Year, which raised the profile of the role of family farming, pastoralism and smallholder farming in contributing to the

achievement of food security and improved nutrition. In its resolution, the UN General Assembly gave particular attention to innovation, recognizing “the important role of science, technology, innovation and entrepreneurship in supporting smallholders, including pastoralists and family farmers, in particular women and youth in rural areas”.

PHILIPPINES

FAO Specialist uses drones to gather visual data on recently damaged rice crops.

©Veejay Villafranca/NOOR for FAO

**SCIENCE,
TECHNOLOGY,
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PLAY AN
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IN SUPPORTING
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INCLUDING
PASTORALISTS
AND FAMILY
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IN PARTICULAR
WOMEN
AND YOUTH
IN RURAL AREAS**

WAY FORWARD

Today's global agriculture and food systems must change to meet new development challenges, allowing us to sustainably nourish people while nurturing our planet.

SOWING THE SEEDS OF TRANSFORMATION

We can achieve true transformation by accelerating and scaling up innovation in agriculture.

This calls for a holistic approach where all stakeholders are involved and committed to support and implement coordinated actions.

FAO'S SUPPORT TO SCALING UP INNOVATION

Awareness raising of the role innovation plays in unlocking the potential for achieving sustainable food and agriculture

Agriculture must innovate to meet global demands, and innovation plays a critical role in making agriculture more competitive and sustainable. Innovation processes generally arise in response to different types of triggers and drivers. It is important to ensure the presence of favorable conditions, of an enabling environment, which fosters and unlocks the potential of innovation to drive socio-economic growth, ensure food and nutrition security, alleviate poverty, improve resilience to changing environments (e.g. climate change) and thereby achieve the SDGs.



Coordinate action among sectors and with partners to strengthen impact

FAO can create a platform for participatory dialogue among the diverse range of stakeholders and decision-makers, to develop new partnerships and business models that involving the public and private sectors, civil society, research, extension and farmer organizations. FAO can play a



ITALY

Examining satellite imagery of forested areas at FAO headquarters in Rome.
©FAO/Giampiero Diana

Engaging youth

Agriculture is an essential driver of economic development and can create jobs for young people by harnessing opportunities in agribusiness entrepreneurship and innovations, including in ICT innovations, along the entire value chain. This can contribute to improving the agriculture sector's image by increasing productivity and returns on investment and providing new and different employment opportunities.

Fostering private sector commitment and south-south cooperation

Cooperation among countries and with the private sector have proven effective and offer a myriad of development solutions – knowledge, experiences, good practices, innovative policies, technologies and resources – that have proven cost-effective and have huge potential to be up-scaled for the benefit of others. It provides complementary advantages and expertise to build more solutions and develop new tools and innovate. FAO recognizes that the private sector is a key stakeholder in the fight against food insecurity, malnutrition and rural poverty, and acknowledges the potential that better coordination and collaboration between the public and private sectors.

strong catalytic and supporting role to empower smallholders and family farmers through innovation, facilitating its adoption, and coordinating broader, collective actions.

Scale up innovation through strategic partnerships, policies, investments

Scaling up innovation in agriculture requires significant

commitment from all stakeholders and decision-makers. This includes farmer capacity-building, improved policy, a redirection of finances and investment, more inclusive and diversified food systems, a change in consumer behavior, strengthened producer organizations, and new partnerships between small-scale producers and entrepreneurs and the larger scale private sector actors.

FAO'S WORK ON AGRICULTURAL INNOVATION

Sowing the seeds
of transformation to
achieve the SDGs



This brochure presents FAO's work on agricultural innovation. FAO advocates a shift from interventions focusing on single components of agricultural innovation towards a system-approach aimed at strengthening institutions and stakeholders' networks that better respond to the needs of smallholder farmers. Agricultural innovation is the process whereby individuals or organizations bring new or existing products, processes or ways of organization into

use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability and thereby contribute to food security and nutrition, economic development or sustainable natural resource management. Innovation is central to lifting family farmers out of poverty, tackling unemployment for youth and rural women, and helping the world to achieve food security and the Sustainable Development Goals.