



Food and Agriculture
Organization of the
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Transforming agricultural research and extension systems

Unlocking the potential of
agricultural innovation to achieve the
Sustainable Development Goals



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Introduction

Latest estimates indicate that over 820 million people are hungry in the world. Extreme weather events caused by climate change, such as droughts and flooding, are damaging the livelihoods of farmers, fishers and forest-dependent people who are already vulnerable and food insecure. Natural resources, such as land, water and fertile soil, are threatened by environmental degradation, loss of biodiversity and ecosystem services and, in certain areas, urbanization and industrial use.

The Food and Agriculture Organization of the United Nations (FAO) believes that agricultural innovation can help its member countries to meet these challenges by moving towards sustainable food systems that reduce food loss and waste and that produce more food, of greater nutritional value, with less environmental damage.

When faced with a major crisis like the COVID-19 pandemic, we are all reminded of the importance of innovation in maintaining sustainable food and agriculture systems and uninterrupted food supply chains ensuring diversified, safe and nutritious food for everyone.

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. Innovation in agriculture cuts across all dimensions of the production cycle along the entire value chain – from crop, forestry, fishery or livestock production to the management of inputs and resources to market access.

Well-functioning, dynamic and demand-driven agricultural research systems and Extension and Advisory Services (EAS) play a critical role in the multi-stakeholder processes which unleash agricultural innovation.

Agricultural research provides high returns on investments. Public agricultural research is particularly effective in promoting sustainable agricultural growth and alleviating poverty. However, in many parts of the world the performance of agricultural research institutions is sub-optimal. This is because of factors such as insufficient funding, poor management, weak human capacities, high dependency on donor funding, weak linkages with EAS and a focus on research priorities that do not directly address the needs of the farmers.

EAS are key catalysts which allow innovation to happen. They are essential for increasing productivity on family farms and ensuring widespread adoption of sustainable agricultural practices. They also play an essential bridging role in bringing together researchers, farmers, the private sector and other key actors in the agricultural innovation system.

FAO supports its member countries by providing policy advice and technical assistance, sharing knowledge and developing capacities. It helps them to transform their agricultural research systems and EAS, thereby unleashing the full potential of agricultural innovation.

*Afghanistan: A lab technician examining seeds under a microscope.
FAO provides assistance to help improve the seed systems that
meet the needs of farmers and international standards.*



1. Transforming agricultural research systems

There is substantial evidence that investments in agricultural research can lead to significant agricultural growth and poverty reduction. By focusing on the needs of smallholders and family farmers, agricultural research can play a major role in enabling them to sustainably improve their production and livelihoods.

In order to do this, National Agricultural Research Systems (NARS) have to evolve and become more efficient and effective. They must respond to farmers' demands, benefit from the potential offered by new funding mechanisms and national or international partnerships, and consider both the immediate and long-term needs of family farmers. They also need to follow the shift in the research agenda away from productivity gains only, towards environmental concerns and efficient resource use.

Highlights

Reforming NARS

FAO supports its member countries to reform their NARS in response to the many challenges and emerging issues they face. For example, a 4-year European Union-funded programme called REAFOR helped the Democratic Republic of the Congo breathe new life into its agricultural and forestry research system, partnering with organizations such as the International Institute of Tropical Agriculture (IITA) and the Center for International Forestry Research (CIFOR). As another example, in 2019, FAO gave technical support to the Government of the Gambia to update and support the formulation of a strategic plan for the National Agricultural Research Institute (NARI) to provide a roadmap for agricultural research in the Gambia. In 2020, FAO initiated technical support to the Governments of the Kingdom of Saudi Arabia and United Arab Emirates to formulate the roadmap and monitoring mechanism for research, technology and innovation (RTI) to support implementation of their food security strategies.

Advocating for increased investments in agricultural research and development

Estimates indicate that USD 56 billion were invested in agricultural research and development worldwide in 2011, representing about 1 percent of the agricultural gross domestic product (GDP). Spending is very uneven. Public investments in developed countries represent over 3 percent of agricultural GDP, whereas it is just 0.5 percent in developing countries. Monitoring such trends is important. In 2015, FAO partnered with the International Food Policy Research Institute (IFPRI) to organize an international workshop called "Towards better monitoring of investments in agricultural research in Europe". During the meeting, recommendations for new methodologies to collect data on investments in agricultural research were discussed with policy-makers.

The Philippines: A group of farmers attending a weekly Farmer Field School (FFS) on vegetable production promoting organic farming and integrated pest management in Mindanao, Philippines.



2. Transforming extension and advisory services

Over the last 30 years, national Extension and Advisory Services (EAS) worldwide have undergone some major changes. Single main public extension systems have made way for pluralistic systems, where services are provided by different actors, including the private sector, non-governmental organizations and farmer organizations.

There has also been a movement from centralized top-down systems to ones where decision-making has been delegated to the local level; and from systems that are entirely publicly funded to ones in which an increasing amount of the financial support comes from other sources and where specific advisory services have been privatized. In addition, digital technologies are now increasingly accessible and being used by EAS providers to reach smallholders and family farmers.

EAS providers also offer a much broader range of services than before because farmers are increasingly part of value chains that extend from input suppliers to consumers. More information is required as farmers may need to adapt their farming systems to environmental and external threats. All of these changes mean that providers of EAS have increasingly taken on new, non-traditional roles and functions. However, they often lack the human and technical capacities, adequate investments and incentives for these changes.

Highlights

Assessment of national EAS

FAO is developing guidelines to assess the functioning of EAS at the national level. To assist countries in making evidence-based decisions regarding EAS, FAO is working on improved indicators to capture the performance of the service provision, critical results brought by EAS and the complexity of pluralistic interactions and innovation processes. The assessment guidelines have been tested to varying degrees in different countries, including Azerbaijan, Ecuador, India, Kyrgyzstan, Madagascar, Tajikistan, Uganda, Ukraine and Uzbekistan.

Policy guidance for reform of EAS

FAO provides its member countries with advice and policy support to manage the design and implementation of an effective reform of national EAS. It has developed a series of “How to do” briefs with guidance for policy-makers in a concrete, illustrative and user-friendly way.

Digital extension

FAO is assisting national EAS to advance the digital agriculture transformation through two main pathways. First, by enhancing the delivery, scope and impact of EAS for smallholder farmers through digital innovations, including both emerging technologies (such as blockchains, artificial intelligence and the Internet of things) and accessible digital tools (e.g. mobile phones, knowledge management platforms and e-extension). Second, by strengthening capacities of advisors and farmers to contribute effectively to the digitalisation of agri-food systems considering potential risks and opportunities. Recently, FAO has provided assistance on digital extension in Azerbaijan and Tunisia in the context of the EAS reform process.

Burundi: Women from Mutambara I "Village de la paix" working on a tomato crop during their training activities.



3. Strengthening the agricultural innovation system

Agricultural research institutions and Extension and Advisory Services (EAS) do not operate in isolation but interact with each other and many stakeholders – such as governments, agricultural input suppliers, market intermediaries, farmer organizations and private sector entities – in what is called an ‘agricultural innovation system’ (AIS). The AIS has been formally defined as a network of actors or organizations, and individuals, together with supporting institutions and policies in the agricultural and related sectors, that brings existing or new products, processes, and forms of organization into social and economic use.

Strengthening the AIS will enable agricultural research systems and EAS to be more effective and more responsive to the needs of smallholders and family farmers. FAO supports its member countries to strengthen their AIS.

Highlights

International Symposium on Agricultural Innovation for Family Farmers

In November 2018, FAO hosted the “International Symposium on Agricultural Innovation for Family Farmers: Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals”.

The symposium was a highly successful event with over 540 participants, including 286 delegates from 92 member countries. Among its key outcomes, the symposium recognized the central role of family farmers in agricultural innovation and the unique role and potential of youth in agricultural innovation. The Chair’s Summary also contained ten recommendations, underlining the global need to strengthen the AIS, recognizing the need for inclusive research and education systems that facilitate innovation for family farmers and stressing that bridging institutions should be strengthened to enable them to act as facilitators for networking and multi-stakeholder dialogue.

Guidelines for AIS assessment at the country level

FAO, in collaboration with the French Agricultural Research Centre for International Development (CIRAD) and other partners, has developed guidelines for AIS assessment in member countries.

Assessments allow identification of weaknesses, gaps, interventions required and key areas for responsible investments to strengthen the AIS, while ensuring that the agricultural research systems and EAS, as well as the other components of the system, work better. The main output of an assessment is a country profile of the national AIS.

The results of the assessment can be used to prioritize and guide investments to revitalize the agri-food system at the country level. With funding from the European Union, FAO uses the guidelines to assess the national AIS in nine countries: Burkina Faso, Eritrea, Malawi, Rwanda and Senegal in Africa, Cambodia, the Lao People’s Democratic Republic and Pakistan in Asia and Colombia in Latin America.

The Philippines: A team of experts from the Department of Agriculture work together with FAO in using drones in gathering visual data on damaged rice crops in Magalang, Pampanga province.



4. Developing capacities for agricultural innovation

The role of agricultural research systems and Extension and Advisory Services (EAS) has been changing in order to shift from a research-driven process relying on technology transfer to an approach that enables and rewards innovation. In many low- and middle-income countries, weak capacity to innovate is a real obstacle to this transformation. It is essential to establish an environment where the needs and demands of resource-poor farmers and consumers are heard and their voices influence the national research and EAS agenda. FAO assists its member countries to develop their capacities for agricultural innovation.

Highlights

Tropical Agriculture Platform

FAO hosts the Secretariat of the Tropical Agriculture Platform (TAP), a G20-supported facilitation mechanism comprising 45 global, regional and national partners, representing agricultural research, education and extension, and international technical, development and funding agencies.

TAP focuses on the development of national capacities for agricultural innovation in the tropics, where most of the developing countries are located and the capacity gap is especially wide.

By helping to bridge the capacity gap, TAP aims to pave the way for agricultural innovations that meet the demands of its principal users – small farmers, small and medium-sized agribusinesses and consumers.

Developing the capacities to innovate in specific countries

Under the TAP Framework, support to capacity development for agricultural innovation has been reinforced in several countries.

Through the European Union-funded Capacity Development for Agricultural Innovation Systems (CDAIS) project, implemented by FAO and Agrinatura from 2015 to 2019, capacity development was supported in eight countries: Angola, Bangladesh, Burkina Faso, Ethiopia, Guatemala, Honduras, the Lao People's Democratic Republic and Rwanda. Since 2019, FAO has been running the 5-year European Union-funded project called "Developing capacities in agricultural innovation systems: scaling up the Tropical Agriculture Platform Framework", which focuses on nine countries: Burkina Faso, Cambodia, Colombia, Eritrea, the Lao People's Democratic Republic, Malawi, Pakistan, Rwanda and Senegal.

Central African Republic: A lab technician, at the local university, working on research to improve cassava crops resistant to various diseases.



5. Agricultural biotechnologies

Agricultural biotechnologies encompass a wide range of technologies applied in crops, livestock, forestry, fisheries and aquaculture, and agro-industry. They include low-tech approaches, such as artificial insemination, fermentation techniques and biofertilizers, as well as high-tech approaches involving advanced DNA-based methodologies and genetic modification.

Agricultural biotechnologies are used for different purposes, such as the genetic improvement of plants and animals to increase their yields or efficiency, characterization and conservation of genetic resources for food and agriculture, plant and animal disease diagnosis, vaccine development and production of fermented foods.

Regarding agricultural biotechnologies, FAO assists its member countries by responding to their requests for advice or technical assistance, providing high-quality, updated science-based information and offering a neutral forum for discussion of policy and technical issues.

Highlights

Global and regional meetings on agricultural biotechnologies

In February 2016, FAO organized the International Symposium on the Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition at FAO headquarters. It was attended by over 400 participants, including 230 delegates from 75 member countries.

As a follow up, FAO organized regional meetings in Malaysia in September 2017 for the Asia-Pacific region and in Ethiopia in November 2017 for sub-Saharan Africa. About 160 people, including delegates nominated by 28 governments in Asia-Pacific, and over 200 people, including delegates nominated by 30 governments in sub-Saharan Africa, attended the regional meetings respectively.

FAO-BiotechNews

This e-mail newsletter contains information from FAO, other United Nations agencies/bodies and the Consultative Group of International Agriculture Research (CGIAR) relevant to agricultural biotechnologies in developing countries. The newsletter was launched in 2002 and is delivered in all six official languages of the United Nations to nearly 5 000 subscribers.

Italy: Small-scale women food producers from the Syrian Arab Republic visit the vegetable gardens of the University of Gastronomic Sciences (UNIGS) in Italy as part of the joint FAO and Slow Food Project.



6. Providing a platform for knowledge exchange/sharing

As a neutral broker and a highly-trusted knowledge organization, FAO has a long tradition of facilitating multi-stakeholder partnerships in thematic areas. FAO also plays an essential role in providing governments and other key stakeholders, including civil society, farmer organizations, research bodies, extension and advisory services providers, higher education institutions and private sector bodies, with platforms to exchange and share knowledge relevant to agricultural innovation.

Highlights

Technologies and Practices for Small Agricultural Producers (TECA)

TECA is an online platform that facilitates knowledge exchange on successful agricultural technologies and practices to help family farmers in the field. Launched by FAO in 2002, it includes technologies and practices that address challenges in areas such as crop production, livestock production, fishery and aquaculture, forestry, beekeeping, post-harvest and marketing, agricultural mechanization, natural resource management, nutrition and food security, capacity development, climate change and disaster risk reduction. It also provides a virtual space for stakeholders to share, learn and connect with each other.

TAPipedia

Developed within the context of the Tropical Agriculture Platform (TAP), this is a global information-sharing portal where resources related to capacity development for agricultural innovation, such as good practices, innovation outputs, capacity development tools, guidelines, success stories and lessons learned, can be accessed and shared. TAPipedia allows TAP partners and other stakeholders to share resources and to gain knowledge from different sources, partners and regions.

FAO Biotechnology Forum

This platform was launched in 2000 with the goal of providing access to balanced high-quality information and to serve as a neutral platform for interested stakeholders to openly exchange views and experiences on agricultural biotechnologies in developing countries. It has over 3 500 members worldwide and has hosted 19 moderated e-mail conferences on topics related to agricultural biotechnologies in developing countries.

Myanmar: FAO support the flood-affected communities in the Sagaing region of Myanmar to build their livelihoods.



7. Partnerships in agricultural research and extension and advisory services

In all areas of its mandate, FAO considers that working with partners is essential. Accordingly, for research and extension, FAO works with a wide range of partners to assist its member countries in transforming their agricultural research systems and Extension and Advisory Services (EAS) to unlock the potential of agricultural innovation and achieve the Sustainable Development Goals.

International agricultural research needs to be embedded in wider development programmes and well linked with development partners at national and international levels to have an impact on food production, hunger and poverty reduction and the sustainable use of resources. To develop more effective and efficient EAS, knowledge sharing, learning and partnering at national, regional and international levels are crucial.

Highlights

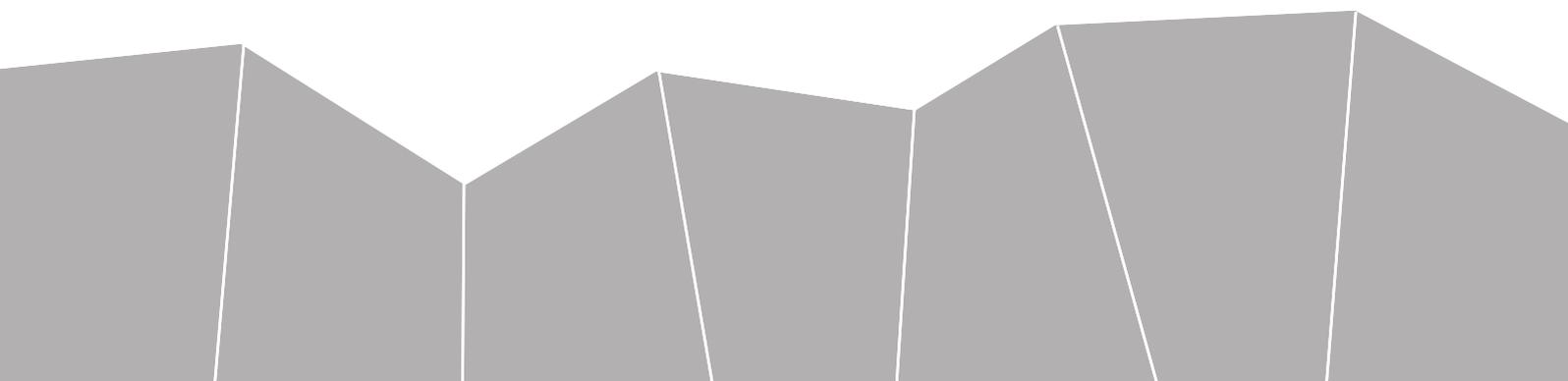
Agricultural research

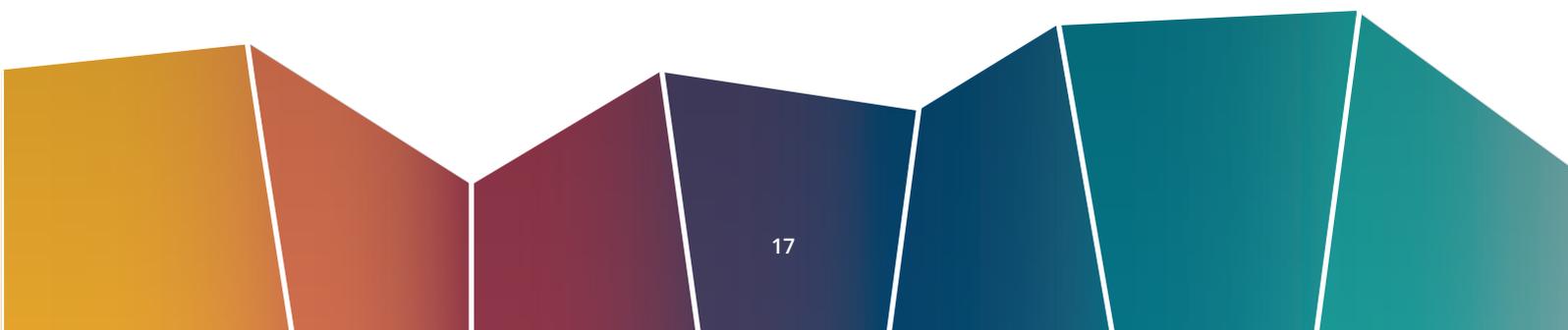
FAO works extensively with National Agricultural Research Systems (NARS) and regional research organizations, including the Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA), Asia-Pacific Association of Agricultural Research Institutions (APAARI) and the Forum for Agricultural Research in Africa (FARA). FAO also participates in several European Union-funded research projects, such as “Small farms, small food businesses and sustainable food security” (SALSA), where FAO is working with 16 European and African partners.

FAO’s partnership with the Consultative Group of International Agriculture Research (CGIAR) is long-established and of special importance. The CGIAR is a global research organization with 15 research centres worldwide. FAO was one of the three founding co-sponsors when it was established in 1971. FAO has extensive collaboration with individual CGIAR centres and is an ex officio member of the CGIAR System Council. FAO also has a long-standing partnership with the Global Forum on Agricultural Research and Innovation (GFAR), a multi-stakeholder movement made up of over 580 partner organizations. GFAR was established by four facilitating agencies, including FAO, in 1996 and FAO has hosted the GFAR Secretariat since 2003.

Extension and advisory services

FAO works actively with the key global, regional and subregional actors in EAS. These include the Global Forum of Rural Advisory Services (GFRAS), launched in 2010, where FAO is a member of its Governing Board. These also include regional networks, such as the African Forum for Agricultural Advisory Services (AFAAS), Asia-Pacific Islands Rural Advisory Services Network (APIRAS), Latin American Network on Rural Extension Services (RELASER), European Forum for Farm and Rural Advisory Services (EUFAS) and 15 other subregional networks.





Agricultural research and extension systems are central to unlock the potential of agricultural innovation and achieve the Sustainable Development Goals. Public agricultural research, extension and advisory services are essential for increasing productivity and promoting sustainable agricultural growth and alleviating poverty.

FAO supports its member countries by providing policy advice and technical assistance, sharing knowledge and developing institutional and technical capacities so that they can transform their agricultural research systems and extension and advisory services, thereby unlocking the full potential of agricultural innovation.

This booklet contains a brief introduction to the subject and then provides the background to FAO's support to its member countries in seven inter-related focus areas, including specific highlights of FAO's work: transforming agricultural research systems; transforming extension and advisory services; strengthening the agricultural innovation system; developing capacities for agricultural innovation; agricultural biotechnologies; providing a platform for knowledge exchange/sharing; and partnerships in agricultural research and extension and advisory services.