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Food and Agriculture
Organization of the
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Продовольственная и
сельскохозяйственная организация
Объединенных Наций

Organización de las
Naciones Unidas para la
Alimentación y la Agricultura

منظمة
الغذية والزراعة
للأمم المتحدة

COMMITTEE ON AGRICULTURE

Twenty-fifth Session

Rome, 26 - 30 September 2016

Achieving Sustainable Rural Development through Agricultural Innovation

Executive Summary

This paper outlines key areas of intervention that are identified as the core of FAO's strategy on strengthening Agricultural Innovation Systems (AIS) across multiple areas of work (e.g. research and extension, agroecology, biotechnology, green jobs, resourcing etc.) for achieving sustainable rural development. The focus areas include (i) Promoting an enabling environment for agricultural innovation; (ii) Strengthening capacity to innovate at country level; (iii) Promoting public-private partnership and; iv) Assessing, prioritizing, monitoring, and evaluating investments in agricultural innovation systems.

Suggested action by the Committee

The Committee is invited to:

- 1) Endorse the key areas of work identified in paragraph 50 as the core of the FAO AIS strategy; and
- 2) Support a greater leadership for FAO in assisting countries in the development of their AIS strategies through comprehensive diagnosis and needs assessments.

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I. Background

1. As indicated at the 24th Session of the Committee on Agriculture in 2014, FAO "*as a knowledge based institution, continues to keep abreast of scientific, technological and other innovations that have been the main drivers of the evolution of agricultural systems. Trends of new discoveries, rapid adoption of new technologies and availability of new methodologies, materials and processes will continue to inform the organization's choices and ways of working.*"¹
2. The State of Food and Agriculture (SOFA) 2014 highlighted that small and medium-sized family farms in low- and middle-income countries could make a greater contribution to global food security and rural poverty alleviation through supportive agricultural innovation systems.
3. This paper outlines the different ways in which FAO addresses innovation in agriculture and seeks the advice and engagement of COAG in taking forward the issues addressed in helping countries achieve the Sustainable Development Goals (SDGs).

II. Agriculture Innovation Systems (AIS)

4. Innovation is the process by which individuals or organizations master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country or the world.²
5. An innovation system is a network of organizations, enterprises and individuals focused on bringing new products, new processes and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance.
6. For innovation to occur, interactions among these diverse stakeholders/actors involved in the production to consumption continuum need to be open and to draw upon the most appropriate available knowledge. Aside from a strong capacity in Research and Development (R&D), the ability to innovate is often related to collective action, coordination, exchange of knowledge, the incentives and resources available to form partnerships and develop businesses, and conditions that make it possible for farmers and entrepreneurs to use the innovations and to be recognized and valued as innovators themselves.
7. An AIS approach looks at the multiple conditions and relationships that promote innovation in agriculture. It may offer a more flexible means of dealing with the varied conditions and contexts in which innovation must occur. It considers the diverse actors involved (research, pluralistic advisory services, private sector, farmer organizations, etc.), their potential interactions, the role of informal practices in promoting innovation and the agricultural policy context.

III. Main AIS issues as drivers for change and sustainable rural development

8. In view of the challenges and the opportunities for achieving the SDGs, particularly food security and nutrition and sustainable rural development, a number of AIS-related issues have been identified as current drivers for change, including:

Agroecological innovations

9. Agroecological innovations apply ecological principles - such as recycling, resource use efficiency, reducing external inputs, diversification, integration, soil health and synergies -, for the design of farming systems that strengthen the interactions between plants, animals, humans and the environment for food security and nutrition. On economic sustainability, diversified production

¹ COAG/2014/2 - Para. 16

² FAO. 2014. The State of Food and Agriculture. Innovation in Family Farming. Rome.

systems can diversify farmers' sources of income, contributing to reduced economic risks and poverty eradication.

10. For example, evidence shows that agroecological innovations enable the shift from flow-through nutrient management to a nutrient recycling model, with increased optimization of natural processes such as biological nitrogen fixation and mycorrhizal relationships, enhancing overall ecosystem services.

11. However, agroecological principles and innovations are not yet widely incorporated or mainstreamed in the current agricultural development models. Due to its inter-disciplinary nature (agronomy, ecology, social sciences, etc.), multistakeholder and participatory mechanisms as well as enabling policies need to be in place at the local level.

Agricultural biotechnologies

12. One of the benefits of agricultural biotechnologies³ is to enhance adaptation and resilience of crop production to climate change through new crop varieties developed using molecular marker-assisted breeding. For example, about four million farmers in South Asia currently grow rice varieties tolerant to complete flooding (submergence) that were developed using molecular marker-assisted selection.

13. Biotechnologies are also used to enhance resource use efficiency, add value to end-products and increase the safety of food. Biocontrol products containing native non-toxic strains of fungi are used to reduce contamination of maize by aflatoxin (toxic metabolites produced by a common fungus) in Kenya and Nigeria, for instance.

14. Overall, there is ever-increasing evidence of the social, economic and environmental benefits of biotechnologies on smallholder and family farming systems; this trend is expected to continue.

15. Regulations, human and institutional capacities and intellectual property rights regimes are some of the factors that constrain access to biotechnologies, especially in developing countries.

Green job creation

16. Agriculture is the largest employer in the world, with a global workforce of over 1 billion. It is also the sector on which most of the world's poor depend for making a living. Additionally, agriculture-related natural resources would face added pressures in the coming decades through continuous growth of global food demand and the consequences of climate change, which are already affecting agricultural productivity.

17. By boosting innovation for green job⁴ creation, the agricultural sector can respond to the triple challenge of (i) conserving and protecting the environment through better management of natural resources; (ii) adapting to climate change through the provision of decent green job opportunities for youth; and (iii) reducing greenhouse gas (GHG) emissions through adjusting land, livestock and

³ Deriving from the definition of "biotechnology" in Article 2 of the Convention on Biological Diversity, as "*any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use*", FAO considers agricultural biotechnology as encompassing *a broad range of technologies used in food and agriculture for the genetic improvement of plant varieties and animal populations to increase their yields or efficiency; the characterization and conservation of genetic resources for food and agriculture; plant or animal disease diagnosis; and vaccine development.*

⁴ According to the International Labour Organization (ILO) definition, jobs are green when they help reduce negative environmental impact ultimately leading to environmentally, economically and socially sustainable enterprises and economies. More precisely green jobs are decent jobs that (i) reduce consumption of energy and raw materials; (ii) limit greenhouse gas emissions; (iii) minimize waste and pollution; and/or (iv) protect and restore ecosystems.

manure management. The green economy, if fuelled by innovation, has considerable potential for employment creation for young women and men, revitalizing an ageing sector.

18. Estimates show that it could create up to 60 million additional jobs, with net employment gains being higher in developing countries; ⁵ in agriculture, for instance, 12 million people could be employed in biomass for energy and related industries⁶. To meet this demand and the opportunity, skills development and training are essential, as well as innovative labour-saving and affordable technologies, green entrepreneurship promotion, improving apprenticeship systems, facilitating start-ups and improving access to finance.

Climate-Smart Agriculture

19. Climate change is a major global threat to our ability to sustainably feed humanity and meet the SDGs. FAO integrates and disseminates many forms of knowledge and innovation that can help farmers become "climate smart", to capture and capitalize on potential synergies of increased productivity, adaptation and resilience of the production systems, and mitigation where possible of GHG emissions from agricultural systems and associated deforestation. While the circumstances and systems of each country may differ, in all cases agricultural innovation is essential to our ability to adapt to rapidly changing climates.

20. This will require communities to be fully informed and presented with impartial evidence, whether on agroecological approaches or on new technologies, by which to make rational and informed decisions on innovations which could help their systems to become "climate smart" and to be able to evaluate these for themselves.

Gender considerations

21. According to the 2011 SOFA report, if women farmers had the same access to productive resources as men, female farmers' yields would increase by 20-30 percent on average but agricultural innovations themselves are not gender or wealth neutral. The failure to take into account differences in access to resources, power, social norms governing the roles and responsibilities of men and women and intra-household resource allocation may result in innovation reinforcing gender and wealth divides and increasing women's workload. A gender lens and appropriate gender-responsive interventions are required at all stages in agricultural innovation processes including at the policy level to ensure that both women and men benefit equitably from, for example, increased productivity, value addition and rural employment opportunities.

Technology dissemination and capacity development

22. The complex webs of innovation operating today involve public private and civil actors, each innovators in their own right. Many different actors are involved in generating, transforming, accessing and using agricultural knowledge in processes of innovation. Earlier assumptions of linear knowledge flow between research, extension and farmers have broken down and the revolution in Information and Communications Technology (ICT) and opening of access to information are creating many new paths for the generation, dissemination and transformation of knowledge that break down communication barriers and challenge institutional silos. New forms of agri-food research and advisory services are now needed, centred on the needs of the poor and that can bridge communities and sectors and cross institutional divides. This itself requires new forms of public-private-producer investment in multisectoral collective innovation actions which directly empower communities to shape and deliver their own desired futures.

⁵ ILO. 2013. Sustainable Development, Decent Work and Green Jobs. Report V. p. 32.

⁶ ILO, 2008. Green Jobs Facts and Figures

23. Over the past decades, there has been an alarming decline in the capacities of national extension systems and an increased fragmentation of efforts combined with weak coordination at national level. At the same time, multiple service providers have emerged but remain uncoordinated.

24. AIS effectiveness strongly depends on the capacity of diverse actors to have a mix of skills and competencies. Strong technical, managerial and entrepreneurial skills are important, but must be complemented with functional capacities related to partnering, negotiating, building consensus and learning.⁷

Resourcing challenges

25. Agricultural research and innovation, together with their enabling inputs and policies, are essential elements required to meet the SDGs. The 2015 Achieving Zero Hunger Report estimates that 17 percent of all new rural development investments are required in agricultural research, development and extension, alongside essential investments for turning innovation into impact, such as rural roads, market and communication infrastructure and rural finance. Ninety percent of these investments are presumed to be from the public sector.

26. Rates of return from investments in agricultural research and extension can often be very high, yet three quarters of all such investments are in G20 nations. In 2004, FAO estimated that at least one percent of national agricultural GDP should be re-invested in agricultural research and development to create the capacities required to meet development goals.⁸ For extension, investments levels should even be higher, four percent of agricultural GDP or more in highly-populated, very poor countries. In 2010, the International Food Policy Research Institute (IFPRI) estimated that to meet the changing needs of the expanding world population, investments in national agricultural research and extension systems needed to increase by 300 percent by 2025.

27. Despite political commitments such as the 2014 Malabo Declaration and the pressing challenges of the post-2015 SDGs, many countries in Africa and elsewhere fall far short of these investment targets. There have been no robust data on the true level of investments, especially by the developing countries, in AIS on a global or regional scale.

28. From 2002 to 2012 the share of Official Development Assistance (ODA) allocated to research and extension has decreased or remained steady rather than increased and was highly volatile, which makes planning and implementation very difficult. The Addis Ababa Action Agenda, resulting from the third International Conference on Financing for Development (endorsed by the UN General Assembly on 27 July 2015), found that ODA alone would not be sufficient to fill gaps from national investments. Better, more effective, equitable and stable demand-driven investments, including new innovative forms of financing, such as private sector investment, taxation and remittances, are required.

IV. FAO's responses

29. Faced with the challenges of supporting AIS for sustainable rural development, FAO has embarked on a series of strategic activities and key areas of work covering multiple sectors along the research to development continuum, including research and extension for innovation, capacity development, agroecology, promoting the use of agricultural biotechnologies for smallholders, rural financing and green jobs creation.

⁷ World Bank 2015. Agricultural innovation systems: an investment sourcebook.

⁸ The World Bank's estimates are slightly higher at 2 percent of agricultural GDP.

Strengthening linkages with research and technology dissemination for innovation

30. The role of research and extension for innovation in support of sustainable agriculture and sustainable rural development cannot be overemphasized. Given the importance of innovation in the transition to sustainability, FAO is assisting countries and communities in strengthening their technical, managerial and organizational capacities to evaluate, select and implement innovative practices and mechanisms including through collaboration and partnership. Many such technologies and practices, as well as institutional and organizational innovations, are already available.

31. In that regard, FAO is actively engaged in influencing the Research for Development agenda, in particular to make new technologies developed by the Consultative Group for International Agriculture Research (CGIAR) and its national partners available to small-scale farmers. Cooperation between FAO and the CGIAR is most extensive in crop production, with special focus on conservation and sustainable use of plant genetic resources, but also addresses crop enhancement, management of land and water resources, plant protection, seed systems and conservation agriculture. Animal production and health, forestry, fisheries, natural resource management and capacity development – with special attention to strengthening national agricultural research systems – are other important areas of collaboration.

32. FAO also collaborates with diverse partners in the research to development continuum such as the Global Forum on Agricultural Research (GFAR) and the Global Forum for Rural Advisory Services (GFRAS). GFAR, hosted by FAO, links the work of FAO through its strategic programmes with a range of innovation partners from across all sectors: farmers and agricultural workers, civil society and non-governmental organizations, consumers, education, finance institutions, public national and international research, private sector companies, women's groups, youth organizations and rural advisory services.

33. During the 2016 Global Conferences on Agricultural Research for Development, the following sets of farmer-centred collective actions were agreed by GFAR partners:

- a) An alliance for the re-appropriation of rural futures by local actors
- b) Multi-stakeholder national innovation platforms linking science and society
- c) A Platform to determine SDG impacts from agricultural innovation
- d) Partnership for creating agricultural leaders of the future
- e) New forms of investment to turn agricultural innovation into opportunities and enterprise for women and youth.

34. These are now each being taken forward as large scale collective actions involving FAO and the many partners in GFAR.

Agroecology

35. The Regional and International Symposia on Agroecology for Food Security and Nutrition organized by FAO in 2014 and 2015 provided the following recommendations⁹ to scale up the multiple benefits that arise from agroecological approaches: (i) put in place effective public policies, legal frameworks and regulations; (ii) promote social innovation and participatory research, knowledge and education on agroecology in agricultural research, development and extension services; (iii) increase public investment in terms of research, statistics and adapted programmes, credits and income-generating activities; (iv) recognize and promote the role of family farmers and smallholders - in particular rural women and youth's rights and equity - in preserving biodiversity, including traditional and farmer varieties and sustainable management of natural resources through agroecology; (v) recognize the potential of agroecology to ensure adaptation and resilience to climate

⁹ The detailed outcomes and recommendations of the Symposia are detailed in the document COAG/2016/INF/4.

change; (vi) ensure smallholders' and family farmers' access to natural resources and adapted social markets through agroecology; and (vii) promote inter-sectoral partnerships and South-South Cooperation on agroecology by fostering participatory exchange of experiences and knowledge across territories, countries and regions.

36. FAO ongoing work on agroecology aims at creating platforms for exchange of knowledge among all sectors and actors. At the field level, agroecological approaches, practices and curricula are being incorporated into the Farmer Field School Integrated Pest Management Projects, to strengthen capacities and knowledge exchange among local practitioners and smallholders for sustainable production and increased resilience to climate change,¹⁰ with a special focus on drylands and food insecure marginalized areas. Further areas of work include the development of multi-stakeholder policy dialogue processes and the elaboration of context-specific technical material, statistical data and assessments.

Agricultural biotechnologies

37. FAO leverages advances in science and technology, including agricultural biotechnologies, in its work to increase food production, reduce losses and wastes and improve nutrition. In particular, FAO supports the strengthening of capacity in member countries and the dissemination of relevant information to enable them make evidence-based decisions. For instance, FAO recently published a series of case studies on the successful applications of agricultural biotechnologies to smallholder production systems in developing countries.¹¹

38. The organization has also continued to avail member countries of the neutral platform to discuss and share experiences on agricultural biotechnologies. In February 2016, FAO successfully organized a symposium on "The Role of Agricultural Biotechnologies in Sustainable Food Systems and Nutrition",^{12,13} which reinforced its role as a neutral platform for dialogue and information dissemination on the theme.

39. In addition to the numerous examples of the successful applications of agricultural biotechnologies in food and agriculture, other important outcomes of the symposium that will shape FAO's relevant work programmes include:

- a) FAO will continue to provide leadership for the global discourse on agricultural biotechnologies.
- b) The wide disparity between developing and developed countries in their access to the benefits of agricultural biotechnologies persists.
- c) New breeding techniques based on genome editing (e.g. CRISPR-Cas9), hold enormous potentials for the genetic improvement of crops and trees and breeds of livestock and fishes.
- d) FAO will organize regional meetings on agricultural biotechnologies in order to engage more stakeholders in the discussions.

Rural financing

40. FAO works with governments, producer organizations, agribusinesses, and financial institutions, including the four regional Rural and Agricultural Credit Associations (RACA) that FAO helped create in the late 1970s. The focus of this work is to develop capacities within all the relevant stakeholders to better understand the financing needs of the rural population and the many economic

¹⁰ Ongoing projects in Angola, Burkina Faso, Mozambique, Niger, Uganda and Mali.

¹¹ FAO. 2013. Biotechnologies at Work for Smallholders: Case Studies from Developing Countries in Crops, Livestock and Fish. By J. Ruane, J.D. Dargie, C. Mba, P. Boettcher, H.P.S. Makkar, D.M. Bartley and A. Sonnino (eds.)

<http://www.fao.org/docrep/018/i3403e/i3403e00.htm>

¹² Symposium website is at <http://www.fao.org/about/meetings/agribiotechs-symposium/en/>

¹³ Symposium Concept Note. <http://www.fao.org/3/a-ax916e.pdf>

activities they engage in, and generate innovation in products and processes to deliver a wide set of financial services that meet target client needs in a sustainable manner.

41. FAO has developed new approaches to partner with the private sector in order to better achieve results. This includes partnering in order to merge knowhow, knowledge and execution capacities to generate innovations within the agricultural and financial sector that translates in more inclusive, resilient and sustainable farming systems.

42. FAO merges its knowledge on the livelihoods of the rural poor, its ability to support governments in shaping better policies and delivery of public services with the private sector knowledge regarding local agricultural markets and influential actors in agricultural value chains. The collaboration enables vulnerable rural groups, such as smallholder families, particularly women and youth, to develop capacities that effectively allow them to improve their livelihoods. Examples of related partnerships with the private sector include Rabobank Foundation and Master Card.

43. Working through many partners and fora, FAO is supporting collective action for more effective investment in agri-food research and technology dissemination. Through processes that are community-driven and link public, private and civil society partners with national research, extension and education institutions, agricultural innovations are being transformed into opportunity and enterprise for rural women and youth. In each country concerned, an integrated pluralistic approach is used with diverse entry points for change along the value chains. The initiative embeds innovation financing into wider rural development investments and helps create the evidence on diverse SDG returns required to justify greater investment in the sector.

Green job creation

44. FAO is strategically positioned to support member countries in promoting green jobs in agriculture and agri-food system development that are both climate and labour-smart. FAO has already built and implemented a programmatic approach on decent rural employment, through knowledge products, tested approaches, guidance materials and tools for capacity development. At the same time, FAO has developed a corporate approach on Climate-Smart Agriculture. The Organization can therefore build on the synergies resulting from combining its expertise on these two priority topics, engaging in projects and programmes at national level.

The Tropical Agriculture Platform (TAP)

45. In an effort to improve coordination and responsiveness of capacity development initiatives, the G20 Agriculture Ministers requested FAO to lead the development of a Tropical Agricultural Platform (TAP), which is designed to improve coherence and coordination of capacity development for agricultural innovation in the tropics. The TAP is a multilateral facilitation mechanism with more than 41 partners worldwide.

46. FAO is intensively pursuing national capacity development activities through country-led projects in Bangladesh, Lao People's Democratic Republic, Angola, Burkina Faso, Ethiopia, Rwanda, Guatemala and Honduras. In the context of the EU-supported project on Capacity Development for Agricultural Innovation Systems (CDAIS), FAO is now expanding this first phase of the project with potentially five additional countries and is seeking additional donor support to rapidly expand these capacity development initiatives in support of sustainable rural development.

V. Gaps and proposed work areas for FAO

47. As highlighted in the SOFA 2014, the challenges facing agriculture and the institutional environment for agricultural innovation are far more complex than ever before; the world must create an innovation system that embraces this complexity. Agricultural innovation strategies must take into account today's complex policy and institutional environment for agriculture and the greater pluralism

of actors engaged in decision-making. An innovation system that facilitates and coordinates the activities of all stakeholders is essential.

48. The comparative advantage of FAO lies mainly in its role as the world's agricultural knowledge agency for policy development, integrated capacity building, technical cooperation, support to rural and agricultural investment, collection and dissemination of global information and through its networks and platforms, links with a wide range of partners.

49. When addressing the Agriculture Innovation Systems for sustainable rural development, FAO needs to carefully select the intervention areas where it can address countries' most urgent needs, has a comparative advantage and the highest probability of impact on the ground. This paper presented the complexity of AIS and highlighted some of the areas where FAO is playing a critical role.

50. Today, FAO should build on its existing successes (e.g. agroecology, biotechnologies, etc.) and through increased multidisciplinary and coordinated efforts to focus on the following areas of work:

- a) Promoting an enabling environment for agricultural innovation (e.g. policy, coordination, knowledge sharing).
- b) Strengthening capacity to innovate at country level.
- c) Promoting public-private partnership.
- d) Advocating and monitoring improved investments and returns from agricultural innovation systems.

51. Taking into consideration the very high variability of AIS among countries, FAO should first ensure that appropriate situation analysis or diagnosis are undertaken at community and country levels and that a needs-driven strategy is developed for each country. Such a strategy will be the foundation for a comprehensive action plan by all actors involved (e.g. policy-makers, investors, researchers, the private sector, extension services, etc.) and will provide a basis for monitoring over time. Strategies also need to take account of the desired futures of rural communities themselves and hence shape the innovations that they seek and are prepared to take up.

VI. Suggested action by the Committee

52. The Committee is invited to:

- 1) Endorse the key areas of work identified in paragraph 50 as the core of the FAO AIS strategy; and
- 2) Support a greater leadership for FAO in assisting countries in the development of their AIS strategies through comprehensive diagnosis and needs assessments.