Food and Agriculture Organization of the United Nations

SUSTAINABLE DEVELOPMENT GOALS

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON AGRICULTURAL INNOVATION FOR FAMILY FARMERS

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

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

Edited by John Ruane

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2019

Required citation:
FAO. 2019. *Proceedings of the International Symposium on Agricultural Innovation for Family Farmers - Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals*. Ruane, J. (ed.). Rome. 120 pp. Licence: CC BY-NC-SA 3.0 IGO.

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ISBN 978-92-5-131504-0

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CHAIR'S SUMMARY[1]

The *International Symposium on Agricultural Innovation for Family Farmers: Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals* took place at FAO headquarters, Rome, 21–23 November 2018 (http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/en/).

The FAO Secretariat estimates that there were over 540 participants, including 286 delegates from 92 member countries and the European Union as well as representatives of intergovernmental organizations, private sector entities, civil society organizations, academia/research organizations and producer organizations/cooperatives.

The specific objectives of the symposium were to:

1. Serve as a global knowledge sharing and partnership platform to better understand the potential of innovation in agriculture to address the Sustainable Development Goals, with a special focus on supporting smallholder and family farmers;
2. Increase understanding of the drivers of innovation and the main constraints;
3. Propose processes, pathways and interventions needed to unlock the potential of innovation in agriculture and scaling up inclusive innovations;

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Shadrack Moephuli

1 Shadrack Moephuli, the President and Chief Executive Officer of the Agricultural Research Council in South Africa, was chair of the symposium. He presented his draft Chair's Summary to participants for comments at plenary session 5 on the final morning of the symposium. He later revised and finalized it on 7 December, after considering the many constructive comments received during the session. This final version is provided here.

4. Celebrate inspiring success stories of innovation and innovators in sustainable agriculture; and

5. Act as a catalyst for boosting partnerships as well as public and private investments to foster and scale up agricultural innovation.

Discussions at the symposium suggest that there is no universal definition for agricultural innovation. To enable common understanding it is important to note the operating definition that was used: *"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"* (http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/about/faq/en/).

In order to unlock the potential of innovation to achieve the Sustainable Development Goals, participants at the symposium, during a series of plenary and parallel sessions, as well as an Innovation Fair, shared experiences and knowledge about different types of agricultural innovation, examples and case studies, criteria for success, the enabling environment and associated factors.

Analyses by FAO and other UN organizations suggest that by 2050 the global population will either reach or exceed 10 billion. Global scientific consensus indicates that different areas of the world will need to increase production by at least 60 percent, assuming current productivity levels for much of the major exported crop products. However, FAO and others have noted that Africa remains a key area where potential for increased production and productivity improvements could be achieved within current available agricultural land. Accordingly, agricultural innovation becomes essential for sustainable adoption of information, scientific solutions and technologies for family farmers.

The symposium recognized the central role of family farmers in agricultural innovation. With this key point in mind, the key outcomes that I have drawn from the symposium are summarized as follows:

KEY ELEMENTS FOR SUSTAINABLE AGRICULTURAL INNOVATION

1. Innovation requires long-term commitment by different actors, particularly for the sustainability of family farmers and enabling achievement of the Sustainable Development Goals.

2. Assessment of agricultural innovation systems (national and subnational) is required to inform appropriate interventions to unlock the potential of agricultural innovation for family farmers.

3. Innovative partnerships can accelerate transformation of agricultural innovation systems, recognizing that trust and equal recognition among partners/actors form the basis of successful partnerships.

4. Innovation is context-specific. Therefore, it is necessary to recognize the diversity of family farmers (including peasants, indigenous peoples, traditional communities, fisher folks, mountain farmers, livestock keepers and pastoralists as well as farmers on marginal lands) and their different needs in different contexts for the scaling up of innovation.

5. In order to achieve the Sustainable Development Goals, in particular SDG 2 (the Goal dedicated to ending hunger, improving food security and nutrition and promoting sustainable agriculture), scaling up innovations through partnerships and use of a diversity of context-specific approaches such as agro-ecology, agricultural biotechnologies and information and communication technologies (ICTs), among others, is required.

6. Demand-driven innovation processes are required, especially, to empower family farmers to innovate (e.g. capacity development in leadership, negotiation, advocacy, data analysis, collective action etc.).

7. Inclusiveness is essential for effective innovation (e.g. gender, youth, indigenous groups etc.), particularly through appropriate policies that must ensure no one is left behind.

8. Formal and informal mechanisms for networking, co-learning and co-creation, knowledge exchange and information sharing are necessary to accelerate innovation.

9. Key elements for successful adoption and use of innovation must lead to efficiency, profitability and the sustainability of family farmers.

10. Lessons from innovation experiences are an essential component for achieving the Sustainable Development Goals for family farmers and youth.

RECOMMENDATIONS

1. There is a need to strengthen the capacity of family farmers to innovate, including through adaptation, sustainable use of knowledge systems, indigenous resources, scientific solutions, co-creation and learning.

2. To facilitate innovation, bridging institutions (or innovation facilitators) must be strengthened (effectiveness, efficiency and impact) to enable their role as facilitators for networking and multi-stakeholder dialogue for good governance within the ecosystem.

3. There is a need for inclusive research and education systems that facilitate innovation for family farmers. To achieve this requires commitments by multi-actors, particularly resources and active participation, to enable sustainable use of new and existing scientific solutions and approaches in the innovation system.

4. Training and education form an integral part of capacity development (e.g. functional capacities and soft skills etc.) to enable effective use of new and existing information, knowledge, technologies and solutions that facilitate innovation.

5. Integrated policies, increased investments by public and private institutions and a holistic approach are essential for creating an enabling environment (e.g. access to land, finance, education, knowledge, market including infrastructure etc.) for innovation and scaling up.

6. Multi-stakeholder governance, including representatives of family farmers, is crucial for innovation, enabling information sharing, facilitating risk reduction of innovations/investments and liaisons between the different actors in the system in policy development.

7. Assessment of agricultural innovation systems is required to inform the need for increased investments to incentivize agricultural innovation.

8. Increased recognition of the needs of youth and women and their greater involvement in the innovation processes is required.

9. Although complex, there is a need to develop appropriate indicators (qualitative and quantitative) to measure the outcomes and impact of innovation (e.g. innovation policies, employment, value chains, productivity, competitiveness, etc.).

10. Although context-specific, family farmers require assistance to mitigate risk associated with innovation (e.g. financial instruments, insurance schemes, innovation support funds etc.).

YOUTH AS CUSTODIANS OF THE UN DECADE OF FAMILY FARMING

The symposium recognized the unique role and potential of youth in agricultural innovation. Accordingly, a special interactive event was held entitled "Youth as drivers of innovation" that provided a platform for young people to highlight their successes, concerns and drivers of innovation and contribute with their inputs to the outcomes of the symposium.

One of the key points that came out of the event was the need to create a Youth Forum or Council where youth representatives from different nations of the world can discuss their insights and work, including those related to agricultural innovation, directly with FAO. The importance of increased partnerships and networks was also underlined.

To achieve the Sustainable Development Goals, the years 2019 to 2028 mark the declaration of the UN Decade of Family Farming. Agricultural innovation will be a critical element towards enabling sustainable achievement of the outcomes that positively influence the Sustainable Development Goals. The global community, including through the facilitation of FAO, must promote active participation of youth in all aspects of agricultural innovation during the Decade of Family Farming for the achievement of the Sustainable Development Goals.

Shadrack Moephuli,
President and Chief Executive Officer, Agricultural Research Council, South Africa
Chair of the International Symposium on Agricultural Innovation for Family Farmers: Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals
7 December 2018

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ACKNOWLEDGEMENTS

Organization of this major symposium at FAO would not have been possible without the dedicated support and commitment of many people. First and foremost among these were the members of the external Advisory Panel,[2] established in May 2018 to provide FAO with strategic advice and guidance regarding the symposium. We would like to especially thank two of its members: Shadrack Moephuli (Agricultural Research Council, South Africa), who chaired the symposium and co-chaired the Advisory Panel meeting in Rome on 11–12 June 2018, and Viviana Palmieri (Inter-American Institute for Cooperation on Agriculture, Costa Rica), who co-chaired the Advisory Panel meeting.

We would also like to gratefully acknowledge the extensive contributions of the other members of the Advisory Panel:

- Bernard Rey (Delegation of the European Union to South Africa)
- Daniel Gad (Omega Farms Plc, Ethiopia)
- Fatma Ben Rejeb (Pan-African Farmers' Organization (PAFO), Tunisia)
- Hans Hoogeveen (Permanent Representation of the Netherlands to the UN for Food and Agriculture)
- Judith Francis (Tropical Agricultural Platform (TAP) Steering Committee)
- Lindiwe Majele Sibanda (Linds Agricultural Services, Zimbabwe)
- Malu Ndavi (International Fund for Agricultural Development, IFAD)
- Marco Ferroni (System Management Board, CGIAR)
- Mohammad Hossein Emadi (Permanent Mission of the Islamic Republic of Iran to UN Rome-based Agencies)
- Paul Mayers (formerly Canadian Food Inspection Agency)
- Philippe Petithuguenin (French Agricultural Research Centre for International Development, CIRAD)
- Rasheed Sulaiman (Global Forum for Rural Advisory Services, GFRAS)
- Ren Wang (Beijing Genomics Institute (BGI), China)
- Robert Bertram (United States Agency for International Development (USAID), United States of America)
- Roberto Cuevas-García (Expert International Consultant, Guatemala)
- R.S. Sodhi (Gujarat Cooperative Milk Marketing Federation Limited (AMUL), India)
- Severine von Tscharner Fleming (National Young Farmers Coalition, United States of America)
- Shi Yan (Shared Harvest Farm, China)
- Stéphanie Barrial (World Rural Forum, Spain)
- Tony Kalm (One Acre Fund, United States of America)

2 http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/about/advisory-panel/en/

The following people kindly participated in the Advisory Panel meeting in June,[3] acting as alternates for Panel members who could not attend: Jennifer Fellows (Embassy of Canada, Italy), Julien Reynier (Atelier Paysan, France), Patrice Djamen (West and Central Network for Agricultural and Rural Advisory Services, Burkina Faso), Shahin Ghorashizadeh (Permanent Mission of the Islamic Republic of Iran to UN Rome-based Agencies) and Torben Nilsson (International Fund for Agricultural Development).

An FAO interdepartmental Task Force was responsible for the development and delivery of the symposium. The Task Force was chaired by Samy Gaiji (Head, Research and Extension Unit) under the direct guidance of Maria Helena Semedo (Deputy Director-General, Climate and Natural Resources). Their clear leadership and strong support throughout the whole process was fundamental for the success of the symposium.

Coming from different departments, divisions and units throughout the organization, the commitment and dedication shown by the Task Force members is gratefully acknowledged: Adewale Adekunle, Claudia Nicolai, Divine Njie, Edmundo Barrios, Francesco Pierri, Halka Otto, Guilherme Brady, James Azevedo Görgen, Kakoli Ghosh, Karin Nichterlein, Lee Heng, Mark Holderness, Natalie Feistritzer, Olcay Ünver, Philippe Ankers, Robert Guei, Sophie Grouwels, Véronique Ancey and Xinhua Yuan.

Plenary sessions were kindly chaired by Mohammad Hossein Emadi (Permanent Mission of the Islamic Republic of Iran to UN Rome-based Agencies), Hassan Abouyoub (Permanent Representation of the Kingdom of Morocco to FAO, IFAD and WFP) and Thomas Duffy (U.S. Mission to the UN Agencies in Rome).

The six parallel sessions were kindly chaired by Bernard Rey (Delegation of the European Union to South Africa), Carla Montesi (European Commission Directorate-General of International Cooperation and Development), Fernando López (Confederation of Family Farmers Organizations of the Extended Mercosur), Frédéric Seppey (Agriculture and Agri-Food Canada), Margaret Gill (CGIAR Independent Science and Partnership Council) and María Cristina Boldorini (Permanent Mission of the Republic of Argentina to FAO). Thanks are also expressed to the FAO rapporteurs for the parallel sessions: Abdoulaye Saley

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Participants at the Advisory Panel meeting, 11-12 June 2018. From left to right: Back row – Torben Nilsson, R.S. Sodhi, Hans Hoogeveen, Jennifer Fellows, Bernard Rey, Malu Ndavi, Stéphanie Barrial, Fatma Ben Rejeb, Karin Nichterlein, Julien Reynier, Judith Francis and Samy Gaiji. Front row – Patrice Djamen, Shi Yan, Shadrack Moephuli, Viviana Palmieri, Roberto Cuevas-García and John Ruane.

3 Meeting report available at http://www.fao.org/3/CA0310EN/ca0310en.pdf

Moussa, Delgermaa Chuluunbaatar, Jakob Skoet, Jean-Marc Faurès, Jeroen Dijkman, Karin Nichterlein, Magdalena Blum, May Hani, Nevena Alexandrova-Stefanova, Patrick Kalas, Per Rudebjer, Philippe Ankers, Siobhan Kelly and Sónia Dias. The special event dedicated to youth was organized by FAO in collaboration with the Young Professionals for Agricultural Development (YPARD). The contributions of Kakoli Ghosh, Michael Euler and Zofia Krystyna Mroczek, from FAO, and Emmie Wachira, from YPARD, to organization of this event are gratefully acknowledged. Various contributions to the symposium by Tina Farmer, particularly to organization of the special event dedicated to chefs and family farmers, and by Alberto Trillo Barca, Diana Gutiérrez, Viviana Di Bari, Clara Vélez Fraga, Andrea Carega, Claudia Mezzapesa, Florencia de Castro and Vanessa Curcio, particularly to organization of the innovation fair, are also acknowledged. Verso Creative and S.T.I. Srl are thanked for assistance with graphic design and installation respectively of the innovation fair.

The symposium benefited greatly from the skills and expertise of Chris Burns and Hlami Ngwenya who moderated discussions during the parallel sessions and the two special events dedicated to youth and to chefs and family farmers. Thanks are also expressed to Alessandro Mannocchi and Alberto Trillo Barca for their assistance and support with editorial and layout aspects of this publication.

Funding towards organization of this symposium is gratefully acknowledged, from Agriculture and Agri-Food Canada, the European Union, the Flexible Multi-Partner Mechanism (FMM, through funding from Belgium, Sweden, the Netherlands and Switzerland), the French Ministry of European and Foreign Affairs, the International Fund for Agricultural Development, Italy and the Italian research institutions and the United States Agency for International Development. This funding allowed FAO to, *inter alia*, support the travel of over 110 participants to the symposium. Travel-related greenhouse gas emissions were offset to make the event climate neutral, by purchase of Certified Emission Reductions through the UNFCCC Climate Neutral Now platform.

Finally, the FAO Research and Extension Unit (AGDR) provided the core technical and organizational secretariat for the symposium, consisting of Samy Gaiji, John Ruane, Tessa Adamson and Alberto Trillo Barca. AGDR was also responsible for a wide range of different administrative and operational aspects of the symposium, and the contributions of Alvaro Galassi, Catherine Letocart, Cecilia Agyeman-Anane, Charlotte Lietaer, Giulia Palestini, Ilka Gómez, Manuela Bucciarelli, Sharon Mayienga, Max Rünzel, Raffaella Piluso and Zofia Krystyna Mroczek to these are all gratefully acknowledged.

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EXECUTIVE SUMMARY

On 21–23 November 2018, FAO hosted the first International Symposium on Agricultural Innovation for Family Farmers at its headquarters in Rome, Italy.[4] The impetus for FAO to host this symposium came from the fact that the world's population is expected to reach 10 billion by 2050, that agricultural output will therefore need to increase considerably to feed everyone, and that the bulk of this increase must come from family farmers who manage about 75 percent of farmland worldwide – producing over 80 percent of the world's food – but who are often poor and food insecure themselves. Innovation is the driving force that can transform food systems and lift family farmers out of poverty to help the world achieve the Sustainable Development Goals (SDGs).

FAO convened the symposium to provide inspiration for innovation actors and decision-makers, especially in developing countries, to unlock the potential of innovation to drive socio-economic growth, ensure food and nutrition security, alleviate poverty, improve resilience to changing environments (e.g. due to climate change) and thereby achieve the SDGs.

The symposium was organized in partnership with other key actors in agricultural innovation, including CGIAR, IFAD, the Tropical Agriculture Platform (TAP) and the European Alliance on Agricultural Knowledge for Development (AGRINATURA). It was attended by over 540 participants, including 286 delegates from 92 member countries as well as representatives of a wide range of UN bodies and specialized agencies, intergovernmental organizations and 'non-state actors' (i.e. representatives of civil society organizations; private sector entities; academia and research institutions; and producer organizations and cooperatives). Representatives of non-state actors wishing to participate were requested to fill out a form expressing their interest in attending the symposium and they were then chosen using a set of pre-defined criteria.

The 2.5-day programme contained a series of plenary and parallel sessions on strategic themes, a high-level segment, an innovation fair with success stories of agricultural innovation, a youth interactive event and a lunchtime event with chefs and farmers.[5]

FAO conceived the different sessions as places for dynamic dialogue between innovation actors. There were nine keynotes addresses in the symposium and all were delivered like a TED talk. The six parallel sessions were organized in "Davos-style" format with each panellist making a short intervention followed by discussions in the panel and with the audience. No PowerPoint presentations or formal speeches were used – to foster an open debate and lively interaction. There were four people on each panel, with two panels in each parallel session, and each session had a professional moderator to ensure the discussion with the panel members and the audience was very interactive and participatory. All sessions had simultaneous translation in at least three languages (English, French and Spanish) to enable participants to freely engage in the discussions. All of the sessions were webcast and recorded and can be watched on the symposium website.[6]

4 http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/en/

5 The detailed symposium programme is available at http://www.fao.org/3/CA0916EN/ca0916en.pdf

6 http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/webcast/en/

These proceedings provide a record of the main highlights from the symposium.

Chapter 1 contains the welcome address by the FAO Director-General and the statements delivered by the President of the UN Economic and Social Council (ECOSOC) and the Associate Vice-President of the International Fund for Agricultural Development (IFAD) in the opening plenary session.

Chapter 2 contains a brief summary of the nine keynote addresses delivered in the symposium. Five were delivered in plenary session 2 on the first morning while the remaining four were delivered at the beginning of the remaining four half-day sessions after that. Introductory remarks to plenary 2 from the session chair and the FAO Deputy Director-General are also included.

Chapter 3 contains summary reports from the six parallel sessions, as well as feedback provided by participants about FAO during discussions in the parallel sessions. Summary reports of two special events, dedicated to youth and to chefs and family farmers, are also included.

Chapter 4 contains the statements made by the high-level representatives of the European Union, African Union and five member countries, as well as the closing remarks of the FAO Director-General, in the high-level segment which was the final session of the symposium.

The **Annexes** contain the definitions of two key terms, agricultural innovation and family farming, used by FAO in organizing the symposium (Annex 1). They also contain a description of the innovation fair as well as the text displayed on the panels for the 20 success stories of agricultural innovation which were presented in the fair (Annex 2).

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CHAPTER 1.

OPENING PLENARY SESSION

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1.1 WELCOME ADDRESS BY JOSÉ GRAZIANO DA SILVA

FAO Director-General

It is an honour to welcome all of you to this first International Symposium on Agricultural Innovation for Family Farmers. Let me start by highlighting that the world is facing unprecedented challenges that affect the sustainability of our food systems. The impacts of climate change on the agricultural sectors are undermining our efforts to provide food security and adequate nutrition for all. In fact, climate extremes such as prolonged droughts are threatening to erode and even reverse gains made in ending hunger over the last decades. As you know very well, hunger has increased in the world since 2015, the same year in which UN Member States agreed to end hunger and all forms of malnutrition by 2030, adopting the Sustainable Development Goals and the 2030 Agenda.

Today, farmers are facing higher temperatures, erratic weather patterns, increased desertification and water scarcity, as well as the outbreak of pests and diseases that are spreading around more quickly than ever. The Fall Armyworm in Africa is one of the best examples of this. As usual, small-scale family farmers are the most affected and vulnerable. We cannot forget that they make up the bulk of people suffering from poverty and hunger in the world.

At the same time, family farmers produce most of the food we eat, particularly healthy and nutritious food, and they play key roles in the preservation of the environment and biodiversity around the world. Family farming also contributes to the

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José Graziano da Silva

creation of more employment opportunities, particularly for youth and women in developing countries. This can help to tackle the increasing levels of forced and distress migration in the world.

So it is fundamental to better support family farmers to cope with these unprecedented climatic challenges. For that, we need to accelerate the pace of innovation for family farmers. And this is what this symposium is all about.

Ladies and gentlemen,

In agriculture and food systems, innovation happens when we transform new ideas into practice, as well as when we combine and apply existing practices, processes and organizational ways of working to different contexts. Innovation is essential across the entire food system. This includes production, processing, distribution, market access, as well as public policies and specific legislation.

Over the last years, FAO and partners have supported countries and family farmers in the application of innovative practices, such as the agroecological zero-tillage in South America and Asia. Another example is the link between school meals and family farming production. This is an innovative approach to guarantee market access to family farmers that has been introduced in many countries.

Innovation is also about replicating and scaling-up existing solutions through international cooperation. A good example is the programme called One Million Cisterns that is being implemented in the Sahel. It is based on a Brazilian experience to store rainwater in arid regions. We also have to recognize the successful innovations that family farmers have implemented over centuries, and support them to develop and spread this traditional knowledge. For that, FAO has been promoting a modality of South–South cooperation called farmer-to-farmer, through which family farmers directly exchange ideas, knowledge and practices.

Digital innovation is another important field to be further explored. FAO has used digital innovation, for instance, to provide meteorological and climate data to family farmers, enhancing early warning and disaster risk reduction models. Innovative technologies, such as drones, satellite imaging, remote sensors and mobile applications, are also important to prevent transboundary pest and diseases in crop and livestock production.

Ladies and gentlemen,

The UN Secretary General has emphasized the need to integrate innovative technologies to achieve the SDGs. FAO has heard these calls to innovate. We are seeking to develop solutions that can be easily, cheaply, and sustainably replicated across countries and regions. For instance, you may have heard of blockchain. It is a decentralized, distributed and public digital ledger used to record transactions. This can be used for financial transactions, mobility of animals or several other purposes. FAO is testing blockchain for food chain optimization, traceability, enforcement of rights, and improving financial transaction processes.

FAO is also partnering with young people. In 2018, we have launched open challenges to promote digital innovation and youth entrepreneurship, connecting FAO technical expertise with young innovators. One of these challenges was tackled during the regional conference on youth employment in agriculture, which took place last August in Kigali, Rwanda. The young African developers that won the challenge are here in FAO headquarters this week. They are exchanging experiences with our technical divisions to improve their ideas and develop digital solutions, such as using artificial intelligence techniques to deal with transboundary pests and diseases.

FAO is also working with the private sector, such as Google, Telefónica from Spain, Unilever and others, to leverage the tools and resources of these companies in order to enhance the impact of our programmes.

Ladies and gentlemen,

This symposium gathers diverse stakeholders to share their knowledge and to unlock policies, programmes and business models. We need to increase our understanding of the innovation drivers and processes. We also need to look for concrete solutions, identify priority interventions and develop strategies to scale up successful experiences to meet the needs of millions of family farmers. This is very important as we are about to enter the UN Decade of Family Farming 2019–2028.

Let me express my appreciation for the financial support provided by the European Union, Canada, the US, France, Italy and IFAD for the organization of this symposium. Through this financial support, we have managed to bring nearly 125 delegates to this event, including many family farmers and farmer organizations.

Let me also highlight that FAO and the Government of Switzerland have launched an International Innovation Award for Sustainable Food and Agriculture. The call for nominations for this Innovation Award is now open. Individuals, institutions or countries can submit their nominations by the end of February 2019. More information can be found on FAO's website.

To conclude, I wish all of you successful deliberations and presentations during this symposium. And let me make a final call: Let's innovate. This is crucial for implementing the 2030 Agenda and achieving the Sustainable Development Goals.

Thank you for your attention.

1.2 STATEMENT BY INGA RHONDA KING

President of the United Nations Economic and Social Council (ECOSOC)

Thank you Chair,
Director-General,
Excellencies,
Distinguished delegates,
Ladies and gentlemen,

It is my honour to address this multi-dimensional, multi-stakeholder symposium today and I am grateful to FAO for inviting me to speak. I am excited to share with you some of the work that we are doing at UN headquarters in connection with the global effort to better understand the potential of agricultural innovation to support achievement of the 2030 Agenda and its SDGs.

Supporting smallholder and family farmers is important to the work of the Economic and Social Council. It is also an issue of priority for the General Assembly, where a resolution on agriculture development, food security and nutrition is currently being negotiated.

I also have particular fondness for this topic, being the daughter of a farmer, now deceased.

As you know, ending poverty and hunger in all their dimensions have their dedicated SDGs. Today, some 767 million people live below the extreme poverty line. Ending poverty requires raising rural incomes and increasing productivity sustainably as to transform rural livelihoods.

We must all work together – governments, stakeholders, the private sector and the scientific community – to leverage the untapped potential of food systems and to boost productivity in incomes on small-scale farms. This will help accelerate rural poverty reduction and contribute to addressing urban poverty and food insecurity.

Securing access to land and other productive resources and services, including water and credit, is critical to smallholder family farmers.

The level of transformation, integration and universality needed to achieve the SDGs also requires the adoption of a more holistic approach to support family farmers – one that delivers impacts across the full range of activities of the food system. Innovation is required on all those aspects.

Channelling public and private investments from domestic and foreign sources to support small family farms can provide a powerful stimulus for rural growth. Such farms account for 80 percent of the food produced in Asia and sub-Saharan Africa, and yet remain among the poorest, most vulnerable and food-insecure groups.

More investment is also needed for agricultural cooperatives by providing them with easy access to affordable finance, rural infrastructure and irrigation, strengthened marketing mechanisms, access to appropriate risk-management instruments and support for the participation of women and youth in economic activities.

To achieve the Sustainable Development Goals and effectively adapt to context-specific climatic changes, we need investments in research and development. But we also need education so as to empower and better serve the needs and demands of family farms in the context of local food systems. Building on the real issues faced by local communities and including their traditional knowledge in the establishment of innovative solutions will increase the sustainability of interventions.

Promising examples from Asia and Europe demonstrate locally-appropriate, cost-effective solutions that deliver across the multi-dimensional targets of Sustainable Development Goals 1–6 and 13–15. Community-managed seed banks, alternative protein sources for feed, integrated cropping systems, water-saving and irrigation techniques, integrated pest management and a continued attention to maintaining diversified habitats constitute practices that have proven their value in terms of yield, ecological and social sustainability.

Research and development needs to be enhanced and take account of the needs and knowledge of family farmers. Ideally, they should be engaged in the quest for innovative solutions. We also need to conduct research jointly with effective and demand-driven extension and rural advisory services. This is critical to ensure that agricultural technologies respond to the demands and needs of family farmers and smallholder producers.

Locally adapted, modern machinery is equally important. While information and communications technology (ICT) holds potential to attract the younger generation, in many instances we need more data to confirm its impact. Meanwhile, traditional means, such as radio (including community radio) and printed media, still go a long way.

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Inga Rhonda King

National and subnational governments remain the key players in the implementation of sustainable agriculture and food systems, in line with the 2030 Agenda and the Paris Agreement. Innovating for family farmers and addressing the factors that impede transitions to diversified agro-ecological systems must become a higher priority. We must also draw the attention of global forums to innovating for family farmers.

The Economic and Social Council is at the heart of the United Nations system to advance the three dimensions of sustainable development – economic, social and environmental. It is the central platform for fostering debate and innovative thinking, forging consensus on ways forward, and coordinating efforts to achieve internationally agreed goals. It is also responsible for the follow-up to major UN conferences and summits.

The UN High-level Political Forum on Sustainable Development (HLPF), under the auspices of ECOSOC, organizes the follow-up and review of sustainable development commitments, and aims to mobilize intergovernmental panels and platforms, such as the Committee on Food Security, to support the process of policy coherence, review and lesson-sharing on the Sustainable Development Goals, notably those related to agriculture and food systems.

ECOSOC and the HLPF can help achieve the level of integration required among agricultural policies, environmental policies, social policies and economic policies. They can support member states in the institutional changes needed to break the silo approach to policy-making and research.

Technology alone cannot provide answers to global challenges nor empower family farmers. But it can increase options and make it easier to deploy effective solutions. It is essential to ensure that technology serves the poor, aims toward inclusive development, and is used to enable people to deal with risks and vulnerabilities. To leverage technologies and innovation for building sustainable and resilient societies, efforts must be locally contextualized and driven, and use of technology and innovation must be inclusive.

As part of the Technology Facilitation Mechanism mandated by the 2030 Agenda and the Addis Ababa Action Agenda, ECOSOC hosts an annual collaborative Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals (STI Forum). It is expected to "provide a venue for facilitating interaction, matchmaking and the establishment of networks between relevant stakeholders and multi-stakeholder partnerships in order to identify technology needs and gaps, also in order to help facilitate dissemination of relevant technologies for the sustainable development goals".

The STI Forum would be the ideal mechanism to leverage the outcomes of this symposium and scale-up innovation initiatives through the inter-agency partnership already in place.

I am keen to learn more about your successful innovations at this symposium and explore ways to scale them up through the STI Forum and related mechanisms.

Thank you.

1.3 STATEMENT BY PAUL WINTERS

Associate Vice-President, Strategy and Knowledge Department, International Fund for Agricultural Development (IFAD)

Director-General Graziano da Silva, President King, Dr Moephuli, Ms Semedo, Your Excellencies, Distinguished colleagues, Ladies and gentlemen,

The coming decade will determine the shape of global and national food systems for generations to come. It is an evolving food system being affected by a number of ongoing changes.

Urbanization and greater affluence is leading to a diet that includes more meat and dairy, fruits and vegetables and more processed foods. Structural and rural transformation are altering the food system and changing the role of agriculture, shifting agriculture from a direct employer to a driver of rural development. The digital revolution is, as the World Bank notes in its recently released World Development Report, changing the nature of work allowing for food production that has *scale without mass.* The recently released Intergovernmental Panel on Climate Change (IPCC) report highlights the threat climate change now poses to agriculture – in particular to the production of crops.

Keeping these ongoing changes in mind, we must take actions now to shape global and national food systems. These actions will determine the type of food system that evolves as we move towards 2030 and will determine the capacity of billions of rural women and men, particularly young women and men, to earn a decent living and build their lives in rural areas.

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Paul Winters

Ladies and gentlemen,

The shape of these food systems will largely be a product of agricultural innovations. In considering the innovation system and the types of innovation processes, pathways and interventions we want to support, we must ask: what type of food system do we want?

First, we want a food system that is productive and efficient. We all know that the world population is growing. Today it is around 7.6 billion. By 2050, it is expected to reach 9.9 billion – a 29 percent increase. Most of that growth will be in Africa, where the population is expected to double, to 2.6 billion. Our food systems must feed this growing population. Agricultural innovation is needed to expand production – double productivity by 2030 – to meet this growing demand.

Second, we want a food system that is sustainable. The IPCC report highlights the challenges of climate change to agriculture. It also states: *"adaptation to its impacts is limited by the availability and economic viability of appropriate technologies"*. However, increasing production runs the risk of adding to the problem of climate change. Expanding agricultural area and changing land use is potentially problematic. Yet, intensifying agriculture can create a host of other environmental issues at the local, national and global level. We need agricultural innovation that creates a food system that has adapted to climate change and is sustainable.

Third, we want a food system that is inclusive. There are an estimated 500 million family farms and four out of five work on small land holdings. While opportunities may lead some of these households to migrate, we need to ensure opportunities are available, particularly for the young, in rural areas. One estimate suggests that over the next decade, 600 million young people in developing countries will be competing for around 200 million jobs. It is not realistic to expect cities and the non-farm sector to absorb them all. We need an agricultural innovation system that includes smallholders and provides crops and technologies that take advantage of the higher labour to land ratios in small-scale agriculture.

Finally, we need a food system that provides nutritious and affordable food and overcomes the triple burden of undernutrition, malnutrition and obesity. The recent State of Food Security and Nutrition in the World (SOFI) reports highlight that our progress in addressing food security has stalled. The SOFI 2018 report also showed being overweight and obese is affecting nearly 2 billion adults worldwide. To make progress, we need an agricultural innovation system that creates a food system that provides people with nutritious food that they can afford.

Ladies and gentleman,

With a clear idea of how we want to shape the food system, this symposium should articulate an effective agricultural innovation system that clearly describes innovation processes, pathways and interventions that builds on local knowledge and traditional systems as well as new sources of knowledge from formal research systems.

In building an agricultural innovation system for family farmers, we must go beyond what we have done in the past. While we should push the frontier in different directions, I would like to highlight three areas for consideration.

First, we must look beyond staple crop fundamentalism and towards a more diverse agri-food system. The diet transition has led to a declining share of staple cereals in developing country diets, even among poorer households, and is expected to continue. Yet, funding for agricultural research has remained focused on staple crops. For example, following the food price crises CGIAR funding for the big three staples, rice, wheat and maize, rose by ten percentage points, while the expenditures for roots and tuber crops dropped by ten percentage points. Numerous secondary crops and cash crops are often completely

ignored. There also appears to be a broader bias towards staples in national agricultural research systems. Staples are clearly important, but a crop neutral agricultural innovation policy, that creates a level playing field and reflects emerging trends and market dynamics, is needed.

Second, we should consider a food systems approach to agricultural innovation. A distinguishing feature of food system thinking is feedback loops: they occur between parts of the food chain (production, processing, distribution and consumption are all connected) and from the socio-economic and environmental outcomes of food production and consumption (such as food security and soil depletion). A food systems approach requires that innovation considers the importance of post-harvest activities, the role of the food system in providing nutrition, overall sustainability and, most importantly, the link between the overall food system and on-farm activities. The food system approach suggests an agricultural innovation system that considers farm-level innovations in a broader context.

Third, we must look to strengthen national agricultural innovation systems. Recent United Nation reforms have called for a strengthening of our country presence and a shift toward greater action at the national level. Agricultural innovation systems should do the same and increasingly foster innovation systems at the national and regional level, building off the strengths of the existing international agriculture research system.

Ladies and gentlemen,

We must shape the global and national food systems for generations to come. Our agricultural innovation systems will play a critical role in this process. Each year the International Fund for Agricultural Development provides millions of dollars in grants for research on agricultural innovation from our own funds and those provided by others including the European Union. We use our investment projects to bring these innovations to scale. We will look for ideas coming out of this symposium so that we play our role in using innovation to shape the food systems.

Only through being proactive can we use agricultural innovations to reorient our national and global food systems to support inclusion and the success of family farmers so that we will be able to sustainably meet the nutritional needs of the future and help end poverty and hunger.

Thank you.

CHAPTER 2.
KEYNOTE ADDRESSES

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CHAPTER 2. KEYNOTE ADDRESSES

During the 2.5-day symposium, nine inspiring speakers were invited to give a keynote address. The format they used was that of a TED Talk and each one was given up to 15 minutes for their talk. Five of the keynotes were given in plenary session 2, on the first morning of the symposium, and the remaining four keynotes were given at the beginning of each subsequent half-day, with the last keynote address delivered on the final morning of the symposium. This chapter contains the summaries prepared by FAO of the nine keynote addresses as well as of the introductory remarks by the chair and the FAO Deputy Director-General at the beginning of plenary 2.

2.1 WELCOME REMARKS BY THE CHAIR OF PLENARY SESSION 2

Plenary session 2 was chaired by **His Excellency Mohammad Hossein Emadi**, Ambassador and Permanent Representative of the Islamic Republic of Iran to FAO and Chair of the FAO Committee on Agriculture (COAG). In his welcome remarks, he expressed his appreciation to FAO for organizing this very important symposium. He noted that innovation had been a driver and engine for change in other sectors and that agriculture needed this sort of driver and engine to foster sustainable agriculture and food system development. The symposium would allow a diversity of voices to be heard (in terms of gender, geography, sectors and age) and to address not only technological innovation but also policy and institutional innovation, which can help the agricultural sector to serve the poorest of the poor and the millions of small/medium farmers all over the world, particularly at the beginning of the decade of "Family Farming". The symposium represented an important opportunity for participants to interact and learn from each other and he appreciated that FAO had arranged the symposium in a way that the settings would be informal so that there would be much interaction and communication between the participants.

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On the screen, His Excellency Mohammad Hossein Emadi.

2.2 INTRODUCTORY REMARKS TO PLENARY SESSION 2

Maria Helena Semedo, FAO Deputy Director-General, Climate and Natural Resources, welcomed participants to the symposium and set the scene by noting that when innovation is mentioned people often think of the latest technology, precision agriculture, artificial intelligence, blockchain technology, genomics, drones or similar. However, innovation is much more than that. It is also about the social, economic, institutional, organizational and policy processes that have an impact on the lives and livelihoods of family farmers. 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 given context. The notion of novelty is important as well as the importance of the context – what works in one situation may not work in another.

She noted with satisfaction that such a large number of representatives of different stakeholders were present, including representatives of governments, intergovernmental organizations, farmer organizations, civil society organizations, academia and research institutions and the private sector. The symposium should be solution-oriented and she urged the participants to have an open and frank exchange of views and experiences, inviting them to think outside the box and outside their comfort zone.

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Maria Helena Semedo

2.3 CREATING EMPATHETIC INNOVATION ECOSYSTEM: WHY DO SMALL FARMERS EXPERIMENT SO MUCH?

Anil Gupta, the founder of the Honey Bee Network, India, gave the first keynote address of plenary 2. He explained that people innovate for different motives and, citing an example of the use of dynamite to catch fish, he noted that innovations can also be destructive. To have innovations that will instead nurture the ecosystem, he argued that certain functions need to be served. These include the scouting and documentation of innovation, and the development of open source databases of farmer innovations; value addition, so that the farmers' knowledge can be converted into products; development of businesses based on innovation, including funding models to make it possible; and protection of intellectual property, where he advocated for open source exchange of knowledge between farmers and use of licencing when the knowledge is used by companies. Recognizing, respecting and rewarding the effort of innovators is essential for this ecosystem.

He said that in India, farmer innovation was considered an essential part of the national innovation system. He emphasized that innovation by women had often been unrecognized in the past. He also pointed out that children had proven to be an important source of innovations. He urged that the symposium should encourage the open and wide sharing of innovations so different countries could learn from each other. He also urged new ways of solving nutritional problems, noting that we cannot just rely on a handful of crops to feed the world.

He concluded his keynote address by saying that "creativity counts, knowledge matters, innovations transform and incentives inspire. But not just material incentives, also non material incentives: recognition, respect, reward. Not just individual incentives, but also collective incentives".

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Anil Gupta (left) and Mohammad Hossein Emadi (right).

2.4 SUPPORTING YOUNG FARMER INNOVATIONS TO ACHIEVE THE SDGS

Ruramiso Mashumba, a young female farmer and founder of Mnandi Africa in Zimbabwe, gave the second keynote address of plenary 2. She said it was a great opportunity for her to share the reality of Africa with participants. She wished to do this by telling her story, beginning with an early upbringing in Harare, the capital of Zimbabwe, and a later move to the rural areas at 14 when her father bought a farm. She studied agriculture, although women were a minority in the school, and then pursued further agriculture studies in the United Kingdom. While there, she learned a lot about the importance of innovative approaches to agriculture and then decided to go back to Zimbabwe to implement what she had learned.

She travelled home to Africa with the idea of developing her farm and making it a model farm where people from the community could learn from her. She explained the challenges that she, as a young woman, faced in getting funding from the bank. She joined a farmer organization in Zimbabwe and this helped her and gave her big networking possibilities. Things began to improve then.

She was later part of the Mandela Washington Fellowship for Young African Leaders programme and was inspired there by the speech of Barack Obama who said that in Africa there are many problems but it is really up to the people there to bring the solutions to those problems. She therefore decided to found Mnandi Africa whose goal is to create model farms to empower other farmers, especially young women farmers. This is necessary because the youth are marginalized. In Zimbabwe, over three-quarters of the people are below the age of 35 but, for reasons such as lack of funding, they are not empowered. She said they were passionate and hungry to bring innovation into existence. She concluded by urging the participants to "join me on this search of supporting young people in agriculture".

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Ruramiso Mashumba

2.5 DRIVING THE FUTURE OF FOOD: INNOVATION, MILLENNIALS AND TECHNOLOGY

Marco Gualtieri, the founder and chairman of Seeds & Chips, Italy, gave the third keynote address of plenary 2. He began by showing a short video which highlighted that the world will be confronted with huge challenges in the future, to feed a rising population in the face of climate change and declining availability of fertile land, but that they can be overcome because humans are innovators. Supporting the FAO Director-General's call at the end of his welcome address to 'Let's innovate', he urged participants to 'Come on!', borrowing the title of the recent report to the Club of Rome.

There are great challenges ahead regarding food and water but "the good news is we can fix it". He argued that the recipe required had three ingredients. The first is awareness about the challenges, including through key international fora such as Expo 2015 in Milan; the UN Summit at New York which adopted the Sustainable Development Goals; and the meeting of the 21st Conference of Parties (COP 21) which approved the Paris Agreement on climate change. The second is youth. The millennials and generation Z will make the different – they were 'born digital'. The third ingredient is technology, which can make the difference. However, to use these three ingredients successfully in the recipe, inclusion, collaboration and a holistic vision are needed.

Regarding investments, he highlighted that global venture capital investments in food technology and agriculture technology were growing as there was a lot of interest, so "investors and money are coming". He concluded his keynote by inviting participants to the upcoming annual Global Food Innovation Summit, organized by Seeds & Chips in Milan in May 2019.

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Marco Gualtieri

2.6 DEVELOPING SUSTAINABLE AND PRODUCTIVE FAMILY FARMING FOR THE BEST OF CONSUMERS AND THE ENVIRONMENT: THE CASE OF FINLAND

Jaana Husu-Kallio, Permanent Secretary at the Ministry of Agriculture and Forestry, Finland, gave the fourth keynote address of plenary 2. She explained that Finland has a unique geographical profile with 75 percent of the land surface covered by forests, over 200 000 lakes and a harsh Nordic climate. Finnish farming still depends on small and medium-sized family farms. Most of the farmers also own forestry which contributes an important part to the farm's income.

Coming from the government, she wished to emphasize the role of the government as a facilitator. The government should also trigger innovation. In her view, the best facilitator is high-quality education and the Finnish Government had focused major attention here to ensure that children could access good education all the way from primary to university level. She also underlined the importance that her country had placed on gender equality. Women have a crucial role to play in agriculture and, if allowed to participate in society at all levels, they are also better able to start up business activities through innovation.

She presented three examples from Finland where the government had triggered innovation relevant to its family farmers. The first was the government's role in providing free school meals, noting that a good school meal is an investment in the future. Finnish legislation guarantees children the right to free meals during school. The second was a project, funded by the Ministry of Agriculture and Forestry, involving students on nutrient and energy-efficient research farms, using biogas production, water protection, low carbon plant production and other sustainable farming practices. The third was the establishment of 'innovation groups' in rural Finland, facilitated by the government and with funding from the European Innovation Partnership. Through these innovation groups, the aim is to move from good ideas (such as using thermal imaging to improve the health of cows) to usable innovations in order to solve practical problems by cooperation between farmers, researchers, advisory organizations and businesses.

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Jaana Husu-Kallio

2.7 TACKLING THE GLOBAL IMPERATIVES FOR SUSTAINABLE DEVELOPMENT USING ARTIFICIAL INTELLIGENCE

Yeming Wang, General Manager for Europe, Middle East and Africa (EMEA) for Alibaba Cloud, gave the fifth and final keynote address of plenary 2. He began by giving a brief overview of Alibaba which started as a small company in 1999 facilitating trading for small enterprises. Today it is a huge group providing information, finance and logistics services. Last financial year, its transactions were worth over USD 760 billion. To manage all these transactions they have to be very technology- and data-oriented and fully digitalized.

Alibaba is using data technology in several sectors such as city management, where artificial intelligence and big data are used to improve traffic congestion in the cities in China and abroad, and industry, to improve the efficiency of manufacturing. Sectors like these and others such as entertainment and gaming are natural early adapters of data technology. Big data can really improve the profits, he said.

Alibaba was also beginning to engage with agriculture which, on the other hand, has been one of the last sectors to embrace big data or digitalization. He showed a video about their recent collaboration with one of the biggest pig farms in China where artificial intelligence technologies are used to monitor the animals' movements, health status and more. Alibaba was also assisting to reduce the digital divide by giving rural villages in China the access to internet. Finally, he also talked about an app called Ant Forest they released which increases users' awareness about carbon emissions, rewarding those who reduce their emissions by planting trees in the desert.

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Yeming Wang

2.8 THE FUTURE OF FAMILY FARMING: A YOUNG FARMER'S PERSPECTIVE

Iris Bouwers, a young farmer from the Netherlands and Vice-President of the European Council of Young Farmers (CEJA), gave the keynote address at the beginning of the afternoon session on 21 November. She appreciated that FAO had invited two young female farmers to give keynote addresses in the symposium and, although Ruramiso Mashumba was from Zimbabwe and she was Dutch, they faced many similar challenges.

CEJA, which represents around 2 million young European farmers, was focusing on generation renewal because many young people do not want to take up the challenges of farming. Currently, only 5.6 percent of people actively farming in the European Union are under 35. To keep the rural areas alive, it is essential that young people want to live and work there. She was passionate and committed to farming. She reminded participants that people need a farmer three times a day when they sit down to eat – and this was often forgotten. She described the history of her farm, where her grandfather began farming in 1961, her father took over in 1998 and she was now working on the farm for two years. She highlighted the importance of sustainability, ensuring the next generation also has a future in agriculture. A good income is central here because "if we want to make agriculture as a whole attractive for young people, we need to make sure there's money to be earned".

She saw three big challenges facing young farmers in Europe: limited access to land, credit and knowledge. She felt that the last challenge was key because if young farmers wish to develop, innovate or prepare a business proposal they needed access to knowledge. Climate change was an additional challenge facing farmers worldwide. Specifically regarding innovation, she advocated a multi-stakeholder approach where it was important to involve young farmers when developing new policies or carrying out new research, as they will be the ones who will be using the innovations.

Her final message to the symposium was that family farming is the backbone of communities and to ensure that when "getting new policies, new ideas and development and innovation in agriculture, to involve the young farmers so that family farming, also in future, can stay and remain that backbone of communities".

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Iris Bouwers

2.9 EMPOWERING INNOVATION

Claudia Sadoff, Director General of the International Water Management Institute (IWMI), Sri Lanka, gave the keynote address at the start of the morning session on 22 November. Beginning with the definition of agricultural innovation provided by FAO for the symposium (see Annex 1), she noted that an idea only becomes an innovation when it is brought into use. So 'empowering innovation' means creating the conditions whereby farmers (or other stakeholders) will bring a new idea (e.g. a new solar panel or a new way of working) into use.

She argued that there are five crucial factors that help to empower innovation. The first, and arguably foremost, factor is learning, which is about bridging the knowledge gap and bringing new ideas and training to people who can then apply innovations. She noted that the knowledge gap might be linked to other gaps (such as the gender gap, as documented by IWMI in one case in Tajikistan) and this would need to be considered when seeking to close the knowledge gap. The second factor is data, where access to data and its translation into usable information for farmers is essential. The third factor is scaling, because many technologies and practises have been piloted and proven but they never spread to or reach other family farmers. She commended here the African Development Bank's Technologies for African Agricultural Transformation (TAAT) initiative which was aiming to scale up proven technologies across Africa.

The fourth critical factor for empowering innovation is policy reform, as a whole host of policies affect access to innovation such as policies regarding water rights, land rights, access to credit and availability/cost of agricultural inputs. The fifth factor is partnering, building partnerships with agribusinesses and exploring public–private partnerships, where she reminded participants that Sustainable Development Goal (SDG) 17 recognizes that the SDGs cannot be achieved without a range of robust partnerships.

She concluded her address by noting that participants in the symposium could do their share to empower family farmers to innovate and that, as they innovate, adopting new technologies or practices or building new partnerships, this in turn empowers the farmers, thus creating a virtuous cycle.

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Claudia Sadoff

2.10 AMUL MODEL: SUSTAINABILITY FOR SMALL FARMERS THROUGH INNOVATIVE MARKET LINKAGE

R.S. Sodhi, Managing Director of the Gujarat Cooperative Milk Marketing Federation Limited (AMUL), India, gave the keynote address at the start of the afternoon session on 22 November. He described how AMUL was formed 72 years ago. Following the advice of one of its founders, Tribhuvandas Patel, the approach was that the small farmers should not only produce, but they should own the whole supply chain and process and market all the products under their brand name. He said this advice was still true today for all small farmer organizations.

The basic structure of the cooperative is that in each village there are approximately 200 farmers who form one of the over 18 000 village dairy cooperative societies, where milk is brought, tested for quality and quantity and payment is made. From there, milk is collected by one of the 18 district milk cooperative unions which have processing facilities to convert milk to value-added products (like cheese). At the state level, there is a milk marketing federation to bring the milk and milk products to the consumer. About 80 to 86 percent of the market price returns to the farmer.

The whole structure is owned by 3.6 million farmers, each with one share, and the cooperative is India's largest food products marketing organization, representing a USD 6 billion business. The AMUL model spread to other parts of India through the Operation Flood programme, which began in 1970, funded by the European Community, World Bank and National Dairy Development Board. India is now the world's largest producer and consumer of milk.

In concluding, he said that critical success factors for the AMUL model included political and professional leadership; investing in latest technology across the entire value chain; and creating a culture of innovation and excellence. The challenges they now face for the future included enhancing productivity; ensuring involvement of the next generation in dairy farming and agriculture; protecting the country from cheap imports; and future leadership.

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R.S. Sodhi

2.11 HEALTH-LINKED RURAL POVERTY AND SOME TAKE-HOME MESSAGES FROM THE SYMPOSIUM

Ren Wang, a member of the board of directors and Senior Vice President of the Beijing Genomics Institute (BGI), China, gave the final keynote address of the symposium, at the start of the morning session on 23 November. He highlighted the large impact that diseases had on poverty, noting that health-related poverty was estimated to represent 42 percent of poverty in China. For example, echinococcosis, a disease caused by a tapeworm, affects about 1 million people worldwide and has a high incidence in Qinghai province in China. The disease has a long incubation period, which can last for many years until the larvae evolve and then the clinical symptoms appear. Another example is thalassemia, the most common genetic disease in southern China and a cause of rural poverty. Such diseases represent a huge financial burden for affected families and their prevention and control would be very useful.

He then described the work of BGI where they have applied genomic technologies to samples from 13 million people, including 850 000 for echinococcosis and 263 000 for thalassemia. He noted the rapid advances that had been made in genetic technologies in recent decades. Sequencing the first human genome took 13 years (1990–2003), several teams of scientists and USD 3.5 billion. Today, the genomes of 60 people can be sequenced in just one day by one sequencing machine and the cost is about USD 600 per genome. By 2020, the cost is predicted to be below USD 300.

He concluded his keynote with three take-home messages:

- Technological innovations are changing the world, and our mindset must also change.
- Innovation in science and technology must be accompanied by innovative business models and broad partnerships, especially public–private partnerships to achieve impact at a scale.
- Innovation can be a powerful driver for poverty reduction and economic development in developing countries; but it needs the support and enabling policies and investment from the national as well as local governments.

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Ren Wang

CHAPTER 3.

SUMMARY REPORTS FROM THE DIFFERENT SESSIONS

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CHAPTER 3. SUMMARY REPORTS FROM THE DIFFERENT SESSIONS

The symposium contained six parallel sessions, each 2 hours and 45 minutes long, which were organized in a "Davos-style" format with each panellist making a short opening intervention followed by discussions with the panellists and the audience, centred on a small number of key questions prepared by FAO beforehand that the moderator addressed to the participants. No PowerPoint presentations or formal speeches were used, in order to foster an open debate and lively interaction. There were four people on each panel, with two panels in each parallel session. Each session had a professional moderator to ensure the discussion with the panel members and the audience was very interactive and participatory. All sessions had simultaneous translation in at least three languages (English, French and Spanish) to enable participants to freely engage in the discussions. All of the sessions were webcast and recorded and can be watched on the symposium website.[7]

Sections 3.1 to 3.6 of this chapter contain the summary reports from the six parallel sessions. Each of the summary reports has three parts. The first two parts of each report were prepared by FAO. The first part provides a brief background to the topic of the session. The second part briefly describes what happened during the session, including some key points made by panellists in their opening interventions, questions asked by the moderator to the participants and main issues that arose in the discussions. The third part contains the session chair's main conclusions or take-home messages from the session that he/she presented to plenary session 5 on the final morning of the symposium.

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From left to right: Viviana Palmieri, Fernando López, Bernard Rey, María Cristina Boldorini, Frédéric Seppey and Carla Montesi.

7 http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/webcast/en/

None of the panellists were from FAO and none of the questions asked by the moderator were about FAO's role or activities. Nevertheless, several participants during the parallel sessions commented on FAO's ongoing work regarding agricultural innovation and/or provided suggestions for what FAO should do in the future on agricultural innovation. This feedback is captured in section 3.7 of this chapter.

Section 3.8 contains the summary report from the two-hour interactive event on 'Youth as drivers of innovation', which took place in the evening of the second day of the symposium. During the event, a number of young innovators briefly presented their agricultural innovations and, in the second part, there was a panel discussion involving youth participants and a number of panellists and keynote speakers from other sessions of the symposium. Section 3.9 contains the summary report from the one-hour lunchtime event entitled 'What's cooking? Dishing up innovation', held on the same day, which was an interactive discussion between chefs, family farmers and the audience.

3.1 PARALLEL SESSION 1: PUTTING FAMILY FARMERS AT THE CENTRE

Background

Family farming is the predominant mode of agricultural production in the world. More than 90 percent of the world's farms are family farms. These family farms are very diverse in terms of size and other characteristics. Worldwide, 475 million smallholdings of up to 2 ha account for more than 80 percent of all farms. Most small-scale food producers, including herders, pastoralists and fishers, are poor. Three-quarters of the world's extreme poor live in rural areas, and the livelihoods of most of the population depend on agriculture.

Actions that target smallholder producers and family farmers can play a fundamental role in enhancing rural livelihoods, spurring entrepreneurial activity, job creation, and providing economic opportunities in the areas where people live. Compelling evidence suggests that investing in agriculture – particularly in low-income countries – has a greater impact on reducing poverty than any other investment.

Family farmers are usually well-adapted to local ecologies, understand land capabilities and sustain the productivity of their resources (land, water, biodiversity) through techniques that are able to combine local knowledge with modern technology. If supported by an enabling policy environment that promotes innovation, family farming has the capacity to cope with current and future challenges related to sustainable agriculture in its different dimensions, thus representing a key element for the development of sustainable food systems.

A coherent strategy aimed at strengthening innovation among family farming must be tailored to local realities and strive to ensure that the interests of family farmers are recognized and strengthened in governance, planning and investment processes. Effective, inclusive and participatory technological and institutional innovations are needed to support family farmers as they adapt and innovate in order to move towards more sustainable and resilient livelihoods.

The session

The session was chaired by Fernando López (Management Secretary, Confederation of Family Farmers Organizations of the Extended Mercosur, COPROFAM) and moderated by Chris Burns.

The theme for the first panel was 'The key role of family farmers' and the panellists were Ann Waters-Bayer (Prolinnova International, Germany), Daniel Gad (Omega Farms, Ethiopia), Fatma Ben Rejeb (Pan-African Farmers' Organization) and Roberto Moncalvo (Coldiretti, Italy).

In their opening interventions, *inter alia*, Ann underlined that rather than agricultural innovation for family farmers, the focus should be on agricultural innovation with and by family farmers; Daniel emphasized the role of innovation in providing opportunities for the young rural youth in Africa; Fatma argued that family farming is not just a way of production but it is a way of life and she advocated for sustainable agricultural growth which would provide young people with a decent livelihood; and Roberto highlighted the importance of multifunctionality of farms in Italy, where farmers were not only producing agricultural products but also involved in food processing, tourism and more.

The first question the moderator addressed to the panel and the audience was about the kinds of innovation that could increase the incomes and be sustainable at the same time. Innovations to reduce food waste and preserve food were highlighted in the responses. The second question the moderator posed was how to address the needs of different categories of family farmers across the world and ensure that no one is left behind. Responses covered issues like the need to encourage farmers to innovate by giving them recognition and respect (as said by Anil Gupta in his keynote address) and the importance of farmers moving up the value chain and capturing more of the profits themselves.

The theme for the second panel was 'The critical role of the enabling environment' and the panellists were Donal Brown (International Fund for Agricultural Development), Fan-Li Chou (United States Department of Agriculture), Laura Lorenzo (World Rural Forum) and Alessandra Gentile (Agricultural Research and Economical Analysis Council, Italy).

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From left to right: Ann Waters-Bayer, Fatma Ben Rejeb, Fernando López, Daniel Gad and Roberto Moncalvo.

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From left to right: Fan-Li Chou, Donal Brown, Fernando López, Laura Lorenzo and Alessandra Gentile.

In their opening interventions, *inter alia*, Donal said the enabling environment is key for innovation and that context is central, as innovation often fails because what works in one context or for one target group does not necessarily translate to another context or another group; Fan-Li underlined the role of the consumer in stimulating innovation as well as the importance of the government's role, providing examples from the United States of America; Laura argued that family farming should be seen as the solution to problems and not as a problem in itself and, secondly, that innovation needs to meet the real needs of family farmers; and Alessandra highlighted the importance of documenting and communicating successful innovations that have been tested as well as the positive role that a demonstration farm could play in communication about innovations.

The first question the moderator addressed to the panel and the audience was on what aspects of the enabling environment can help a family farmer to accelerate the rate of innovation. Numerous aspects were highlighted in the responses, including access to land tenure, markets, digital technologies and, particularly, access to funding and knowledge. The key role of government in creating this enabling environment was highlighted as well as the need to ensure farmer representation in the dialogue.

For the second question, the moderator noted that innovation processes also entail risk-taking for family farmers and he then asked participants, based on their experiences, what they thought could be done to reduce the risks for family farmers when adopting innovative practices. The use of specific funding strategies to support farmers to overcome potential difficulties they might face at the beginning was suggested. There was also discussion about the nature of the specific innovation involved, with some participants arguing for caution in introducing new innovations. The importance of access to good knowledge to mitigate risks through, for example, demonstration farms or farmer-to-farmer learning, was underlined.

For the third question, the moderator asked participants, from their experience, which incentives they thought could support family farmers in scaling up successful innovation. Increased income, for example through farmers selling processed rather than raw fruits, was a main one. Other incentives suggested included that the innovation would allow the farmer have an easier life or save time or anything that would increase the farmer's sense of security (such as access to land, markets or credit as well as availability of a crop insurance scheme or extension services, in case problems arise).

For the final question, the moderator asked participants about concrete policy options they knew that ensure that small farms, youth, gender and elderly are part of the innovation processes. Participants mentioned specific incentives in Italy for women in farming; that policies on women may not have real impact in the field; and that policies should consider the whole value chain rather than the farm.

Conclusions by the session's chair

For Panel 1: The key role of family farmers

- Family farmers should be at the centre of the innovation processes.
- There is a huge diversity in family farming. It is much more than a way of production, it also includes culture; it is indeed a way of life.
- The family farmers should actively participate in the whole process of innovation from participatory research, design, implementation and monitoring of innovation through co-innovation.
- Innovation has to be inclusive without leaving anyone out.
- Innovation is not only technological. It also involves social, organizational or process innovation.
- Innovation must recognize and include the traditional and ancestral knowledge of the family farmers.
- Agroecology is really important to develop sustainable systems for the family farmers.

For Panel 2: The critical role of the enabling environment

- It is necessary to have comprehensive public policies for family farmers, such as access to land, financing, research, education, infrastructure, especially for women and youth.
- There is a need of greater financing for innovation for the family farmers.
- The importance of strengthening the capacities of family farmers and cooperative organizations to incorporate more family farmers, especially the most vulnerable, into innovation processes.
- Institutional innovations are necessary to adapt to the needs of innovation in family farmers.
- Evaluate innovation systems at the national, regional and global levels.
- Develop specific impact indicators for innovation in family farming that includes economic, social and environmental indicators. Include the proposals of family farmers.
- Have good governance that effectively integrates the family farmers, especially in new digital technologies, to generate an adequate regulatory framework.
- The UN Decade of Family Farming (2019–2028) will be a huge opportunity and an enabling environment to promote public policies, including innovation policies with, and in favour of, family farming.

3.2 PARALLEL SESSION 2: STRENGTHENING RESEARCH, EDUCATION AND BRIDGING INSTITUTIONS TO ACCELERATE INNOVATION

Background

Innovation is the result of a complex interaction between various actors and institutions. The agricultural innovation system is an open, evolving and complex system that encompasses relationships within and between a large number of different organizations, institutions and socio-economic structures. These include the private sector, producer organizations, research organizations, extension and advisory services, universities, tertiary and vocational education institutions, governments and civil society organizations. These may also include bridging institutions which bring actors together and build relationships among them, thereby catalysing innovation and playing the role of an innovation broker.

Transformation through innovation is the defining feature of the United Nations 2030 Agenda for Sustainable Development. Critically, transformation is not about treating symptoms, but is an approach that seeks to address the root causes of inequality and environmental degradation. Nowhere are these questions more pressing than in the agri-food sector. Food security, human nutrition and health, the livelihoods of rural communities, responses to climate change and economic growth remain intimately connected to the sector. Yet the agri-food sector needs to balance this with a history of growth that has often been environmentally damaging and sometimes socially divisive. It is no exaggeration to say that the success of the SDGs depends on finding ways that innovation can transform agri-food systems towards more productive but also more sustainable and socially inclusive pathways.

Agricultural research organizations, extension and advisory service providers, and educational bodies thus face the challenge of adapting their activities to the necessities of the era. While technological breakthroughs will undoubtedly be critical in these efforts, it is increasingly recognized that realizing transformative change in agri-food systems and ending

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From left to right: Nienke Beintema, Viviana Palmieri, Margaret Gill, Huang Guixiu, Mark Holderness and Hlami Ngwenya.

poverty and hunger will require a complex set of interrelated technological, social, institutional, and policy and political changes. Thus, agricultural research organizations, extension and advisory services, and educational bodies will need to adapt and change in response to this emerging innovation landscape.

The session

The session was chaired by Margaret Gill (Chair, CGIAR Independent Science and Partnership Council) and moderated by Hlami Ngwenya.

The theme for the first panel was 'Addressing research priorities: Transforming research and education for farmer-centred innovation' and the panellists were Nienke Beintema (International Food Policy Research Institute), Huang Guixiu (Chinese Academy of Tropical Agricultural Sciences), Viviana Palmieri (Inter-American Institute for Cooperation on Agriculture, Costa Rica) and Mark Holderness (Global Forum on Agricultural Research and Innovation, GFAR).

In their opening interventions, *inter alia*, Nienke emphasized the importance of increasing the levels of investments in agricultural research because of the expected benefits in economic development and meeting the development goals; Viviana underlined that farmers have been, and will always be, innovators and the need for all actors in the innovation system to work together and co-create; Huang described the situation in China where the research priorities for smallholder and larger-scale farmers were different as the production systems differed and larger farms were more market-oriented; Mark called for a rethink of how we are working, urging that a move is needed from a linear research-extension-farmer model to one with multi-directional webs of knowledge and where family farmers are at the centre of the processes of research and innovation.

Regarding research, the moderator asked the panel and audience to consider how agricultural research can best contribute to the needs of family farmers and achievement of the Sustainable Development Goals. A recurring theme expressed in the responses to this question was the need for farmers to be at the table when the research agenda is being developed so research can be truly demand-driven. Points raised during the discussion included the need to instil trust between small farmers and research; the potential difficulties of getting researchers to engage in co-innovation processes; the importance of foresight studies to look at the desired future for a particular community; and that few countries were really investing in participatory research including smallholder farmers. Regarding investments in research, it was highlighted that governments in developing countries need to increase their investment in agricultural R&D. It was also noted that there are several examples in African, Asian and Latin American countries where farmers are paying for agricultural research. An example from Côte d'Ivoire was highlighted as a success, where farmers pay for funding of agricultural research and they identify the issues for the research system to address.

Regarding education, the moderator asked the panel and audience to consider which specific policies and actions will be required to ensure that the education system responds to the current trends and the change in agri-food systems. Many of the responses to this question stressed that the educational system needed to be transformed and revamped to instil innovation thinking, inspire young people to engage with agriculture and to produce the young agricultural and rural leaders of the future. Some positive developments in these directions were noted and the work of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and GFAR was commended in this respect. Participants also underlined the need to develop functional capacities, like learning to interact and be part of participatory processes, and the importance of adult literacy training with farmers.

The theme for the second panel was 'Strengthening and reforming bridging institutions to accelerate innovation' and the panellists were Rasheed Sulaiman (Global Forum for Rural Advisory Services, GFRAS), Bernhard Kowatsch (World Food Programme Innovation Accelerator), Cécile Bibiane Ndjebet (African Women's Network for Community Management of Forests, REFACOF) and Wang Qingyin (China Society of Fisheries).

In their opening interventions, *inter alia*, Rasheed argued that bridging organizations, and the need for brokering, have gained increasing importance because there is now a better understanding about how innovation happens, with innovation as a process that needs to be facilitated across a large number of actors, and that extension and advisory services traditionally played a bridging role between research and the farmers but it was now understood that there is a need to bridge across a larger number of organizations; Bernhard underlined the importance of interventions at the systemic level, such as the food system, and described the role of his organization as an innovation accelerator looking for specific start-ups or innovations that can make step changes; Cécile highlighted that the gender dimension was very important, as female farmers have different roles, needs, expectations and challenges, and that agricultural innovation requires long-term commitment and should go beyond technology and account for socio-cultural issues; Wang, from the perspective of the aquaculture sector in China, noted the difficulties of applying research findings into practice (the 'last mile challenge') and described some approaches to overcome them, such as organizing farmers and researchers to visit each other and the use of online technologies to link researchers and experts with the farmers.

The moderator then asked the panellists and audience how to improve the effectiveness of bridging organizations in enabling family farmers to innovate. A very rich discussion followed. Some of the points raised included that: bridging organizations can play a critical role in reducing transaction costs; several examples exist in developing countries showing that farmer organizations can play a strong bridging role; training certain stakeholders (e.g. researchers) to dialogue with the other actors was important in a multi-stakeholder process; and that a new set of skills and functional capacities needed to be developed for organizations to play this bridging role.

The moderator also asked about funding mechanisms and responses from participants to this question included that: market-based solutions are one option to ensure financial sustainability of the bridging services; government funding of bridging institutions was fundamental and governments should also ensure the institutions direct their efforts towards family farmers; and policy-makers often do not realise the importance of strengthening bridging organizations because they lack evidence of impact, thus assessing their impact is critical.

As different actors may play a bridging role, the moderator asked how this could be coordinated so that the different stakeholders work together and do not send conflicting messages to the family farmers. In the discussion, it was noted that in many cases you might not know who is acting as a bridging organization so it was suggested that an assessment be carried out to identify who is doing this at the national level. It was also suggested that coordination be led by the public sector but that capacities in coordination might be weak and therefore need to be developed in public sector institutions.

Conclusions by the session's chair[8]

There was agreement that research, education and the bridging institutions all form part of one thing; we are "all in this together" was the phrase that emerged from the discussions. Along with family farmers, research, education and the bridging institutions must work together to accelerate innovation, address challenges, take advantage of opportunities

8 Presented to plenary session 5 by Viviana Palmieri who filled in for the chair, Margaret Gill.

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From left to right: Rasheed Sulaiman, Bernhard Kowatsch, Margaret Gill, Cécile Bibiane Ndjebet and Wang Qingyin.

and so try to achieve the SDGs. It is a multi-stakeholder network, with multiple relationships in all directions, in which new ways of doing things are needed to empower actors to work together.

To fulfil its role in the innovation process, research should be outlined through joint definition of the goals and the vision along with the family farmers and so be able to co-design, co-create, do collective action between the different actors, building on all sources of knowledge to identify new opportunities and engaging in participatory research to also co-develop new knowledge.

The bridging role is played by multiple organizations. There is not just one kind of bridging organization and it is a very dynamic group of organizations which fulfils a new set of functions to connect a wide array of actors. It is not just connecting research with farmers anymore, there is a wider array of actors in the system. They must also promote different types of innovation, use new technology and business models and be inclusive of all different needs and people in the family farming community and the different actors, including gender and youth.

Regarding education, it was agreed that, at all levels and for all the actors, we must rethink education to include the different types of capacities required for innovation – understanding the context, thinking outside the box, learning to interact with different stakeholders, developing leadership, in addition to the usual capacities in agricultural professionals for dealing with or promoting agroecology or being able to respond to specific needs and demands at a certain time for the dynamic context.

Finally, both research and bridging roles require enhanced capacities in soft skills such as listening and working together, negotiation, identification of the right partners, the capacity to innovate as well as developing trust for co-creation and networking.

3.3 PARALLEL SESSION 3: BUILDING EFFECTIVE AGRICULTURE INNOVATION SYSTEMS AND EMPOWERING ITS ACTORS

Background

Agricultural innovation systems are 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".[9] There is growing agreement and recognition that effective functioning of agricultural innovation systems significantly contributes to improving agricultural and food systems and to achieving the SDGs.

Agricultural innovation systems are contextual, diverse and vary in scale from local to national level. This variation requires investments to be assessed, prioritized, sequenced and tailored to the needs, challenges and resources that are present. The stage of development of agricultural innovation systems depends on a number of factors such as a favourable enabling environment; existence and effectiveness of an agricultural innovation strategy/policy; structure and function of markets; and the ways that actors interact, generate, share and use knowledge, as well as jointly learn. Monitoring and evaluation of an agricultural innovation system are essential for assessment and prioritization.

Studies have shown that many developing countries are, as yet, unable to harness the full potential of agricultural innovation. Main constraints include weaknesses and gaps in policy; traditional and sector-oriented institutional arrangements; weak individual and organizational capacities; and incoherent approaches in capacity development interventions. Such constraints impede the co-creation, promotion and diffusion of agricultural innovations that are responsive to family farmers' needs.

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From left to right: C Partha Sarathi, Philippe Petithuguenin, Irene Annor-Frempong, Senzeni Zokwana and Frédéric Seppey.

9 Tropical Agriculture Platform. 2016. Common Framework on Capacity Development for Agricultural Innovation Systems: Conceptual Background. CAB International. https://www.cabi.org/Uploads/CABI/about-us/4.8.5-other-business-policies-and-strategies/tap-conceptual-background.pdf

For an agricultural innovation system to be effective, the technical and functional capacities of its actors must be built and strengthened. Stronger technical skills are very important, but they must be complemented with functional expertise, such as capacity to navigate complexity, collaborate, reflect and learn, and engage in strategic and policy processes.

New partnership and business models with stronger coordination between the various actors and good governance systems are needed to foster effective agricultural innovation systems. Strengthening agricultural innovation systems is not just about technical and functional skills. Many cross-cutting policy issues (e.g. agriculture, poverty reduction, science, technology and innovation, education, infrastructure, finance and trade) affect and shape agricultural innovation policy.

The session

The session was chaired by Frédéric Seppey (Assistant Deputy Minister, Market and Industry Services Branch, Agriculture and Agri-Food Canada) and moderated by Hlami Ngwenya.

The theme for the first panel was 'Building effective agriculture innovation systems' and the panellists were Senzeni Zokwana (Minister of Agriculture, Forestry and Fisheries, South Africa), Irene Annor-Frempong (Forum for Agricultural Research in Africa, FARA), Philippe Petithuguenin (French Agricultural Research Centre for International Development, CIRAD) and Partha Sarathi (Agriculture & Co-operation Department, Government of Telangana, India).

In their opening interventions, *inter alia*, Senzeni described some of the recent challenges facing South Africa, such as drought and the Fall Armyworm, leading to loss of income and reduced production and the need for innovation to overcome such challenges, where the government works with a wide range of stakeholders; Irene said that an agricultural innovation system was a web of many actors, that family farmers are central to ensuring that the system responds to agricultural transformation processes in every country and also underlined the importance of strengthening connectedness which will ensure that the farmer determines the priorities of research and education; Philippe stressed that improving innovation should be seen as a gradual process with various stages, beginning with diagnosis, and that to improve effective agricultural innovation systems, financing was necessary and that some funds should always be dedicated to capacity building among stakeholders; and Partha described the challenges in the State of Telangana, in India, and underlined the importance of the target audience, i.e. the smallholder farmer community, really being convinced and having a felt need if a potential innovation to solve their problems is to succeed.

Noting that agricultural innovation systems are complex institutional set-ups, the moderator asked the panel and audience, based on their experience, to share some concrete examples of a well-functioning agricultural innovation system. Examples cited included development of a multi-stakeholder platform in South Africa to face the challenge of Fall Armyworm; Senegal, where a government law improved the system; and Benin, where farmers have led the research process and are developing new soy products.

The second question the moderator asked the participants was how to measure the success of an agricultural innovation system or know that the system is performing well. One suggestion was to identify key components in the agricultural innovation system, develop indicators for them and use scorecards to put all the indicators together, following a similar process used for the Comprehensive Africa Agriculture Development Programme (CAADP). Other suggestions were to measure indicators of the specific goal of the agricultural innovation system, e.g. to provide more income for farmers or to increase the number of female entrepreneurs.

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From left to right: Stéphanie Barrial, Silim Nahdy, Myra Wopereis-Pura, Øyvind Fylling-Jensen and Frédéric Seppey.

The third question the moderator asked the participants was what can be done to accelerate the transformation of an agricultural innovation system in a way that the system addresses effectively the needs and the demands of family farmers. A common thread in many of the responses was that acceleration would only be achieved if the system was tailor-made to the needs and priorities of the family farmers. Other factors mentioned as being important in this context included multi-stakeholder facilitation, building the capacities of actors to work in this complex system, full participation of key stakeholders, and strong motivation and commitment by the actors.

The theme for the second panel was 'Strengthening capacities to innovate' and the panellists were Øyvind Fylling-Jensen (Norwegian Institute of Food, Fisheries and Aquaculture Research, NOFIMA), Silim Nahdy (African Forum for Agricultural Advisory Services, AFAAS), Myra Wopereis-Pura (Capacity Development for Agricultural Innovation Systems (CDAIS) project) and Stéphanie Barrial (World Rural Forum).

In their opening interventions, *inter alia*, Øyvind underlined that farmers' knowledge and insights were of crucial importance for innovation and that, from the perspective of an applied research institute, it was very important to create meeting places for the dissemination of research results, in an appropriate format, to farmers; Myra argued that innovation can only happen if there are capacities to innovate, particularly the functional capacities, the soft skills, and noted that FAO and the European Alliance on Agricultural Knowledge for Development (AGRINATURA) were working together in the CDAIS project which strengthens the capacities to innovate through an integrated approach starting from an individual, to an organization and to the system level; Silim advocated for a sustained coherent system-wide approach to capacity development to enhance and sustain innovation and said that, without this, the issue of scaling up and out will remain a challenge; Stéphanie emphasized the need to involve family farmer organizations in the decision-making, co-building and co-innovating in the agricultural innovation system from the very start and, regarding measurement of impact, argued that any indicators that are used should be co-created and devised with the family farmers themselves.

Since the panel was about capacities, the first question the moderator asked the participants was to name the one skill or capacity they would have loved to have gained 20 years ago which would have made them more productive now in terms

of supporting the farmers in this complex agricultural innovation system. Responses prioritized functional skills, such as the ability to collaborate, negotiate, listen, learn from and respect the farmer's views and knowledge, and tell the farmer's story. It was also suggested that spending a certain amount of time working on a farm would make it possible to better understand what it means to be a farmer.

The moderator then asked the panellists to provide some concrete examples of experiences in building the capacity to innovate. Myra described some of the successes achieved with the CDAIS project in eight developing countries, where development of functional capacities had been fundamental. Øyvind described two successful projects, involving use of holistic thinking to meet the challenges together with tomato and brassica producers along the entire value chain in Norway. Stéphanie described a successful project in Uruguay where several national family farmer organizations worked together with researchers to improve the livestock system. Silim described an example from citrus fruit growers in South Africa where success was made possible by a combination of different factors including technology, training, a favourable enabling environment and knowledge flow.

The moderator then asked participants what needs to be done differently to empower and emancipate family farmers to be the real drivers of innovation. In responding, participants highlighted a large number of factors and issues which would empower and emancipate farmers to be the true drivers of innovation, indicating thereby the complexity of agricultural innovation systems and the numerous interdependencies that are built into the systems. Stability was a recurrent issue, as farmers need access to basic services and resources as well as the right to organize themselves to drive any process. The importance of teaming and partnerships was highlighted, as well as funding, capacities, access to knowledge and farmer-to-farmer exchange. The importance of facilitation, providing a structured space for learning and, again, ensuring that farmers sit at the table, were also underlined.

Conclusions by the session's chair

There are five major points I noted from the two panels:

1. First and foremost, it is crucial to centre innovation efforts around the needs and priorities of farmers. For agricultural innovation systems to be effective, the full involvement of farmers is required, along the innovation continuum – from issue identification to adoption of innovation. This includes ensuring decision-makers understand the realities of farming.

2. While international efforts are required for sharing experiences, it is very important to work at the local, regional and national level to ensure agricultural innovation systems meet the needs of specific circumstances – there is no one-size-fits-all approach.

3. Fostering an enabling environment was highlighted both in the context of building effective innovation systems and in strengthening capacities to innovate. This was referenced in terms of dialogue and technical/science literacy, economic or social conditions, policies and regulatory frameworks that allow farmers access and choice to address their challenges and achieve their goals.

4. Communication and partnership, and the flows of communication and partnership, are very important. It was recognized that capacity to innovate requires skills beyond those of a technical or scientific nature: collaboration, listening to others' perspectives, securing the perspective of those that may not be heard traditionally – be they young farmers, women, smallholders or indigenous communities.

5. Measuring effectiveness of agriculture innovation systems was another theme discussed and the importance of establishing performance indicators that reflect the realities of specific categories of farmers. Innovation is not an end in itself; it must have objectives. For example, it may be a means to improve livelihood conditions of farmers by improving productivity and/or enhancing value added, the development of more sustainable agricultural practices or greater empowerment of farmers.

3.4 PARALLEL SESSION 4: REACHING MILLIONS OF FAMILY FARMERS: SCALING UP SUCCESSFUL INNOVATION

Background

There is no universal consensus on the definition of family farming. The International Steering Committee for the 2014 International Year of Family Farming defined it as follows: "Family farming (which includes all family-based agricultural activities) is a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, including both women's and men's. The family and the farm are linked, co-evolve and combine economic, environmental, social and cultural functions".[10]

Research and innovation are key drivers of the SDGs. Agricultural innovation is key to achieving SDG 1 (End poverty in all its forms everywhere), SDG 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) as well as SDG 12 (Ensure sustainable consumption and production patterns).

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From left to right: Robin Buruchara, Pamella Thomas, Bernard Rey, Iftikhar Mostafa and Leonel Osorio Quiñónez.

10 FAO. 2014. The State of Food and Agriculture: Innovation in family farming. http://www.fao.org/publications/sofa/2014/en/

Small-scale family farming is a reality that will be with us for the coming decades. Achieving SDG 1 requires a dual-track approach, making small-scale agriculture more efficient to increase net profits and offering opportunities for income diversification outside of agriculture.

It is often said that there are many innovations available and ready to be used on a large scale by family farmers, but these innovations either stay on the shelf or their adoption does not go beyond the "pilot" stage. Is this really the case? Are these innovations really adapted to the needs of small-scale family farmers and local entrepreneurs? And why is it that they are not adopted on a large scale?

The session

The session was chaired by Bernard Rey (Minister Counsellor, Head of Cooperation, Delegation of the European Union to South Africa) and moderated by Chris Burns.

The theme for the first panel was 'Replicating and scaling up successful innovation' and the panellists were Robin Buruchara (International Center for Tropical Agriculture, CIAT), Pamella Thomas (Agriculture Alliance of the Caribbean, AACARI), Leonel Osorio Quiñónez (Cooperativa Agrícola Integral Atescatel, Guatemala) and Iftikhar Mostafa (World Bank).

In their opening interventions, *inter alia*, Robin said that in order to ensure that technologies are not left on the shelf it is essential to have a clear mechanism linking the products of research to the end users and, secondly, that there is a demand from the end users, which is ensured by using a participatory approach in developing the technologies; Pamella said that scaling up innovation is very important but it has to be relevant to the end users and she described the recent adoption of blockchain technology for marketing three commodities in the Caribbean region, as marketing was one of their major challenges; Leonel described the challenges facing small farmers in the eastern region of Guatemala and said the farmers were really motivated to use innovation for production and marketing of their beans, and had adopted a biofortified bean variety; and Iftikhar argued that to increase uptake of innovations, it was important that: risk be reduced for family farmers (e.g. through financing mechanisms); farmers are connected to research, development and extension; there is demand for the innovation, and good communication about it; the innovation increases farm incomes; there are public–private–producer partnerships; and that the government provides the enabling environment that will promote innovation.

The first question the moderator asked the panel and the audience was to identify the bottlenecks for farmers to innovate. Several of the responses highlighted the importance of communication for innovation, particularly using farmer-to-farmer knowledge exchange approaches and practical demonstrations of the innovations. Other interventions suggested that free trade agreements, resulting in cheap imports and low prices for producers, as well as lack of access to finance can act as bottlenecks for farmers to innovate.

The moderator then asked the participants what needs to be changed to scale up successful innovations by family farmers. Several people said that knowledge exchange needed to be improved, where information technology could play a role but should not replace farmer-to-farmer exchanges or other learning processes. Some participants said a change in attitude and mindset was needed, of small-scale farmers who might have been doing the same thing for generations as well as of the different stakeholders in the agricultural innovation system, such as the farmers, researchers and government, who need to communicate and begin to work with each other. The government, through its tax policies and other instruments, can also stimulate farmers to innovate and a practical example of this was provided from the United States of America. At the end of the discussions. Roberto Ridolfi, Special Adviser on Strategy and Financing Development at FAO suggested a

Nobel Prize for access to innovation would be a good idea and, pending its creation, an international trust fund could be set up to foster the transfer and scaling up of innovation, possibly at the Rome-based UN agencies, as no such international mechanism currently exists.

The theme for the second panel was 'Bridging the knowledge gap: Learning from others' and the panellists were Dannie Romney (Centre for Agriculture and Biosciences International, CABI), David Hughes (Pennsylvania State University, United States of America), Severine von Tscharner Fleming (National Young Farmers Coalition, United States of America) and André Laperrière (Global Open Data for Agriculture and Nutrition, GODAN).

In their opening interventions, *inter alia*, Dannie shared experiences about a CABI plant health programme called Plantwise, where there is horizontal and vertical communication, within and between the stakeholders, which is demand-led and where digital tools are also used to link the different stakeholders; David argued that the fundamental constraint in the African landscape is the lack of extension officers and an integrated knowledge solution and he described the example of the PlantVillage platform, which diagnoses crop disease and has over 8 million users; Severine, noting that less than 6 percent of farmers in the United States of America were under 35 years of age, said her mission was to bring more brains, bodies and businesses onto the land and she described some of the new approaches that young farmers were using in areas such as land tenure, microfinance and development of farm tools; André told participants about his organization, which tries to break down silos and get people to transfer their knowledge using data as one of the channels to have large-scale impact, and he gave an example of cross-discipline cooperation, where analysis of signal data from cell phone towers is used to estimate rainfall in Burkina Faso, Chad and Niger.

The first question the moderator asked the panel and the audience was to identify the bottlenecks to accessing knowledge about innovation. Keys issues identified included that people may receive inconsistent, conflicting and confusing information from different platforms and that different kinds of people (men/women, young/old) tend to access information in different ways. Poor access to Internet was also mentioned as an issue, even in developed countries.

The moderator then asked participants how to overcome the bottlenecks in knowledge access. One of the key messages was that there is a need to communicate and share in different ways. Different communication tools, such as radio programmes, films, SMSs and podcasts, can be used depending on the target audience. Films on topics such as Fall Armyworm had been shown in the evenings to farmers, followed by an open discussion. The importance of "seeing is believing" was noted, so demonstration farms and peer-to-peer learning were recommended. An example was provided of agribusiness TV in Burkina Faso, where videos of young agribusiness innovators were very popular and inspiring other young people.

The moderator then asked participants about the use of effective and affordable digital tools to close the knowledge gap and get people to innovate. A wide range of valuable experiences were shared. It was reported that in Burkina Faso and Kenya, digital tools and platforms were developed for farmers but their use was very low because the farmers and their organizations were not involved in designing the tools. The importance of formatting, and the way the data are presented, was highlighted and successful examples were described, such as the use of a telephone hotline by farmers in Ethiopia; tablets by cooperatives in Thailand; and milk recording and payment services for dairy farmers in India.

It was also argued that there are increasing concerns about the amount and quality of information being delivered to farmers, as large numbers of service providers were starting to provide information to farmers, often free and for commercial purposes, and that quality of the information could be quite variable. Specific concerns were also raised about private sector ownership of farmers' data collected by high-tech tractors. The role of public sector organizations and FAO in supporting knowledge sharing was underlined.

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From left to right: Dannie Romney, David Hughes, Bernard Rey, Severine von Tscharner Fleming and André Laperrière.

The final question the moderator addressed to participants was about their recommendations to capture, document and share farmers' knowledge and learning on innovation to the benefit of other family farmers such as smallholders, youth and women. Responses indicated there are numerous initiatives worldwide of self-sufficient, self-financed platforms, including in Colombia (Cultivando Futuro) and Alberta, Canada. It was noted that data collected from farmers, for example regarding pests and diseases, could be potentially sensitive and have trade implications and that the data should be accessible through a platform hosted by a trustworthy public organization, such as FAO.

Conclusions by the session's chair

I'm going to provide one very clear message for each of the two panels, which had a common underlying starting point: 'It is often heard that many technologies are available, ready to be used at large scale, but remain on the shelf!'.

The first panel was on scaling up and replicating successful innovation. The clear message I took from here was the absolute necessity to appreciate well the needed balance between approaches that proactively promote innovation and technology and approaches which take much greater account of the requirements of the farmers. Maybe it is a switch of accent in terms of these two fronts: we do not need to replace one with the other, we need both to take into account diffusion patterns that differ from situation to situation. The fact that innovation is context-specific was very clearly put forward as a key principle.

The proactive type of approaches face multiple possibilities, from promoting faster innovation processes with the same limited population to a much larger number of actors in the value chains accessing innovation. Panellists stressed that upscaling and accelerating innovation has to take advantage of all the participants, through participatory processes around the innovation system, which in turn promote mutual learning and peer-to-peer learning. Thinking about the complex change of production systems, it is about moving towards a transfer of know-how rather than a transfer of the technology itself.

The question of demand was frequently mentioned, reflecting on trust and/or free choice for the smallholders about their options. Conversely, increasing demand can be instrumental to upscaling innovations.

Certainly what emerged from the first panel was the transition to the second panel on the lack of knowledge, this knowledge gap: in other words, in many cases, technology is not the limiting factor.

For the second panel, the key message I noted there was: Yes, indeed, sharing knowledge is crucial for innovation but, in itself, it is not sufficient for innovation. Obviously, the environment around the family farmers is as important for innovation as the knowledge itself. While knowledge is key for taking decisions on investments in labour or in capital, mitigating risks associated with these decisions can, in turn, leverage upscaling.

We heard about various ways of promoting knowledge in this panel; a new field of work is in progress, in which information technology and digitalisation are playing an increasing role. What was stressed was that, right now, we have an increasing number of digital platforms which make information and knowledge available. There are a lot of open source platforms and their numbers are increasing. For family farmers, panellists stressed that free access raises issues of trust, issues of quality and, in some cases, questions about the underlying interests of the provider that makes the information available. If we were to draw a parallel with the medical sector, it would be that we have heard the doctors talking about the risks related to self-medication which is allowed by open source data.

These digital platforms bridge the knowledge gap, but awareness raising about their underlying risks is required, as well as about the public goods they convey contributing to a sustainable agriculture. Considering this complexity, mapping the actors involved in the innovation process could assist policy-making.

3.5 PARALLEL SESSION 5: DRIVING SUCCESSFUL INNOVATION THROUGH EFFECTIVE DECISION-MAKING AND INNOVATIVE PARTNERSHIPS

Background

Many developing countries are as yet unable to harness the full potential of agricultural innovation to address their development needs. Challenges and opportunities for sustainable agricultural growth from local to global levels are increasingly complex and interlinked. This requires multi-stakeholder collaboration and partnerships for innovation processes based on joint decision-making on common goals, action plans, division of tasks, learning, etc. to induce and scale up innovations.

Effective decision-making in innovation processes to benefit the most vulnerable, requires the engagement of a wide range of actors, including smallholder family farmers, youth and women. Enabling policies are needed to create the conditions for innovation partnerships that contribute to pro-poor agricultural growth and the SDGs. Innovative partnerships can be key drivers of innovation processes and achieve impact through exchange of knowledge, information, technologies and practices as well through enhancing enabling policies and action plans.

Partnerships and alliances can be viewed as a voluntary association of partners based on mutual trust and an agreement on collaboration modalities. Partnerships require:

- a common goal while contributing at the same time to each institution's mandate;

- shared decision-making and responsibility;
- clear accountability and defined tasks;
- pooling of complementary resources (technical, financial, human);
- benefits for each partner (motivation to join the partnership);
- all partners to share risks and confront them together; and
- transparency.

Partnerships matter to unlock innovation to achieve the SDGs. Collective actions are required to remove barriers and address the constraints (technological, social, organizational, policy, etc.) that stifle the capacity of family farmers, and other stakeholders in agriculture and food systems, to innovate. Scaling up, which is fundamental, also requires that all innovation actors involved in the decision-making processes develop a better understanding of impact pathways as well as new partnership and business models involving the public sector, private sector, civil society and farmer organizations.

The session

The session was chaired by Carla Montesi (Director for Planet and Prosperity, European Commission Directorate-General of International Cooperation and Development) and moderated by Chris Burns.

The theme for the first panel was 'Driving successful innovation through effective decision-making' and the panellists were Roberto Rodrigues (Getulio Vargas Foundation, Brazil), Caleb Harper (MIT Media Lab, United States of America), Eve Luvumu Namutebi (Ministry of Agriculture, Animal Industry and Fisheries, Uganda) and Agung Hendriadi (Ministry of Agriculture, Indonesia).

In their opening interventions, *inter alia*, Roberto voiced his concerns that small producers, unlike big producers, may not be able to benefit from all the technologies available and he highlighted the key role that cooperatives can play in providing

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From left to right: Roberto Rodrigues, Eve Luvumu Namutebi, Carla Montesi, Caleb Harper and Agung Hendriadi.

technical assistance to smallholder farmers; Caleb said that with the use of robotics, artificial intelligence, chemical science, data science and biotechnology in the food system, we are entering the digital biologic era, urging that policy-makers need to seriously consider the issues of data availability and use, and he also highlighted the role of technology in making agriculture interesting for the youth; Eve underlined the importance of effective and stable decision-making and policies in a country like Uganda where 80 percent of the people derive their livelihood from agriculture, and that the policies need to be developed together with the family farmers; Agung described the realities of achieving food security in a country like Indonesia, with thousands of islands, and said that to develop effective decision-making, it was very important to treat the farmers as an actor and to motivate them to produce sufficient food by themselves.

The first question the moderator asked the panel and the audience was to provide successful examples where government policy encouraged innovation among family farmers. Numerous examples were provided, including introduction of the National Agricultural Extension Policy in Uganda in 2016 which led to funding and recruitment of extension workers and increased farm yields; policies in India to search for ideas and innovation from schools and to fund innovation at the district level; and public procurement schemes in Brazil where the government buys food directly from family farms for school meals, and also provides them with some technology.

The next question the moderator asked was about how the family farmers were involved in establishing these policies. Again, numerous experiences were shared. These included from Uganda, where farmers were involved in development of recent policies directly, by the government engaging with them in specific meetings, or indirectly, through reports from extension workers which bring feedback from the farmers to the ministry or by periodic interactions between high-ranking policy-makers and farmers; Kenya, where county governments organize meetings in the villages for the farmers to speak to the government about plans and what they want done; Burkina Faso, where farmer organizations were able to advocate and influence government programmes on agroecology; and Brazil, where family farmers participate in policy building through official channels, with the national cooperative organization participating in national policy building by law, and unofficial channels, through social movements which are not formal organizations but are powerful and can also participate in policy-making.

To conclude the discussions, the moderator asked the audience, based on their experiences and knowledge, for recommendations to decision-makers for designing policies that drive innovation for family farmers. Recommendations from participants included to ensure that farmers were part of the decision-making; and that the policies should highlight areas such as increasing farmers' incomes and ensuring their access to technology and digitalization.

The theme for the second panel was 'Building on innovative partnerships' and the panellists were Angelo Riccaboni (Partnership for Research and Innovation in the Mediterranean Area (PRIMA) Foundation), Judith Francis (Tropical Agricultural Platform (TAP) Steering Committee), Francisco Reifschneider (Brazilian Agricultural Research Corporation, Embrapa) and Nguyen Do Anh Tuan (Institute of Policy and Strategy for Agricultural and Rural Development, Viet Nam).

In their opening interventions, *inter alia*, Angelo highlighted that stakeholders in a partnership need to participate on an equal footing, that involvement of farmers is essential in partnerships for innovation and that emulation was an important driver of change; Judith recommended building on TAP, which developed a common framework on capacity development for agricultural innovation systems, and emphasized that innovation is context-specific, so scaling up innovation is not easy and innovative partnerships are challenging; Francisco urged that innovation in establishing partnerships is needed, describing the establishment of the Agricultural Innovation MKTPlace initiative as a good example of an innovative partnership, and emphasized the importance of trust, which is the outcome of concrete undertakings like transparency and shared governance; Nguyen, describing how Viet Nam moved from being a food-deficit country in the 1980s to a big

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From left to right: Francisco Reifschneider, Judith Francis, Carla Montesi, Angelo Riccaboni and Nguyen Do Anh Tuan.

exporter of agricultural products today, highlighted that partnership is very important for innovation and that innovation is very context-specific.

To open the discussion, the moderator asked participants to provide a concrete example of a successful partnership that brought innovation for family farmers. They provided a wide range of examples. These included TAP, where experts from over 40 organizations came up with a common framework on building capacity for agricultural innovation systems, which is being tested in numerous countries; PRIMA partners who developed an online course on sustainable food systems according to a Mediterranean perspective; local government partnering with farmers in Italy so that a farmers' school was set up; the Capacity Development for Agricultural Innovation Systems (CDAIS) multi-stakeholder project in Rwanda, which allowed farmers to get good disease-free cassava planting materials; research and private sector collaboration in Ghana, resulting in supply of banana juice to supermarkets; the Foundation for Food and Agriculture Research (FFAR), a partnership between government, research institutes and private sector in the United States of America to encourage young people to get into agricultural research; the Water Efficient Maize for Africa (WEMA) project, which is a public–private partnership delivering seeds to smallholder farmers; partnership between farmer groups and consumers in the Republic of Korea, so healthy produce can be provided directly to urban consumers; partnership between academia, farmers, government and civil society in Iran (Islamic Republic of) in evolutionary participatory plant breeding; partnership between small-scale farmers, a research institute and a university in Uruguay to improve varieties of potato, sweetpotato and onion; and partnership between research and the private sector in Turkey to improve chickpea varieties.

The moderator then asked participants about the key characteristics of a successful partnership for innovation. The importance of facilitation or brokerage, to ensure that everyone can participate and share, was highlighted in particular. Other important characteristics mentioned were clear deliverables; a good business case; a clear and realistic financial structure; an open space for dialogue and learning; recognition and appreciation of each party's knowledge; and trust.

The third and final question the moderator asked the participants was about their recommendations to enhance existing and create new partnerships for innovation. Above all, participants highlighted the need for long-term commitments to building up and sustaining partnerships. It takes time and repetitive interactions to make them work. Empowerment of the actors was also underlined, together with recognition and respect for the roles of the different stakeholders. Participants also recommended the need for clear metrics, including what needs to be done and when, as well as monitoring and evaluation.

Conclusions by the session's chair

There are two important take-home messages from our session.

First, that innovation for family farming is not only a question about new technology but it is also about creating innovative partnerships. Of course, these partnerships can take different forms, but there are common factors that we have to consider in order to achieve successful innovation. These factors include clear objectives and deliverables, a realistic financial architecture, professional brokerage and facilitation, and open space for dialogue and learning. But successful partnerships are also based on trust and on equality of partners and this requires time and long-term engagement from all partners that are involved.

The second message is that no one size fits all and that innovation is context-specific. This implies that we have to take into account the difference between farmers and we need to understand the local conditions and to use a bottom-up process to articulate the needs for innovation. This was underlined different times.

We mentioned the risk that we face today that farming is for old people and here, once again, innovations are key to make farming attractive for the youth. We have to all engage in the creation of more jobs for the youth in order to give them a better perspective for their future and this implies, as we have done in this symposium, that we need to have the youth engaged in the partnership at the early stage. They also need access to finance and this will require working on innovative financing instruments. I personally support strongly the proposal we just listened to from the youth session including the recommendation to set up a youth council here in Rome and I think the youth have to be the priority in our reflection and looking to their future.

3.6 PARALLEL SESSION 6: INCREASING ACCESS TO MARKETS AND ENGAGING THE PRIVATE SECTOR TO ACCELERATE INNOVATION

Background

The 2030 Sustainable Development Goals (SDGs) clearly define the need for more constructive relationships between public policy, the private sector, research, science and education, for all sectors including agriculture. Achieving the SDGs will need linkages between these stakeholders that collectively focus on solutions that combat climate change, generate employment for young women and men, while ensuring access to sufficient and nutritious food for all.

However, involving private sector interests in the design and management of public goods such as food security and natural resource management through agricultural research and development is complex. It requires well-planned processes adapted to each country, strong political will as well as a commercially-led approach to agri-food sector development. While innovations need to be guided by public good priorities, research, science and evidence-based analysis needs to be unbiased and relevant to the food and agriculture industry and food consumers.

Innovation in agriculture cuts across all dimensions along the entire value chain – from production to the management of inputs and resources, to organization and market access, including applying new knowledge and practices or simply engaging with markets in new, more rewarding ways. One fundamental driver for all innovators, including family farmers, is access to markets that contribute to sustainable economic growth and poverty reduction for farmers. Farmers with access to markets, including local markets, for their produce (be they food staples or cash crops) have a strong incentive to innovate.

Technologies help farmers and food enterprises to produce marketable surpluses sustainably, add value and access valuable knowledge. Innovation and markets depend on, and reinforce, each other. Investments in physical and institutional market

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From left to right: Marco Alberti, Margaret Nakato, María Cristina Boldorini, Jyoti Macwan, Patrick Struebi and Hlami Ngwenya.

infrastructure are essential to allow family food enterprises access markets. Producer organizations and food processing associations can also play a key role in helping family food enterprises link to input and output markets, increase their bargaining power and enter niche markets.

Private sector actors are very diverse in form, scale and modes of operation. Depending on the context, they may include small, medium or large food processing or trading enterprises, service providers, food exporters, individual agripreneurs, producer organizations, as well as family farmers.

An enabling environment for investments in innovation for the agriculture sector requires good governance, stable macroeconomic conditions, transparent legal and regulatory regimes, secure property rights, risk management tools and market infrastructure. To ensure the enabling environment is responding to the needs of value chain actors and food consumers, more systematic consultation with the private sector is required when designing public policy frameworks and strategies.

The session

The session was chaired by María Cristina Boldorini (Ambassador and Permanent Representative of the Republic of Argentina to FAO) and moderated by Hlami Ngwenya.

The theme for the first panel was 'Increasing access to markets and targeted strategic investments' and the panellists were Jyoti Macwan (Self-Employed Women's Association (SEWA), India), Margaret Nakato (World Forum of Fish Harvesters and Fish Workers), Marco Alberti (Ente nazionale per l'energia elettrica (ENEL), Italy) and Patrick Struebi (Blooom).

In their opening interventions, *inter alia*, Jyoti described the successful Rural Distribution Network (RUDI), launched by SEWA, where small-scale farmers produce, process, package and market their produce, which led to recognition of the women as farmers and strengthening of the village economy; Margaret said that participation of small-scale food producers in some value chains can be a challenge because they do not have a voice, but when they process and market the produce themselves, like fishers in Ecuador and women who collect clams in Tunisia, they can be very beneficial; Marco provided three key messages, namely that we need a new paradigm of public–private cooperation, no innovation is possible without sustainability and we need to enable the capacity to innovate; Patrick noted that small-scale farmers often sell an excellent product to intermediaries or to local markets at very low prices and highlighted that technologies which link farmers directly to markets can be a game-changer.

The first question the moderator addressed to the audience was to ask them to share successful examples of public–private partnerships that promote innovation for sustainable food systems. Examples they provided included farmers in China and the Philippines who are using drones to move high-value products, like fruit and vegetables, to market into e-retail chains and the FOODBOWL facility in New Zealand, where producers can access production facilities and food safety expertise to test whether new food products might be suitable for release on the domestic or international market.

The moderator then asked participants how public investment can be deployed to foster innovation for the development of sustainable agri-food systems. The importance of public investment was highlighted in several interventions, particularly investments in infrastructure such as roads, but also in social security, schools and in building capacities, such as business management skills. The government's role was considered essential in many areas, including creating enabling policies for smallholder farmers, so they are encouraged to produce and innovate and that they have access to markets; and reducing the risk for farmers. It was also noted that, at least in some cases, governments seem to be pulling away

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From left to right: Bram Govaerts, Michael Sudarkasa, María Cristina Boldorini, Ayşe Sabuncu, Michael Keller and Hlami Ngwenya.

from their role in investments and leaving it to the private sector, which was not considered ideal as the private sector will focus on areas where profit can be optimized.

Participants also noted that it was not just about private versus public investments and that other models existed for family farming, such as an example of community-supported agriculture from China where consumers pay in advance for some years of produce as an investment for the farmer. It was also noted that the biggest investors in agriculture are the farmers themselves. The importance of small farmers organizing themselves was also underlined as this makes it possible for them to get loans from the bank.

The theme for the second panel was 'Engaging the private sector to accelerate agricultural innovation' and the panellists were Ayşe Sabuncu (Impact Hub Istanbul, Turkey), Michael Sudarkasa (Africa Business Group, South Africa), Bram Govaerts (International Maize and Wheat Improvement Center, Mexico) and Michael Keller (International Seed Federation).

In their opening interventions, *inter alia*, Ayşe reminded participants that the 'private sector' includes many different kinds of entities, including entrepreneurs who are a big player that needs to be brought to the table when discussing solutions for small-scale farmers, following the principles of transparency, collaboration and co-creation; Michael Sudarkasa explained why innovation was important in the African context and described five key areas where the private sector can play a role, namely provision of energy, provision of capital, creating infrastructure, capacity development and promotion of good practices and models; Bram outlined the need to develop and catalyse working and resilient agri-food systems, and described the successful experience of the Sustainable Modernization of Traditional Agriculture (MasAgro) programme in Mexico, involving a large network of partners which generated a safe innovation space with multiple benefits for smallholder farmers; and Michael Keller described the diversity of the private seed sector, where there are nearly 8 000 companies, including those that are local, regional and sub-regional, cooperatives and multinationals, and highlighted that the farmers are seen as a partner rather than a client by the seed sector.

In the subsequent discussion with the audience and participants, the moderator asked first about practical ways of engaging the private sector in the development of policies and national agriculture strategies that also protect public goods related to sustainable agri-food systems development. She then asked whether enough was known about the plurality of private actors to promote their role in innovation, what the knowledge gaps were and how the gaps could be addressed.

During the lively debate a number of key issues were raised. One was about the large heterogeneity of the private sector (ranging from small companies, which could close from one year to the next, to very powerful multinational companies) which needed to be considered when discussing the 'private sector'. Another was the differing perceptions of the big companies, where some participants argued they were part of the problem and that their actions had damaged smallholder farmers while others argued there were too many prejudices against them and that profits were important for them but it was also important for them that the farmers were profitable, so it was a win–win situation. Given these different positions, some participants highlighted the importance of having an open space or hub for dialogue, and that FAO might be an appropriate host for these kind of discussions.

Other points raised in the discussions included the importance of financial sustainability of farmers, which could be a big factor if young people were to remain farming. Regarding policy, the example of Canada was provided to show the importance of a government having a representative mechanism where the views of everybody could be heard. It was also noted that government policies could not fully satisfy everyone and that policy choices were needed. Thus, if the government's goal was to resolve problems related to family farming, the policies needed to be developed with this focus in mind.

Conclusions by the session's chair

There are five main points:

1. Producer organizations, especially cooperatives, are essential to face the challenges of small-scale farmers, especially when it comes to increasing investment in innovation. We addressed how small innovations along the value chain have improved the quality of their production.

2. Government investments and public policies are needed, such as investment in infrastructure, capacity building and other areas such as public procurement schemes for small-scale farmers. This would enable small-scale farmers to have access to local markets and boost contacts between them and the consumers.

3. Innovation and new technologies are crucial in order to maintain the competitive edge of small-scale farmers and promote sustainable production. Here, we discussed sustainable agriculture and energy, and water. Generating employment opportunities for youth is essential because young farmers have to feel that farming is attractive and that they can make a living from it.

4. FAO is the organization per excellence that allows small-scale farming and family farming to benefit from the impact of innovation and therefore South–South and triangular cooperation is a fundamental tool for the transfer of technology and innovation between developing countries.

5. Producers, entrepreneurs and small-scale farmers should be provided with a full range of tools and approaches for sustainable agriculture, giving them the possibility to choose the most convenient pathway for their development. This will only be achieved through a coordinated effort involving governments, academia, the private sector, civil society and, of course, international organizations such as FAO.

3.7 FEEDBACK ABOUT FAO FROM THE PARALLEL SESSIONS

One of FAO's major roles is that of a neutral broker. In organizing this international symposium, FAO provided a neutral forum where the representatives of its member countries and of other key relevant stakeholders could meet to exchange knowledge and experiences and learn from each other about agricultural innovation for family farmers. In organizing the symposium, FAO deliberately kept out of the limelight. No FAO staff were invited to be keynote speakers, panellists or chairs in the many sessions of the symposium and the moderators did not ask participants in the parallel sessions to address any specific questions about FAO's role or activities in agricultural innovation. This was done because FAO wanted to ensure that all representatives of innovation actors, including governments, intergovernmental organizations, civil society organizations, private sector entities, academia and research institutions, and producer organizations and cooperatives, would take ownership of this first International Symposium on Agricultural Innovation for Family Farmers.

Although FAO stayed out of the limelight, several interventions during the parallel sessions expressed appreciation for different aspects of FAO's ongoing work regarding agricultural innovation, as well as provided suggestions for what FAO should do in the future. This feedback is summarized here.

Feedback about FAO's ongoing work on agricultural innovation

Different participants expressed their appreciation for FAO's work on documentation and knowledge sharing, including documentation of innovations that are ready to be applied under different conditions (feedback provided in parallel session 1); assessment of the actors providing advisory services (parallel 2); the Forest and Farm Facility, where farmers across countries and regions share knowledge and technologies (parallel 2); and the Fall Armyworm Monitoring and Early Warning System (FAMEWS) portal which maps data on Fall Armyworm infestations (parallel 4).

FAO's role as an important development partner was also recognized, including with the Government of South Africa in surveillance of the Fall Armyworm (parallel 3) and the Ministry of Agriculture in Uganda, the PRIMA Foundation and the Agricultural Innovation MKTPlace initiative (parallel 5).

FAO's work on capacity development for agricultural innovation systems was also commended. FAO's role as host of the Secretariat of the Tropical Agricultural Platform, which aims to improve coherence and coordination of capacity development for agricultural innovation in the tropics, was appreciated as it gives the platform a more global framework to further the innovation agenda (parallel 5). FAO, together with the European Alliance on Agricultural Knowledge for Development (AGRINATURA), has also been running the successful EU-funded Capacity Development for Agricultural Innovation Systems (CDAIS) project which is operating in eight developing countries (parallels 2 and 3).

Finally, FAO's role as a neutral broker in bringing together representatives of different state and non-state bodies at the symposium and providing them with the platform for an open dialogue to share knowledge and experiences, network and learn from each other about agricultural innovation was highlighted in most parallel sessions. These sentiments were expressed eloquently by Thomas Duffy (Chargé d'Affaires, US Mission to the UN Agencies in Rome) while chairing plenary session 4, where the findings of parallel sessions 3–6 were presented. In his concluding remarks, after listing the wide range of stakeholder groups present at the symposium, he said "This is why we have a Food and Agriculture Organization. Put another way, there's no other organization we can think of that could, with this type of convening power, bring all these voices under one roof. We thank the Organization for doing that".

Feedback about what FAO should do in the future on agricultural innovation

The most common suggestion that participants made was for FAO to play a role in providing governments and other stakeholders with platforms to facilitate knowledge exchange relevant to agricultural innovation (parallels 4 and 6). This was encouraged because of FAO's long tradition and successful work in facilitating multi-stakeholder partnerships and because it is a trusted institution.

Given the speed with which digitalization of agricultural data is moving and potential concerns about private sector ownership of the data, there was a suggestion for FAO to be involved in the issue of data access for farmers and interpretation of the data (parallels 4 and 5).

The importance of leadership was underlined and it was suggested that FAO should be more involved in innovation and should develop a clear strategy on innovation (parallel 5). It was proposed that FAO should have a role in investments. It was suggested that FAO can play a role in providing a framework for funding that is robust throughout political changes (parallel 3) and that an international trust fund could be set up to foster the transfer and scaling up of innovation, possibly at the Rome-based UN agencies, as no such international mechanism currently exists (parallel 4).

Given all the knowledge that has been created about capacity development for agricultural innovation systems through the Tropical Agricultural Platform, whose Secretariat is hosted by FAO, it was suggested that we should build on this platform (parallel 4).

It was also suggested that FAO is the organization per excellence that allows small-scale farming and family farming to benefit from the impact of innovation. FAO can catalyse and support South–South cooperation and triangular cooperation as a fundamental tool for the transfer of technology and innovation between developing countries (parallel 6).

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A discussion panel in the Plenary Hall, FAO headquarters.

3.8 YOUTH AS DRIVERS OF INNOVATION: INTERACTIVE EVENT

Background

Innovation has the potential to provide the stimulus for youth engagement in sustainable agriculture by increasing its attractiveness, creating decent jobs and providing new opportunities both in rural and urban settings. And young people have enormous potential to contribute to agriculture as drivers of agricultural innovation. However, especially in developing countries, they face numerous challenges in becoming successful innovators due to the lack of an enabling environment, access to adequate skills, finance and facilities, among others. With the rapid increase in youth population, there is a need to ensure that they become drivers and beneficiaries of innovation in a manner that can fulfil their goals and ambitions.

This two-hour event, which took place in the evening of the second day of the symposium and was moderated by Chris Burns, provided the space for the discussion between young participants of the symposium and experts in food and agriculture. The event was an opportunity to emphasize youth as drivers of innovation, as well as their perspective with regard to innovation in agriculture.

The session had two objectives. The first was to provide the youth with an opportunity to share their experiences related to opportunities, obstacles and challenges they encountered while initiating an innovative agricultural project. The second was for youth to discuss their ideas, challenge the outcomes of the symposium and ensure that their inputs were taken into consideration in the final session of the symposium. The event aimed therefore to identify and convey the key messages from youth on the role that innovation in agriculture can have in shaping their future and meeting their aspirations. These key messages were indeed reported to plenary session 5 the following morning.

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From left to right: Melissa Bozzolini, Alpha Sennon, Maycol Cano, Nikki Pilania, Severine von Tscharner Fleming, Maria Helena Semedo, Hans Hoogeveen, Kevin Kabera, Sara Kate Smith and Mwila Kangwa.

The event was webcast live. Interested students, researchers, agri-entrepreneurs and youth engaged in agriculture from all over the world were encouraged to join online and participate in the event with their questions via Twitter. The session was organized in collaboration with Young Professionals for Agricultural Development (YPARD), which took a particularly active role in the promotion and dissemination of the event through social media channels. Interpretation in English, French and Spanish was available.

The event

Maria Helena Semedo, Deputy Director-General, Climate and Natural Resources, FAO, gave the welcome remarks together with Hans Hoogeveen, Ambassador and Permanent Representative of the Netherlands to FAO, who also gave the closing remarks. The event was structured in two parts. The first was the Young Innovators Showcase, where young innovators presented briefly, both on-site and online, their agricultural innovations. The second part was dedicated to the Innovators Panel Discussion that featured youth participants alongside a selection of people who had been keynote speakers and panellists in other sessions of the symposium. The audience engaged in the discussion with their questions and comments.

The Young Innovators Showcase featured the following participants: Thort Chuong (University of California, Davis, United States of America [online]); Sara Kate Smith, (4-H Programme, Canada); Mabelle Chedid (Food Heritage Foundation, Lebanon [online]); Kevin Kabera (STES Group, Rwanda); Phillip Subu (Malaita Youth in Business Association (MYIBA), Solomon Islands [online]); Mwila Kangwa (Agripredict, Zambia); and Nikki Pilania (Chaudhary Agriculture Services Pvt. Ltd., India).

In his intervention, Thort presented his innovation carried out in Cambodia consisting of 'net houses', used as a barrier against insects that damage vegetables, thereby reducing pesticide use. Sara related how she campaigned for a new event that aimed to improve communication and professional skills of rural youth in Canada. Mabelle explained why she established her foundation to preserve and promote local food systems in Lebanon and reverse the trend of consuming

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Chris Burns, moderator.

fast food. Kevin talked about the BazaFarm technology that they have developed in Rwanda to help farmers optimize agricultural inputs, like water and fertilizers, using a solar-powered device based on the Internet of things. Phillip, online from the Solomon Islands, due to connectivity problems, could not fully explain his work in an agricultural-led social enterprise that works with young farmers. Mwila developed a diagnostic tool that farmers in Zambia can use to detect if a crop has been infected with a pest or disease by taking a picture with their mobile phone. Nikki told how she started a dairy farm in India's Uttar Pradesh State, which is now producing 500 litres of milk per day and she plans to expand.

The second part of the event featured the discussion between the young participants and a selection of panellists and keynote speakers from the symposium. These were Melissa Bozzolini (Luiss University, Italy), Alpha Sennon (WhyFarm, Trinidad and Tobago), Maycol Cano (4-H Programme, Nicaragua), Severine von Tscharner Fleming (National Young Farmers Coalition, United States of America), R.S. Sodhi (Gujarat Cooperative Milk Marketing Federation Limited (AMUL), India), Caleb Harper (MIT Media Lab, United States of America), Wang Qingyin (China Society of Fisheries) and Ruramiso Mashumba (Mnandi Africa, Zimbabwe).

In her intervention, Melissa underlined the need for behavioural changes in the way we relate to the planet in order to achieve Zero Hunger. Alpha said that we must start by reaching out to children to teach them about food and nutrition security. He used the example of the superhero AGRIman that they have created as a means to encourage youth involvement in agriculture. Maycol talked about the tutorial learning system called SAT (acronym in Spanish for Sistema de Aprendizaje Tutorial) that he uses for educational purposes in Nicaragua. According to him, investing in education and access to land are key issues for youth to get involved in agriculture. Severine underlined the importance of working together worldwide and making a concrete commitment towards responsibly managing what she called the "common land".

In his intervention, Sodhi emphasized the need to make agriculture attractive for young people and he linked this issue to ensuring sustainable rural development. Caleb brought up the topic of open technology and communities of knowledge exchange, so how to integrate new technologies and get youth to access them. He also emphasized the role of FAO as a convener for funding to reach young innovators. Wang explained that in China there is the "empty village" concept that describes the consequences for rural areas and agriculture of the massive migration of youth to urban areas. He also said he was bringing many lessons back to China from the symposium. Ruramiso wondered how to convey all the information learnt throughout the symposium so that other people learn and contribute to it, and said that the symposium could have also come up with a concrete action plan after compiling the information.

After the panellists' interventions, the moderator opened the floor for discussion. Questions and comments from the audience both on-site and online addressed diverse topics. There was a common theme on the need to facilitate access to funding for young farmers. In relation to that, FAO was commended as a key convener in the realm of food and agriculture to bring together different stakeholders that can fund projects. From the audience it was also stressed that it is crucial to build general support and trust towards young innovators. The creation of a youth council within FAO was also requested as a measure to guarantee that youth is taken into account. Further to this, it was also suggested that FAO should have staff in the country offices focusing on youth issues. The need to include and promote education in agriculture beginning at the school was also underlined as a fundamental approach to provide job opportunities for youth. Some ideas were exchanged concerning how to involve young people in rural areas that are illiterate or do not have a mobile phone in global dialogues or accessing online platforms or tools. The generational change in agriculture was another topic repeatedly mentioned because of the high average age of farmers worldwide.

In his closing remarks Hans Hoogeveen announced that the Netherlands and the International Agri-Food Network (IAFN) have taken the initiative to finance the setup of a Youth Council for the Rome-based agencies of the United Nations, so that the voice of youth can be heard in these institutions.

Key messages from the event

Nikki Pilania, one of the young participants in the event, presented the following summary to plenary session 5 the next morning:

It has been an honour and pleasure to be here speaking with various stakeholders present at FAO and on behalf of youth that were invited to present their insights into agriculture from 12 different countries of the world, I thank FAO for giving us this opportunity to present the reality that is there on the ground. Thank you so much.

So yesterday we had a youth event that lasted about two hours and there was a discussion on the challenges and opportunities that are there in agriculture. We have been discussing for the last two days how important the role of youth is, and will be, in agriculture. Given the fact that agriculture now has an increasingly ageing population all over the world and lack of interest of youth in agriculture makes it even more important to facilitate for various international organizations and other stakeholders to provide the enabling environment to youth.

So there are various things that we can do. Something that we can do immediately is to identify the people who are already involved in agriculture in different regions of the world and see how we can support them so that they can grow and contribute directly in rural parts to uplift with other farmers the livelihoods of others.

So a few things that came out of the event were that we need to create youth forums and youth council so that the youth representatives from different nations of the world can discuss the insights, the work that is happening at national level, at local, regional level directly with FAO. So there should be increased involvement of youth in policy-making and directly with the other stakeholders which is very, very important.

The second thing is youth often needs a collaboration. It is very difficult to grow, to scale up if you do not have collaborators, if you do not have a team. Alone we cannot do much. So how can FAO and different governments ensure that collaboration, that partnerships, happen? So, this was another important thing because FAO has strong networks, governments and private organizations have networks but that needs to be provided to the young agripreneurs in their field and that will enable them to grow faster and directly bring impact on ground.

The third thing that was discussed is that innovation has to happen on the production side. If we see in agriculture where the flow of capital is coming, there is lack of capital, lack of access to finance is a major obstacle. So there can be financial forums directly communicating with the young agripreneurs and providing the networks on whom they can approach to grow their respective agricultural ventures. This was a third point.

Incubation centres can be promoted providing training to the young agripreneurs on writing business proposals, on upscaling their skills so that will also contribute to their skills and will enable them to grow and contribute in much bigger way. That was the summary.

3.9 WHAT'S COOKING? DISHING UP INNOVATION: A CONVERSATION BETWEEN CHEFS AND FAMILY FARMERS

Background

This lunchtime event was a dynamic, interactive discussion between chefs, family farmers and the audience. Its aim was to look at ways in which chefs and family farmers can jointly drive, support and contribute to innovation for sustainable agriculture and food systems, nutritious and affordable food, and food security – especially for family farmers as a vital source of healthy, accessible and sustainably-produced food. This can include self-sustaining information sharing networks, better access to markets, creating and benefiting from new market opportunities, and promoting local culinary traditions, including unused and forgotten foods.

Chefs play a key role across our food systems, connecting the farmer with the consumer through the creative process of cooking. Chefs not only help feed people, they also feed trends and influence markets and can contribute to building a more sustainable food system and healthier diets.

The event consisted of a one-hour talk show style discussion moderated by Hlami Ngwenya. As panellists, there were four chefs and two family farmers. The event was widely promoted through social media with a Facebook live streaming and a Twitter wall, as well as a live webcast. People were able to watch the event live around the world and post questions that were addressed in the session.

The event

Hlami welcomed everyone to the session, noting that by bringing farmers and chefs together it was getting the field to meet the fork. She began by asking each of the four chefs what innovation means for them.

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From left to right: Hlami Ngwenya, Leire Arana, Kim Palhus, Anahita Dhondy, Maria Helena Semedo, Elijah Amoo Addo, Bela Gil and Andrea Gaudenzi.

Anahita Dhondy, from India, highlighted that chefs are at the crossroads between farmers and consumers. According to her, innovation is to cook delicious food and to bring to the table neglected traditional foods like millet, so that consumers can appreciate them and start cooking them at home. This benefits the farmers, the climate and everyone, she said.

Elijah Amoo Addo, from Ghana, said that innovation in agriculture means introducing new practices or technologies to ensure that agricultural production, processing, as well as food consumption is done in a more sustainable and efficient way. He stressed the important role that chefs and street food vendors have in feeding people who might not have the time to cook at home.

Bela Gil, from Brazil, underlined the importance of biodiversity. She noted that we eat less than 1 percent of about 300 000 edible plants. Chefs have to innovate in the kitchen; farmers have to innovate on the land; and consumers have to innovate in the plate, by eating new foods. We should embrace nature, not work against it, that is the real innovation in agriculture, she said. Agroecology is one way to improve and preserve biodiversity. She also used millet as an example of a neglected food that people were starting to discover and enjoy in Brazil.

Kim Palhus, from Finland, said it was exciting for him to go to a farm because there is always something new to discover. There are numerous innovations from farmers and small-scale farms, and he provided an example of oats in his country. He stressed the importance of quality, giving better taste, less waste and more appreciation for the food.

The moderator then gave the floor to the two family farmers, asking them what innovation in agriculture means for them. The first was Leire Arana, from Valle Salado de Añana in Spain which has been designated as a Globally Important Agricultural Heritage System (GIAHS) by FAO.[11] The second was Andrea Gaudenzi, an Italian olive oil farmer from the slopes between Assisi and Spoleto, a site that has also been designated as a GIAHS.

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Chef Kim Palhus interacting with some participants during the event.

11 http://www.fao.org/giahs/giahsaroundtheworld/designated-sites/europe-and-central-asia/en/

Leire highlighted that price is not the only relevant factor for the consumer but that quality is also important. The salt they produce in this Spanish valley is highly appreciated and she said they had an alliance with a gastronomic university and with chefs. Innovation was very important because it made it possible to use by-products to make new products.

Andrea noted that innovation has been very important, as it led to new systems of olive oil extraction which greatly increased quality. So, he said that technology is needed to improve quality. However, in olive oil production, he emphasized that it was also important to preserve tradition and to maintain artisanal characteristics.

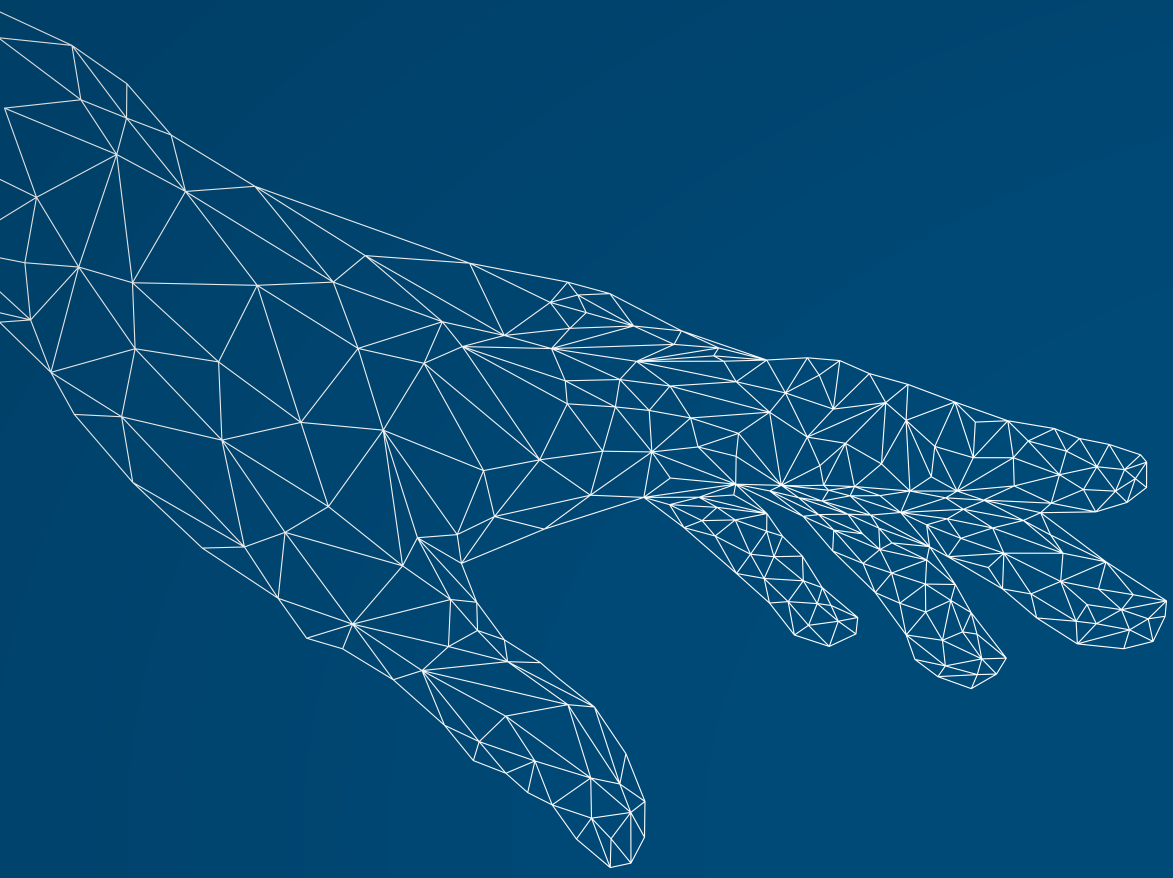
The discussion was then opened and the moderator gave the floor to the audience both on-site and online for their questions. Food waste was a key issue during the conversation. Bela and Anahita described how to reduce food waste in the kitchen by using edible parts of the food that are often wasted. The traditional way that subsistence farmers in Africa dealt with food was described by Elijah as a positive model. He also said that consumers should be more inquisitive with chefs, to ask about the source of ingredients and that chefs should be able to respond to such questions. That is why chefs and family farmers need to work closely together and be "the best of friends".

Accessibility to good, nutritious and non-expensive food was another major topic of the discussion. Social media was commended by Anahita and Bela as a key channel to help bridge the gap between consumers and farmers and improve accessibility through conveying knowledge about methods and techniques. Related to this, the discussion also touched upon how chefs can promote healthier and more nutritious food. Kim stated that non-processed food in the Nordic and Finnish diets are a good example of this. He said that it is not necessary to have high-class restaurant preparation to eat healthy food. Regarding waste, he also noted that people tend to buy too much when food is on offer.

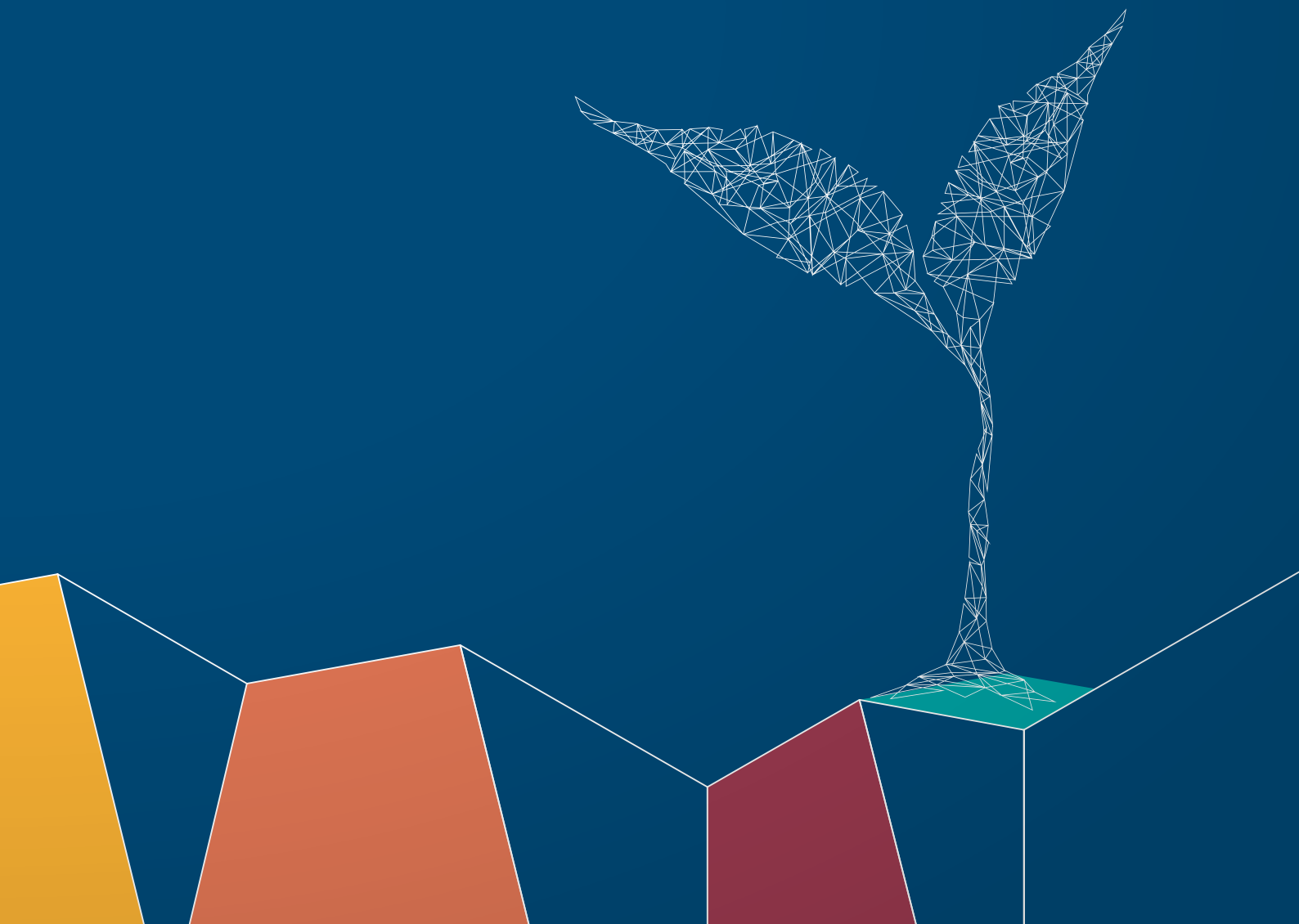
Elijah explained the need for chefs and the owners of restaurants and hotels to work together. He described the positive case where he persuaded restaurant owners to use an underused grain called fonio leading to a successful cooperation that was built with the fonio-producing farmers. Chefs therefore need to convince business owners of the profit they can make from innovations in the kitchen. He stressed that food does not need to be publicly well-known or advertised to be good quality. Anahita and Kim insisted that, in order to achieve Zero Hunger by 2030, chefs need to listen to and work with farmers.

Closing remarks

Maria Helena Semedo, Deputy Director-General, Climate and Natural Resources, FAO, gave the closing remarks. She explained the origin of this event that brought together farmers and chefs, saying it was the first time that such an event had been held in FAO. She highlighted some of the key topics that were discussed, including the importance of the quality of food, its nutritional value, and its relation to how we preserve the environment and biodiversity while creating income for family farmers. She linked it also to traditional knowledge, which was mentioned often during the event. Respect for culture and, at the same time, the need to sometimes change culture is essential. She also underlined the importance of the media and social media in changing the way we consume food, the way we cook and making food more nutritious.



CHAPTER 4.
HIGH-LEVEL SEGMENT



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4.1 STATEMENT BY NEVEN MIMICA

European Commissioner for International Cooperation and Development

Your excellencies,
Distinguished guests,
Dear friends and colleagues,

Today, hundreds of millions of family farmers face unprecedented challenges. Family farmers experience first-hand the effects of climate change, population growth, new pests and diseases. They know too well how drought and scarcity of natural resources causes poverty, hunger and malnutrition.

And their legacy is often at risk, with the average age of farmers worldwide continuing to increase. Fewer and fewer youths are interested in taking over the family farm from their parents.

At the same time, in seeking solutions to these challenges, we are discovering new opportunities. Collectively, we possess exceptional levels of knowledge, technology and capital. And urbanisation and growth will drive demand for farmers' produce.

So, why is it, that many family farmers find it difficult to grasp these opportunities?

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Neven Mimica

First off, public policies and investments in rural areas are often inadequate. Secondly, there is too little public sector research and too few extension services. And thirdly, innovation systems are not having the impact we need them to have.

The European Union continues to address all of these challenges. Between 2014 and 2020, we are investing EUR 8.5 billion in rural development, sustainable agriculture, food security and nutrition. And family farmers are our primary beneficiary group.

Our end goal here is to inch closer to achieving the SDG 2 of ending hunger, and indirectly contribute to all other SDGs. One solution lies in the rural transformation, with sustainable agriculture at its heart. To achieve this, one aspect is more critical than ever. This aspect is innovation, which is also the key topic of this symposium.

On the surface, an innovation is an idea implemented to solve a problem. But, putting this into practice is far more complex! Achieving success and having big, positive impacts on society lie in building knowledge and improving innovation systems. And making sure this impact is sustainable long-term requires creating better capacity for innovation at local level.

The public sector has a critical role to play in linking up key stakeholders – civil society, farmers' organizations and the private sector. Together we can build the institutional architecture to enable innovation to flourish. This will not only help smallholder farmers build capacity, it also provides incentives for them to innovate.

Research and extension play a central role in these innovation pathways. The institutional architecture operates at different scales, from the global to the national and local levels. However, many stakeholders involved are currently not equipped enough to address the challenges of supporting climate change adaptation and mitigation.

From a development perspective, our vision for innovation is to drive an inclusive, sustainable and climate-relevant transformation. A transformation tailored to local conditions, at farm level. And a transformation to allow family farmers' participation in value chains with strengthened relationships with agri-businesses on fair terms.

It is precisely with this vision in mind that the European Commission launched last year the DeSIRA initiative – Development Smart Innovation through Research in Agriculture. Together with a number of EU Member States and the Bill and Melinda Gates Foundation, we pledged around EUR 600 million to this initiative to boost development-smart innovation through agricultural research, capacity building, and more public and private partnerships and investment.

Within the DeSIRA framework, we will be supporting a range of institutions and programmes linking climate-relevant research and innovation to development initiatives. Many of the DeSIRA projects and programmes will kick off in 2019. This will include support to the tune of EUR 30 million to African research and extension organisations like the Forum for Agricultural Research in Africa and the African Forum for Agricultural Advisory Services.

Most of our support will be implemented at country level, where we will strengthen agricultural knowledge and innovation systems with targeted actions. These include actions in agro-forestry and forest agriculture, water management and rice farming systems, pest- and disease-control, and livestock management.

To give you a couple of examples of how we are rolling out these innovation initiatives in practice:

In Ghana and Ivory Coast, we will work with producers, traders and cooperatives in the cocoa value chains. With them, we will screen best practices and build on them to identify the most efficient farming systems. We want to be able to lower costs and optimise fertiliser use, as well as have the most effective responses to diseases such as cocoa swollen shoot virus.

In Burkina Faso, Mali, Niger and Senegal, we will help national plant breeders benefit from the latest advances in plant breeding through state-of-the-art tools and methodologies. This will help modernise the most important crops in the region – cowpea, groundnut, millet and sorghum – and make them more resilient to local environments and climate change.

We will then involve family farmers in these innovations through individual coaching, peer learning and exchanges, but also larger scale pilot actions.

In addition to the above mentioned projects, many others are in preparation worth about EUR 100 million in total, and covering more than 20 countries in Africa and Latin America.

Within the DeSIRA framework, it is only natural that we also partner with the FAO, other Rome-based agencies and partners in innovation systems analysis. This will include support in the context of the Tropical Agriculture Platform, as well as the Global Forum on Agriculture Research.

All of this will complement what we do with international research actors, such as the Consultative Group on International Agricultural Research.

This is also part of the bigger European Research and Innovation picture, in particular, the Horizon 2020 programme. Horizon 2020 is the largest source of public funding for research and innovation from the European Union, with nearly EUR 80 billion. Out of these funds, EUR 1.8 billion are contributing to research in agriculture and forestry in the period 2014–2020. And this amount is expected to increase for the next financial period.

And already next week, the European Commission will officially launch its "Knowledge Centre for Global Food and Nutrition Security". This central hub will gather, generate and make available state of the art knowledge and research insights for more efficient action and impact. Emphasis will be on partner countries where food and nutrition security and sustainable agriculture are priority sectors for EU support.

Achieving rural transformation and innovation will not be possible without private sector investments. However, investment in agriculture has a perceived high risk – both by banks and investors. Reducing this perceived risk is a key objective of our External Investment Plan.

On one hand, it will help support the improvement of the investment climate, but also help de-risk investments though the European Sustainable Development Fund Guarantee of EUR 1.5 billion. My personal ambition is that an important share of it goes to investments in agriculture.

To conclude, the route to rural prosperity and sustainable agriculture is complex and demanding. But, as I mentioned in the beginning of my intervention, collectively, we do possess exceptional levels of knowledge, technology and capital to make this happen.

Let us therefore strengthen our joint efforts in promoting and accelerating agricultural innovation for an inclusive, sustainable and climate-relevant rural transformation.

Thank you very much for your attention.

4.2 STATEMENT BY JOSEFA LEONEL CORREIA SACKO

African Union Commissioner for Rural Economy and Agriculture

INNOVATION OF FAMILY FARMERS: THE AFRICAN UNION EXPERIENCE

Introduction

I am delighted to join you this morning to discuss key initiatives currently going on at the African Union concerning agricultural innovation for family farmers. Family farmers are extremely important hence the United Nations declared 2014 as the International Year of Family Farming which was successful in raising global awareness on the important role played by family farming in eradicating hunger and poverty, providing food security and nutrition, improving livelihoods, managing natural resources, protecting the environment, and achieving sustainable development, especially in rural areas.

Family farming is the most predominant form of food and agricultural production in both developed and developing countries. FAO State of Food and Agriculture Report for 2014 indicates that there are over 500 million family farms. They make up over 98 percent of farm holdings, responsible for at least 56 percent of agricultural production on 56 percent of the land. Family farmers also work on a significant portion of the world's farming land. Regional averages are: 85 percent in Asia; 62 percent in Africa; and 18 percent in South America.

Innovation in family farms is thus crucial if we are to transform food systems, lift family farmers out of poverty and help the world to achieve food security, sustainable agriculture and the SDGs by 2030.

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Josefa Leonel Correia Sacko

Why innovation is necessary in Africa?

Africa faces a number of challenges in achieving food and nutrition security. Food production remains well below its potential. Africa has a quarter of the world's arable land, but only generates 10 percent of global agricultural output. In addition, more than 75 percent of total arable land in sub-Saharan Africa is degraded with nearly 3.3 percent of agricultural GDP lost annually because of soil and nutrient loss. Climate change has reduced cereal production levels by up to 3 percent, contributing to decreased food availability in the region and increasing the number of malnourished children.

Despite recent progress, a number of key biophysical, socio-economic and political factors continue to constrain African agriculture. Biophysical constraints to high yields include degraded soils, pests, crop disease and weeds. Ecological conditions in parts of the African continent are conducive to rapid pest growth, disease-causing and vectoring organisms and weeds whose recommended control methods are either unaffordable to the resource-constrained smallholder farmers, incompatible with their cropping systems, or are neither effective nor environmentally sustainable. Therefore there is an urgent need to inject innovation into family farming in Africa.

Efforts at innovation

The African Union has taken concrete steps, and has put in place both policy and strategic initiatives to drive innovation in Africa.

African Union Heads of State and Governments in January 2015 adopted a people-centred "Agenda 2063: The Africa We Want". As Africa's economic blueprint, it is intended to assist the AU in achieving its vision of "An integrated, prosperous and peaceful Africa, an Africa driven and managed by its own citizens and representing a dynamic force in the international arena" and deliver on the aspirations of African citizens and global expectations including the sustainable development goals in the face of a rapidly changing globalizing world. The AU Agenda 2063 recognizes science, technology and innovation as a multifunctional tool and enabler for achieving continental development goals.

The AU Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) places science, technology and innovation at the epicentre of Africa's socio-economic development and growth. STISA-2024 responds to the demand for science, technology and innovation from various impact sectors including agriculture. One of the priority areas is Eradication of Hunger and Achieving Food Security.

In my department which has been rechristened "Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment" as part of ongoing institutional reforms of the African Union, we have embarked on several initiatives.

A two-day high level meeting on Harnessing Innovation for African Agriculture and Food Systems was held at the African Union headquarters in Addis Ababa, Ethiopia on 25 and 26 November 2013. The main objective of the meeting, involving more than 40 senior officials including Ministers of Agriculture from the African Union member states, business people, farmers and academics, was to discuss recent models of success in African agricultural development and chart opportunities and challenges on the path ahead. The meeting was co-hosted by the then AU Commission Chairperson and former UN Secretary General and Head of the Kofi Anan Foundation, Mr Kofi Anan of blessed memory.

Among others, the meeting explored how to elevate the voices of Africans, from the smallholder farmer to Heads of State, to advocate for an improved framework for country level agricultural development, planning and implementation; further

equip these voices to better articulate their priorities to promote alignment among donors, the private sector, G8/G20, millennium development goals and other global mechanisms; develop and scale up innovative mechanisms for progress as well as explore emerging challenges including demographic shifts, population growth, climate change and evolving dietary preferences.

The global population is projected to increase from 7 to 9 billion people by 2050, with the majority of this growth in Africa. The food production needs to change to account for extreme weather events, climate change, decline in natural resources accessibility and quality (e.g. water, soil, biodiversity). In order to respond to those challenges, the EU–Africa High Level Policy Dialogue (HLPD) on science, technology and innovation has been working with African and European experts and policy makers to develop a research roadmap for joint action in the past two years. The EU–Africa HLPD had adopted the roadmap for the EU–Africa Research and Innovation Partnership on Food and Nutrition Security & Sustainable Agriculture (FNSSA) in 2016. The FNSSA has four pillars: 1) Sustainable intensification; 2) Agriculture and food systems for nutrition; 3) Expansion and improvement of agricultural markets and trade; 4) Cross cutting issues (includes ICT).

The African Union Commission in conjunction with the Food and Agriculture Organization of the United Nations (FAO) and the Government of Rwanda (GOR), in partnership with other organizations, convened a 2-day conference on Youth Employment in Agriculture from 20 to 21 August 2018 in Kigali, Rwanda. The theme was: Youth Employment in Agriculture as a Solid Solution to ending Hunger and Poverty in Africa: Engaging through Information and Communication Technologies (ICTs) and Entrepreneurship.

The role of digital apps and services in triggering innovations in the agri-food sector was a key underlying theme, with digital innovations such as FAO's newly launched Fall Armyworm Monitoring and Early Warning System (FAMEWS) and related "talking app" Nuru featured at the conference. The apps are designed to support farmers, agricultural workers and other partners to identify and report on fall armyworm infestation, which can quickly destroy large tranches of agricultural land and contribute to food insecurity.

While tractors are used to prepare land on over 60 percent of cultivated lands in Asia, the corresponding figure for sub-Saharan Africa is around 5 percent. Moreover, the use of draught animals in sub-Saharan Africa is minimal outside of Ethiopia – due in considerable measure to the tsetse fly. The result is that many African farmers deploy low-yielding techniques and may prefer slash-and-burn methods, a practice that entails poor productivity, repels youth and is incompatible with the continent's Zero Hunger goal.

Therefore, there is the need for innovation across all segments of the agricultural value chain – from the application of inputs, on farm production, post-harvest handling, including processing and marketing, and consumption of agricultural products. Using innovative approaches in carrying out these functions will help to make the African agricultural value chain more competitive, and more profitable for the many different actors whose livelihoods depend on these agricultural value chains.

FAO and the African Union on 5 October 2018 in Rome launched a new framework document that aims to increase agricultural efficiency and reduce drudgery by helping countries in Africa to develop strategies for sustainable farm mechanization. The Sustainable Agricultural Mechanization: A Framework for Africa (SAMA) is the result of discussions with policy makers from AU member states, the AU Commission, FAO and key partners. The new framework identifies 10 priorities for AU member states to include in their national plans, ranging from the need for a stable supply of machine spare parts and innovative financing mechanisms, and the importance of regional collaborations that allow for cross-border hiring services. It emphasizes that these strategies should cover the entire agri-food value chain, including harvesting, handling,

processing and food safety aspects, with an eye to reducing food losses, boosting rural employment and bolstering the links between farmers and consumers.

Messages to take forward

Innovation is extremely relevant for family farmers in Africa. Evidence has shown that under supportive conditions, agriculture in Africa can produce higher yields, generate adequate income for farmers, regenerate the natural capital and environmental services, and contribute to human development. Supportive conditions include active and effective research, sustained community participation, state support and progressive policies, adequate investment and multi-stakeholder partnerships across scales and between sectors. Where these conditions are met, agriculture-led growth generates substantial improvements to human well-being and helps meet a number of human development goals, including gender empowerment, poverty alleviation and food security.

We have demonstrated in this brief review that Africa indeed has several initiatives to boost innovation of family farmers. However, the translation of these decisions into concrete action remains a key challenge, especially as they need to be implemented at the national level. We need the support of all major stakeholders to implement these policies.

I thank you for your attention.

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4.3 STATEMENT BY SENZENI ZOKWANA

Minister of Agriculture, Forestry and Fisheries, South Africa

Introduction

South Africa is honoured to be part of this International Symposium on Agricultural Innovation for Family Farmers: Unlocking the potential of agricultural innovation to achieve the Sustainable Development Goals. The holding of this symposium by itself is a giant step as it reaffirms the commitment towards improved farming practices for our farming communities.

We want to congratulate the FAO and partners for the foresight in holding such a successful event. Most importantly, we appreciate that the FAO endeavoured to ensure that all voices are heard. The voices of farmers, be they big or small, but most importantly the focus on female farmers and youth. We also heard from academia, researchers and, of course, government.

At the outset, we also want to recognise the UN General Assembly's decision recently to proclaim the years 2019–2028 as the United Nations' Decade of Family Farming and we believe this is in recognition of the success of the 2014 International Year of Family Farming 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.

Views on the symposium

We have heard over the last two days the challenges faced by family farmers, be it security of tenure or simply access to land, financial support, access to markets and profitability. It is up to us to reinvigorate family farming as part of maintaining vibrant rural areas' ability to sustain livelihoods. Our people will thus choose to migrate, because they so wish and not because they face a difficult and deplorable existence currently experienced in most rural areas.

We have heard how partnerships, innovation, extension and research are necessary in the survival of family farmers.

South Africa joined the peoples of the world in committing to the Sustainable Development Goals (SDGs) of the United Nations towards ensuring that no one gets left behind. Of importance to us here, is SDG 1 of 'End poverty in all its forms everywhere' and SDG 2 of 'End hunger, achieve food security and improved nutrition and promote sustainable agriculture'. In South Africa, SDGs are aligned with the timelines of our socio-economic blueprint, the National Development Plan, as both are timed towards 2030.

Reflections on the way forward

The theme of the symposium is agricultural innovation and I thus address this theme. As governments, we are responsible for creating an enabling environment that will foster innovation in agriculture in support of family farmers.

We do so in the form of policy and legislative instruments. Indeed, the policy frameworks we formulate have to put family farming at the centre. We can only do this if we create smart partnerships with family farmers and other stakeholders in the public sector but also those that are in the private sector.

Policies need to address amongst others the following themes:

- access to finance for land, inputs, mechanization and operational capital;
- research and innovation to solve problems and horizon scanning;
- partnerships between government and non-government actors;
- participation in the entire agricultural value chain with specific support on access to markets;
- technology to improve productivity and profitability; and
- extension services for knowledge sharing.

We need a new dynamism in policy frameworks to ensure that policy has agility towards new knowledge generated and such knowledge is transmitted speedily requiring adoption of technology in the extension delivery mechanisms.

A simple example of such could be the use of short messaging services such as WhatsApp to communicate input prices, market pricing information, new diseases and pests identified or even weather information.

Secondly, although there is finance generally available, it is clearly not geared to address the concerns of family farmers as we have heard from this symposium.

Policy thus needs to address the unique situations that family farmers face daily and provide tailor-made financial instruments or solutions.

The lack of access to markets has created an unfortunate situation where family farmers become price takers and thus subject to the whims of the markets and value chain practices. We need to ensure that we impact market access issues

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Senzeni Zokwana

first through compliance to sanitary and phytosanitary requirements locally, regionally and internationally within the frameworks of the World Trade Organization.

We also need to focus attention on the challenge of private industry standards that are mostly competitive when initially these were meant to protect consumers.

The research and innovation agenda should respond to the material conditions including climate change, new pests and diseases, with the understanding that farmers also possess unique know-how accumulated from years of farming. So, research questions should not only be based on the need for new knowledge requirement based on a literature review but should address issues that farmers have on the ground. Thus research output will result in new seed varieties resistant to drought or pests, new approaches for extending shelf life or new formulations.

Lastly, I will speak to the need for the exchange of information or extension services. In South Africa we have even used peer-to-peer matching as a way of transmitting information between farmers, as an example.

Other ways include engagements with commodity organizations or groups and even between family farmer groups where farmer-to-farmer exchange of information, practices and even seed are facilitated. These practices show that extension delivery mechanism can also work beyond the usual expert-to-farmer mechanism. We have also in response to fall armyworms used the distribution of leaflets and radio broadcast to transmit information to farmers.

As I conclude and on behalf of South Africa, let me congratulate the FAO for a successfully held symposium. This symposium could not have come at a better time especially for family farming people, women and youth. A young family farmer who spoke here yesterday reminded us that we need farmers at least three times in any given day. I want to encourage all and state that pessimism is prime in farming and together we will do more, as we usually say in South Africa. I thank you!

4.4 STATEMENT BY AUGUSTINE AUGA MAEUE

Minister of the Ministry of Agriculture and Livestock, Solomon Islands

Thank you for giving me this chance to represent our family farmers and share something on behalf of my family farmers in this important forum.

Perhaps you do not know where Solomon Islands is? I flew 30 hours to be with you here in Rome. We do not produce one gram of CO_2 but we are the first victims.

Solomon Islands is a country of over 900 small islands – meaning that our family farmers are scattered around the country with no access to markets and infrastructures. Their only source of transportation to the main market in the capital city Honiara are two to three days of travel by boats or ferries.

Because they are only subsistence farmers, they often don't produce enough and they struggle to scale up to larger or commercial farming. They don't use fertilizers as they are expensive for them.

Challenges for these family farmers is reaching markets – and so an attempt to solve their problem is the creation of contracting networks where the government is working with the private sector to create supporting network for farmers so that the produce of our family farmers reach markets. These contracting networks are called 'Lead Partners networks'.

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Augustine Auga Maeue

The government and its development partners are supporting businesses around the communities where our family farmers live create networks of farmers. These small businesses are called the Lead Partners. These lead partners provide training to their networks of farmers, provide seeds and nursery services. They then buy the product of their farmers and sell them to buyers in Honiara or export them to buyers outside the country. This way, our farmers who cannot access markets have buyers right where they live.

If there was any innovation suggestions for Solomon Islands, it would be any innovation that will allow farmers to preserve their produce for days and still retain their freshness – will help our farmers greatly – but must be cheaper for our farmers.

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4.5 STATEMENT BY GILBERTO CORREIA CARVALHO SILVA

Minister of Agriculture and Environment, Cabo Verde

Excellencies,
Honourable participants,
Ladies and gentlemen,
Good morning everyone,

On behalf of the Government of Cabo Verde, I would first like to thank FAO for its invitation to attend this very important international symposium on innovation for family farmers.

I would like to stress that innovation for family farmers is indeed a very relevant topic, given the important role that family farmers must continue to play in meeting humanity's global food and nutritional challenges.

In Cabo Verde, more than 99 percent of farms are family farms, so when we speak about agriculture we speak about family agriculture. Although the country is dependent on importation of large quantities of food products, notably cereals, oils, fats and sugar, to meet its population's needs, about 34 percent of the population works in agriculture, which contributes about 8.2 percent of the GDP. The main agricultural activities are growing maize and beans during the rainy season, horticulture and irrigated fruit growing, as well as livestock.

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Gilberto Correia Carvalho Silva

Before talking about agricultural innovation, let me stress that the agro-ecological conditions for farming in Cabo Verde are difficult. The country is located geographically in the Sahel region of Africa and is therefore strongly challenged by drought and desertification. In addition, as a small island state, it is more intensely affected by climate change. I am talking in particular about increasingly frequent extreme weather and climate events, increased aridity, soil and vegetation degradation, salinization and ecosystem degradation, particularly in coastal areas.

These agro-climatic constraints have worsened, calling into question agriculture's potential. In this context, water scarcity is without a doubt the most limiting factor. The implementation of adaptation and resilience measures in the agricultural sector in the face of climate change is urgently needed. This requires a very strong commitment to innovation in production systems, including not only the introduction of appropriate technologies, but especially the adoption of new attitudes and practices by different actors, in particular by family farmers.

Ladies and gentlemen,

For Cabo Verde, innovation is of such importance that one could say it is a question of survival for the population, especially in rural areas. Efforts have been made, particularly in recent decades, to promote innovation. Allow me to quickly mention some innovations that have had the greatest impact on production systems in the country:

- the construction of a large series of water tanks, including family cisterns, which have often made it possible to increase permanent irrigation on family holdings and the watering of fruit trees;
- drip irrigation – irrigated croplands have benefited greatly from water saving, the expansion of holdings and increased production;
- hydroponic crops, which have yet to be consolidated, but which have great potential;
- the dissemination of protected crops, bringing many benefits in terms of production and protection against pests and diseases;
- the introduction and promotion of alternative energies in water pumping and distribution systems for irrigation. In addition to clean energy, alternative energy practices reduce production costs;
- the introduction of improved varieties of vegetables and fruit plants in terms of production, commercial value, nutritional quality and resistance to pests and diseases;
- micro-gardens in the context of urban and peri-urban agriculture – which need to be consolidated; and
- artificial insemination and breed improvement, especially in ruminants, with great benefits for livestock breeders.

At the preparatory and launching or dissemination stages, I can refer to the use of technologies for the safe reuse of treated wastewater for irrigation and the desalination of brackish water. Trials of hydroponic techniques for dissemination at the family farm level are also underway.

Of course, in these examples, I have mainly focused on technological innovations, given the natural and technical constraints that agricultural production encounters. However, family farmers are and must be at the centre of the innovation process, which includes of course other important aspects, such as respect for the environment.

Achieving concrete innovative solutions has not been easy. There are constraints related to the characteristics and the development level of the country. I am talking about being an island, difficulties in getting funding for family farms and for research and development, as well as institutional weaknesses that have a particular impact on capacity building, the dissemination of innovation, and support for the organization of the productive class, especially family farmers. Reducing these constraints and creating an environment conducive to innovation is a priority. On behalf of the Cabo Verde Government, I appeal to FAO and other partners to strengthen cooperation to accelerate agricultural innovation in our country. Special attention should therefore be given to the Small Island Developing States.

Before closing, I would like to take this opportunity to inform the participants about the holding of the first forum of The Global Framework on Water Scarcity in Agriculture (WASAG), which will take place on 19–22 March 2019 in Praia, Cabo Verde. The forum currently consists of 60 members and aims to share knowledge, best practices and innovative solutions for water management in the context of aridity and water scarcity.

Let me conclude by reaffirming the relevance of this international symposium. I congratulate FAO for this initiative, which serves as a de facto platform for knowledge sharing and for partnerships to unleash the potential of agricultural innovation to achieve the SDGs.

Thank you very much.

4.6 STATEMENT BY MANFRED ALBERTO MELGAR PADILLA

Vice-Minister of Food and Nutrition Security, Ministry of Agriculture, Livestock and Food, Guatemala

Good afternoon everyone. I would like to thank FAO for inviting me to this great event.

Innovation, the basis of agricultural transformation in Guatemala

Guatemala is a market of opportunities. The country has an estimated population of 17.5 million inhabitants. It is a country with great potential for investment in technology, research and business development. Owing to its geographical position, it is a strategic point for trade and it also offers a variety of microclimates which are ideal for diversifying agricultural production.

Innovation plan to revitalize agriculture

A plan has been launched to strengthen the presence of the Ministry of Agriculture, Livestock and Food through capable and well-equipped extension service members with new technologies to recover and create irrigation infrastructure; to ensure

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Manfred Alberto Melgar Padilla

the population has better access to more and better food; to drive the organization of agricultural value chains with food processing; and to protect animal, crop and aquatic resources through the prevention and eradication of pests and diseases.

Actions for innovation

- sustainable increase of family farming production for food security and nutrition;
- economic development and diversification;
- access to markets, credit and farmers' insurance for small and medium enterprises, and the inclusion of information about prices of agricultural products in the value chain through an app from the Ministry; and
- institutional strengthening.

Actions to foster agricultural innovation

- creating the economic conditions that reduce migration;
- adaptability and resilience to climate change;
- technical assistance and support;
- infrastructure and irrigation;
- good agricultural and livestock practices and good manufacturing practices;
- community, family and school vegetable gardens;
- youth and gender inclusion;
- productive value chains and farmer organizations;
- projects on capacity development on agricultural innovation systems, with CDAIS supported by FAO;
- the Consorcios Regionales de Investigación Agropecuaria (CRIA, Regional Agricultural and Livestock Research Consortia) programme and the Instituto Interamericano de Cooperación para la Agricultura (IICA, Inter-American Institute for Cooperation on Agriculture), with support from the Department of Agriculture of the United States (USDA); and
- technological and scientific innovation, such as the case of the Chortí bean, with high iron and zinc content values.

The goal is to develop the capacities for agricultural innovation and the achievement of upward social mobility. We seek upward social mobility of family farmers based on food production surpluses owing to the incorporation of good agricultural practices, irrigation, partnerships and productive infrastructure, among others.

In which areas are we innovating?

In subsistence family farming and the promotion for their transition to surplus production through:

- backyard poultry management;
- vegetable gardens with native plants;
- soil conservation;
- irrigation and water harvest and management;
- food storage;

- fruit tree nurseries; and
- others.

In market-oriented family farming, the country intends to specialize in competitive and high-quality standard agricultural production, according to international trade rules. There are products that can potentially compete in the domestic and international markets to fulfill the unsatisfied food demand, such as grains, mini vegetables and berries, among others. The construction of productive infrastructure such as technified irrigation systems and supply stockpile centres is required.

In agribusiness:

- financial strengthening of the government agencies in charge of epidemiological surveillance, food safety and pest and disease control; and
- streamlining of import and export processes of agricultural and hydro-biological products.

How do we move forward towards a new type of agriculture?

Guatemala is the fourth most vulnerable country to the effects of climate change in the world. This year, rainfall scarcity affected agricultural production and the only solution to this problem is to ensure access to water.

It is worth mentioning that we do not cause climate change, but we do suffer from its effects.

In this regard, the Ministry of Agriculture, Livestock and Food is implementing the Great National Irrigation Plan, through which, by the end of 2018, we will have reactivated 81 000 ha of different crops through irrigation. We expect to cover more than 100 000 irrigated ha in 2019.

We firmly invest in research and scientific innovation to develop staple grain seeds, green vegetables and tubers of drought-resistant varieties, under the leadership of the Instituto de Ciencia y Tecnología Agrícolas (ICTA, Agricultural Science and Technology Institute) of the Ministry.

The backbone of agriculture is extension services. The institutional presence in the field was broken up 25 years ago. We are recovering the coverage of technical counselling and support to agricultural production. To do so, we rely on the support of external cooperation – from FAO, the European Union, USAID and other cooperating partners.

This year, 340 professional extension service members were funded to guarantee agricultural innovation programmes. Local extension agencies have been strengthened. They are receiving training mostly thanks to FAO's support. Funding from the European Union has allowed us to renovate a small fleet of 11 trucks, and 90 pick-up trucks were bought to support the travel of extension service members in the field.

Recently, the Congress of the Republic of Guatemala passed the School Feeding Law. For the implementation of this law, we are working with schools through the Organizaciones de Padres de Familia (OPF, School Parents Organizations), in order to ensure full transparency in the local purchases of goods for school menus. This generates market opportunities for family farmers, represents a formal source of income generation, reactivates the local economy and improves child nutrition at school.

For that reason, the Ministry has certified more than 8 000 family farmers who are ready to supply schools with agricultural and livestock products. As part of the country's planning and organization of its productive capacity, the Ministry generated

a historic registry of more than 1.5 million family farmers. We are currently working on the classification of these farmers in order to determine the kind of assistance that they need.

The Ministry is currently fostering partnerships by financing 98 agricultural productive chains. Most of the funding goes, among other areas, to infrastructure development, equipment modernization, market research and transport.

At the global level, the opening to markets and new commercialization alternatives are a challenge for quarantine protection services. As part of the modernization project, we are building latest generation areas dedicated to quarantine treatment and international waste management in ports, airports and border posts.

Guatemala's main priorities for the next five to ten years

- operationalizing the 2018–2025 Science and Technology Strategic Plan;
- strengthening the Consejo de Ciencia y Tecnología (CONCYT, the National Science and Technology Council); and
- operationalizing the national innovation system and the national innovation and technology transfer subsystem.

Main challenges

- fragmented and dispersed innovation initiatives in general;
- resistance because of farmers' traditions to the adoption of new techniques of agricultural innovation related to different value chains; and
- lack of financial support for innovation-related public entities.

We would like to thank FAO and other partners for their solidarity and determined support. We hope to have continued support to achieve the Sustainable Development Goals, and to continue the strengthening of strategic programmes and projects for the Ministry, the country and the region.

Thank you very much.

4.7 STATEMENT BY ALESSANDRA PESCE

Under-Secretary of State, Ministry of Agricultural Food, Forestry and Tourism Policies, Italy

Good morning,
FAO Director-General José Graziano Da Silva,
Ministers and Deputy Ministers,
Ladies and gentlemen,

First of all, I would like to thank FAO for having organized this symposium on a subject that is very close to my heart, the theme of innovation and research. In my intervention I will try to talk about what we are doing in Italy in the field of research and innovation, focusing on three points:

A. strategic priorities in agricultural research;

B. activities to make research accessible to farmers; and

C. cooperation activities in the field of agricultural innovation.

Regarding strategic priorities in agricultural research, in Italy, the planning of research activities in the agricultural sector for the period 2018–2020 has as its primary strategic objective the sustainable development of agriculture and the agri-food system.

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Alessandra Pesce

We have identified four focus areas in relation to family farming:

1. climate and environmental protection;
2. digital growth;
3. conservation of genetic resources; and
4. promotion of the quality of agricultural production.

Regarding protection of agricultural and forest ecosystems, particular attention is given to water resources and to soil, themes which were already highlighted in previous interventions this morning. The latter is an irreplaceable resource for agriculture and also plays a highly relevant role for climate protection because it acts as a carbon sink. Another natural resource of considerable interest is water. On this topic, there is a very strong drive of research and innovation in Italy.

Regarding digital growth, this is the new frontier on which we must focus. We need to integrate new digital technologies with agricultural production systems and with the entire processing and distribution chain, through the development of knowledge and applications of modelling approaches, remote sensing and information technology for precision agriculture. Precision agriculture allows to reduce production costs, improve product quality, ensure environmental sustainability, and also reduce water consumption and harmful emissions.

The protection and preservation of the national genetic heritage is another relevant area.

The last area is about the importance and excellence of agri-food production. The diversity of the territory, crops and cultures is reflected in a rich variety of traditional products that represents an essential heritage of our *Made in Italy*. We need to focus on traceability in the value chain, to guarantee the geographic origin of raw materials and their characteristics, and for the consumer's protection.

It is crucial to make research accessible to farmers and to family farming. This is done through the promotion of European partnerships for innovation, networks of researchers, networks of farmers, consultants, with new models of research transfer.

We need to strengthen these public–private partnerships which involve research institutions, agricultural businesses, their associations and the agri-food industry, also through the contribution from the private sector.

Furthermore, I think that in order for the knowledge system to have the necessary and expected impact, we must continue to pay particular attention to the methods of information dissemination and sharing, keeping the focus on training farmers so that they can combine tradition with innovation and attract new generations to family farming.

We believe that sustainable growth is closely linked to innovative development and dissemination of knowledge. For this reason, we want to promote training not only in Italy but also to provide opportunities for young researchers from developing countries. The agreement that has been signed between FAO and the four Italian national research institutes dealing with agriculture and the environment, namely the Council for Agricultural Research and Analysis of Agricultural Economics (CREA), National Research Council (CNR), National Agency for New Technologies, Renewable Energy and Sustainable Economic Development (ENEA) and Italian Institute for Environmental Protection and Research (ISPRA), allows for concrete actions of international cooperation in the fight against hunger and the elimination of poverty. CREA with the other organizations has made ten scholarships available for young researchers from developing countries to be trained at these research facilities.

This is, in extreme synthesis, the Italian experience. Once again, I thank FAO for the opportunity of dialogue that has been offered to us. This symposium has reiterated the need for research and innovation to be at the service of farmers. We still need to work to create closer linkages between research and family farming, a production model that characterizes our country and the countries that participated today in the symposium. We are aware of the strong development potential of this model, which we must promote without neglecting the role of women and youth. It is a model that in more general terms allows us to fight hunger, combat climate change, have an efficient use of resources, promote profitability for rural areas and, in extreme synthesis, improve living and working conditions.

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4.8 CLOSING REMARKS BY JOSÉ GRAZIANO DA SILVA

FAO Director-General

Let me start by thanking all of you for your presence here, particularly the EU Commissioner, Neven Mimica; the AU Commissioner, Josefa Leonel Correia Sacko; the Ministers from South Africa, Solomon Islands and Cabo Verde; the Vice-Minister from Guatemala; and the Under-Secretary of State from Italy. I would also like to recognize the presence among us of Ambassador Inga Rhonda King, President of ECOSOC. I thank you very much for your presence and we noticed that you have been here since the very beginning with us. We appreciate that.

When I was entering the room, the Chair, the President of the Agricultural Research Council, gave me the summary that he is preparing. The first recommendation refer to "family farmers at the centre of innovation". I think this summarizes very well what we need to do. You have listened to the high-level speakers. They all mention the urgency that climate change is posing for family farmers. All of them ask for us to rush with solutions and to innovate. And, in fact, family farmers are among the most affected and the ones who have less resources to react to this new challenge posed by impacts of climate change. It is a complex issue, and we need to respond with new techniques and new ways of management. We need a farmer-led, inclusive innovation system that is done not for them but with them. Family farmers need to be part of this innovation system.

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José Graziano da Silva

The symposium gives FAO the potential to look for the drivers of innovation and also to unlock potential innovation for family farmers. We also took note of the importance of involving governments. It is fundamental to have adequate policies in place to implement new research approaches, to implement extension services and, of course, to make them available – to adequately provide financial support. This is what we intend to do in FAO. We'll be preparing to do this in the next years.

I would like to highlight also an important point. If you look at the definition adopted in this symposium, it says that "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". So this is very important, because innovation is not only about things, new things. Sometimes we believe that innovation is all about a new cell phone or a new something. It is not. Let me tell you about one of the most important innovations, in my opinion, for family farms that I saw in the last years. It is this school meal programme that buys the fresh products from family farmers locally and creates a market for them that was not there before. It also allows local development in these areas that are very deprived sometimes and could not be expected to have big investments from industry. So this is innovation, this is what we needed to look for.

I would like to conclude by saying that we took many lessons from this symposium. One of them is that if we look to the presence of youth, you see that it is not possible to separate innovation from youth or youth from innovation. They are together, they are connected, and we had an opportunity to see this. You saw the 12 youths that we brought from Africa that were the winners during the conference on youth employment in agriculture that we organized in Kigali, Rwanda. They are not asking for funding only, they are asking for opportunities to participate and collaborate. And they gave us good news: that not only older people remain in agriculture or are interested in agriculture. We can count on the youth also, if we provide them with adequate opportunities and jobs. I think this is a great lesson that we must take into account.

I would like to close by saying that we really appreciate your support, your presence. I take, for example, the interest the President of ECOSOC has shown in the work we are doing here. We will take this also to New York to inform the General Assembly about this symposium.

I would like to end by saying that FAO will establish a dedicated unit for innovation. During these three days, I have listened to the appeals made from different panels saying that we need a better coordination inside the house. And I agree with that, because we have innovation nowadays spread in all parts of the organization and we need something to connect them and to get them together and also to look ahead to what needs to be prioritized. So we will work on this proposal of this innovation unit.

And I also took the opportunity this morning, when I had Commissioner Mimica here in FAO to sign three new important projects for the organization, to speak about the innovation fund that we are looking to set up in FAO. We are calling for donations, particularly from the private sector, who need to be on board. More than ever, we need the private sector to bring us innovative approaches.

So, thank you all for your presence. For those that have come from different parts of the world, I wish you a safe trip home. And we count on you to promote innovation. Thank you.

ANNEXES

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ANNEX 1: DEFINITION OF AGRICULTURAL INNOVATION AND FAMILY FARMING[1]

1. WHAT IS AGRICULTURAL INNOVATION?

Innovation is a very popular term, used in many different circumstances, such as advertising, political speeches, national research programmes and academic articles. When used in everyday language, the term is often used generically to signify progress, improvement and novelty. While many different definitions of innovation are found in the literature, there is no single one that is widely accepted. People can therefore use different definitions and have a different understanding of what innovation means and what it encompasses. None of these definitions are incorrect – they are all equally valid.

As there is no universally accepted definition, it is essential for FAO to specify what it means by agricultural innovation when organizing the symposium. Put simply, innovation refers to 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. Putting it in the framework of agriculture, the working definition that FAO will use for the purpose of organizing this symposium is: *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.*

Novelty is a key aspect of the definition, i.e. although the products, processes and ways of organization may already exist, they are new to the individuals or organizations who are bringing them into use in a given location and context for the first time. Also, it is not restricted to use of technologies but also use of social, organizational, institutional or marketing processes or arrangements. Further details and clarifications regarding the definition used for the symposium are provided below.

Innovation versus innovations: While agricultural innovation refers to the process whereby new or existing products, processes or ways of organization are brought into use for the first time, the plural term innovations refers to the products, processes or ways of organization that are brought into use.

"New or existing": The products, processes and ways of organization may be new (never used elsewhere) or they may already exist (used before but not in this location and context). They are, however, new to the individuals or organizations who are using them for the first time in that context.

"Into use for the first time": Products, processes or ways of organization only become innovations when they are brought into use, i.e. when they are used by individuals or organizations, and when they are new to those individuals and organizations who use them for the first time. It does not, therefore, include products, processes or ways of organization which are at the conceptual, research, development or trial stage and have not yet been used in practice.

"In a specific context": Some products, processes or ways of organization may be already in use in a specific location and context. However, when they are brought into use in the same location but in a different context for the first time this

1 Definitions are from the FAQs prepared for the symposium: http://www.fao.org/about/meetings/agricultural-innovation-family-farmers-symposium/about/faq/en/

is considered to be agricultural innovation (e.g. if farmers in a certain region have been using biofertilizers for maize production and then begin to use them for the first time in the forestry sector).

"Products": The term 'products' in the working definition refers to a broad category that encompasses all final goods (e.g. an agricultural tool/machine or a new variety of fruit) and services (e.g. specific financial advisory services to farmers) destined to a market for consumption, including the technologies involved. Some other examples can be new biofertilizers, crop varieties, vaccines, conventional technologies, information and communication technologies (ICTs) or new radio programmes for farmers.

"Processes": The term 'processes' in the working definition refers to innovations aiming to improve, *inter alia*, the production methods (techniques, equipment and software used to produce goods or services) or ways of delivery (broadly speaking, logistics). Process innovations are often aimed at reducing unit costs for production or delivery, and improving products. Examples include ways of delivering farm produce to markets, grading farm produce into different quality classes or using new farming techniques that can boost yield.

"Ways of organization": The term 'ways of organization' in the working definition includes, *inter alia*, business practices or business models, workplace organization, institutional arrangements or improvements in different elements of marketing. Examples include producers organizing themselves in new ways to increase their bargaining power when buying inputs and selling their produce; reform of rural advisory services so they are more demand-driven and able to better respond to the needs of the farmers; and introduction of participatory research approaches so that research institutions and farmers work more closely together.

Sectors: Agricultural innovation encompasses innovation in the crop, livestock, forestry, fishery and agro-industry sectors, thereby encompassing use of new or existing products, processes and ways of organization by individuals and organizations in the different production systems and value chains of these sectors.

Knowledge: Innovation is made possible by knowledge. Generally speaking, the knowledge involved in innovation may be entirely new or it may be new knowledge combined with existing knowledge. This knowledge can come from one or a combination of different sources – from farmers and other individuals; formal scientific research institutions or other kinds of public or private organizations, including civil society organizations.

Invention versus innovation: An invention can be defined as a novel idea that has been given form (e.g. as a diagram, model or technology) which has potential for application. The term 'innovation', on the other hand, refers to the actual implementation of the invention into society. Only when used does an invention become an innovation.

Risk: Innovations are expected to be beneficial. These expectations may come, for example, from reports of experiences by individuals or organizations in other areas or from results of research trials. However, the innovations may turn out to be less beneficial than expected, or even not beneficial at all, for some or all of the individuals or organizations who use them. This may happen because it is the first time they use these innovations and some learning and adaptation to their current working practices may be required or because they have not been successfully adapted to the local context. Despite the expectation of benefits, there is therefore an element of risk involved in their adoption of the innovations.

Effects: Innovations can have large effects (so-called disruptive innovations, e.g. using a tractor in place of animal traction for farm work) or more gradual effects (incremental innovations, e.g. using a new model of tractor).

Monetary benefits: Innovations can be adopted by individuals/organizations for the purpose of gaining monetary and/or non-monetary benefits. Examples of the latter might include use of new labour-saving devices which allow the producers to have more time available for other activities.

Degree of use: Use of innovations by individuals or organizations does not mean they have been put into use by all of them. In practice, the process of bringing innovations into use can take some years (often following a diffusion pattern whereby successful innovations are typically used by a small minority of producers first and the remainder use them at different rates thereafter).

2. WHAT IS FAMILY FARMING?

There is no universal consensus regarding the definition of family farming. However, as FAO (2014) and Garner and de la O Campos (2014) note, most definitions recognize two key characteristics – ownership and/or management of the farm by a family and, secondly, that the family supplies most of the labour on the farm.[2,3]

The General Assembly of the United Nations declared 2014 as the International Year of Family Farming (IYFF) and invited FAO to facilitate its implementation through a multi-stakeholder International Steering Committee. The International Steering Committee defined family farming as follows: *Family Farming (which includes all family-based agricultural activities) is a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, including both women's and men's. The family and the farm are linked, co-evolve and combine economic, environmental, social and cultural functions.*

Characteristics of family farming

Number of family farms: Family farming is the predominant form of agriculture in both developed and developing countries. According to FAO (2014), it is estimated that there are at least 500 million family farms in the world. Family farms are estimated to represent over 90 percent of the world's farms.

Location: Roughly three-quarters of the 570 million farms in the world are located in Asia. An estimated 35 percent are in China, 10 percent in the rest of East Asia and the Pacific, 24 percent in India and 6 percent in the rest of South Asia. An estimated 9 percent of farms are located in sub-Saharan Africa; 9 percent in Europe and Central Asia; 4 percent in Latin America and the Caribbean; 3 percent in the Middle East and North Africa; and 0.5 percent in North America.

Family labour: The labour of the farm (production unit) and the family members (family unit) coincide in family farming. The family members that own and operate the farm do most of the work, if not all. This does not exclude the participation of casual workers, be it on a permanent or seasonal basis.

Diversity: This is perhaps the most important characteristic of family farming. Family farmers are an extremely diverse group: they can notably vary in terms of size of their farm, access to market and natural resources, patterns of production,

2 FAO. 2014. The State of Food and Agriculture: Innovation in family farming. http://www.fao.org/publications/sofa/2014/en/

3 Garner, E. & A. de la O Campos, 2014. Identifying the "family farm": An informal discussion of the concepts and definitions. ESA Working Paper No. 14-10. FAO. http://www.fao.org/3/a-i4306e.pdf

investment capacity, role of self-consumption, use of inputs and technologies, labour (i.e. seasonal workers), outputs, productivity (ranging from subsistence to commercial agriculture) and other characteristics.

Capacity: Family farms vary in their capacity for commercial production and innovation. According to FAO (2014), they can be put in three broad categories:

- subsistence or near-subsistence smallholders, who produce essentially for their own consumption and have little or no potential to generate a surplus for the market;
- small or medium-sized family farms, that are already market-oriented and commercial, generating a surplus for the market (local, national or international), or that have the potential to become market-oriented and commercial given the right incentives and access to markets; and
- large family farms, which are essentially large business ventures although they are managed by a family and use mostly family labour.

Farm size: Lowder, Skoet and Singh (2014) and FAO (2014) estimate that the vast majority of family farms are small.[4,5] Globally, 72 percent of farms are less than 1 ha in size (covering only 8 percent of farmland); 12 percent are between 1 and 2 ha in size (covering 4 percent of farmland) and 10 percent are between 2 and 5 ha in size (covering 7 percent of farmland). Thus, about 94 percent of farms worldwide have less than 5 ha, and they occupy 19 percent of farmland. In addition, a small proportion of farms are very large. Thus, about 1 percent of farms are greater than 50 ha and they occupy roughly two-thirds of all farmland. Large farms dominate in high-income countries and upper middle-income countries and in countries where extensive livestock grazing is important. Many of these farms are family farms. It is therefore important to note that a family farm and a small farm are not necessarily the same thing.

Sectors: Family farming refers not only to crop production but also to aquaculture, fisheries, forestry and pastoral activities. Family farmers include peasants, indigenous peoples, traditional communities, fisher folks, mountain farmers, pastoralists and many other groups representing every region and biome of the world.

Food security: Based on a sample of 30 countries, FAO (2014) estimates that family farms manage about 75 percent of farmland worldwide and produce over 80 percent of the world's food. They are therefore critical for meeting global food security and sustainable production challenges. Paradoxically, family farmers are often poor and food insecure themselves. In low-income and lower-middle-income countries, small family farms are particularly important for achieving food security. Farms smaller than 5 ha occupy about 70 percent of all farmland in the low-income countries and about 60 percent in the lower middle-income group. Thus, not only are the majority of farms smaller than 5 ha but they also cover the majority of agricultural land and produce the greater part of national food output in low-income and lower-middle-income countries.

Off-farm income: Most farming families do not rely exclusively on farming for their livelihoods but have multiple sources of income. The smaller the family farm, the bigger the dependence they typically have on off-farm income.

4 Lowder, S., Skoet, J. & S. Singh. 2014. What do we really know about the number and distribution of farms and family farms in the world? Background paper for The State of Food and Agriculture 2014. ESA Working Paper No. 14-02. http://www.fao.org/docrep/019/i3729e/i3729e.pdf

5 FAO. 2014. The State of Food and Agriculture: Innovation in family farming. http://www.fao.org/publications/sofa/2014/en/

ANNEX 2: THE INNOVATION FAIR – TWENTY SUCCESS STORIES OF AGRICULTURAL INNOVATION

One of the objectives of the symposium was to celebrate inspiring success stories of innovation and innovators. One of the ways in which this was done was through organization of the innovation fair, which showcased 20 success stories of agricultural innovation for family farmers and/or by family farmers. The fair explored how and why agricultural innovation happens and benefits family farmers.

Success stories presented in the innovation fair provided excellent examples of the key drivers that lead to successful innovation, without neglecting the obstacles and challenges that had to be faced and overcome before the innovations were brought into use. The cases showed the impact that these agricultural innovations have made in people's lives.

The selection of success stories encompassed a broad range of innovations that are being used in the different agricultural sectors, and revolved around the use of agricultural innovation to address four key challenges: climate change; sustainable natural resource management; food insecurity, hunger and malnutrition; and job creation, with a focus on youth.

For the innovation fair, each success story had a presenter and a dedicated space with panels about the story in the FAO Atrium. During the lunch intervals, the presenters stood beside the panels to discuss their innovation and success story with the other symposium participants. This annex contains the short summary text displayed on the panels of the 20 success stories. Additional information on the success stories is available at http://www.fao.org/3/CA2588EN/ca2588en.pdf.

H_2GROW: GROWING FOOD IN IMPOSSIBLE PLACES

The World Food Programme's (WFP) H_2Grow innovation enables plant growth in non-fertile, arid spaces with a soil-less cultivation technique, using 90 percent less water than traditional agriculture. By introducing various hydroponic methods into emergency and development contexts, H_2Grow is continuously tailoring growth systems to support vulnerable people living in the harshest of conditions.

In 2016, H_2Grow developed a proof of concept to improve the livelihoods, especially for refugees, in certain contexts of protracted humanitarian need. In the Algerian Sahara Desert, H_2Grow is supporting the Sahrawi refugees to develop a localized hydroponic system to grow barley for use as animal fodder and strengthen their food security. The semi-nomadic Sahrawi refugees greatly value livestock for milk and meat.

The project is now being rolled out, reaching 200 active production units, with the feasibility of replicating and scaling this low-cost model into other vulnerable communities being explored. FAO and WFP are working together this year in the Sudan to implement an H_2Grow pilot in camps in Darfur.

DROUGHT TOLERANT MAIZE VARIETIES IN ZIMBABWE

In the past ten years, most farmers in southern Africa experienced around one to three drought years, due to climate change. In Zimbabwe the situation was far worse due to the El Niño phenomena which ravaged the region during the 2015/16 growing season. The International Maize and Wheat Improvement Center (CIMMYT), together with the International Institute of Tropical Agriculture (IITA), conducted the Drought Tolerant Maize for Africa (DTMA) project to breed and disseminate drought-tolerant maize varieties in Zimbabwe and other countries regularly affected by drought stress.

The project involved the national maize breeding and extension systems of 13 sub-Saharan African countries and private seed companies. Between 2007 and 2013, around 160 drought-tolerant maize varieties were released and scaled for uptake by smallholder farmers. Millions of farmers in the region benefited from the outputs of this partnership, which included support and training for African seed producers and the promotion of vibrant, competitive seed markets.

CLIMATE-SMART VILLAGES IN WEST AFRICA

Agriculture in west Africa has faced many challenges in recent years as a result of climate change. Extreme climate events, such as droughts, negatively impact soil fertility and crop production. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has been working since 2011 with local partners to develop climate-smart villages (CSVs). CSVs implement sustainable technologies and practices, such as improved crop varieties and soil and water conservation, to improve livestock and crop farming.

The CSV approach has proven effective as a scalable partnership between rural communities and broader stakeholders, with great potential to be deployed and implemented in similar environments. The successes demonstrated by local CSVs can be utilized by policy-makers to create change on a global scale and empower local agricultural workers to adapt their value chains based on climate information.

ELOCUST3: A MOBILE APP FOR MONITORING AND EARLY DETECTION OF THE DESERT LOCUST IN AFRICA

The Desert Locust is considered the most dangerous of all migratory pest species in the world due to its ability to reproduce rapidly, migrate long distances and devastate crops. FAO recently upgraded its well-established global Desert Locust monitoring and early warning system to allow governments to more effectively manage this deadly pest. The resulting eLocust3 system combines the latest advances in digital, IT, communication and satellite technologies into a unified monitoring and early warning system.

It is being used by national survey and control teams in 30 countries to record and transmit field data in real time from some of the remotest areas on Earth to decision-makers and forecasters so that action can be taken and alerts and warnings can be issued. eLocust3 has contributed significantly to a decline in the duration, severity and frequency of devastating Desert Locust plagues in Africa and Asia.

ERADICATION OF THE MEDITERRANEAN FRUIT FLY IN THE DOMINICAN REPUBLIC

In 2015, trading partners of the Dominican Republic imposed an export ban on most fruits and vegetables because of a major regional outbreak of the Mediterranean fruit fly. As an emergency response, the Dominican Republic's Ministry of Agriculture collaborated with several international organizations to establish the Moscamed Programme, which provided the financial and operational support to commence a large-scale eradication project.

The programme used area-wide integrated pest management techniques, including cultural control activities, bait spray and the implementation of the sterile insect technique (SIT). SIT is a form of insect pest control that breeds masses of sterile male insects in special rearing facilities, then releases the modified population into the wild. The sterile males mate with wild females in nature but do not produce offspring. Over time, this brings the insect population down, or in some cases eradicates it completely, as was the case in the Dominican Republic. By 2017, the country's Mediterranean fruit fly population was officially eradicated. SIT is one of the most environmentally friendly control strategies available, as it does not require the use of chemicals on the insect's native habitat. Development and improvement of SIT is ongoing worldwide, and its applications are being expanded to curb other insect pest populations.

PARTICIPATORY CERTIFICATION AND LABELLING SCHEME TO PROMOTE MOUNTAIN BIODIVERSITY AND IMPROVE LOCAL ECONOMIES AND LIVELIHOODS IN NEPAL

The indigenous agricultural practices of mountain communities have contributed a variety of high-quality goods to global diets. While small-scale mountain agribusinesses cannot compete with lowland production, they can tap into the rising demand for sustainable, fair trade products. The Mountain Partnership (MP) in collaboration with Slow Food, FAO and the Government of Italy, founded the MP Products Label in 2015 – a global labelling scheme to brand high value mountain products. The first phase of this project selected 16 products from seven countries, including two from Nepal – Jumla's mixed beans and Himali black lentils – for their potential to sustainably improve livelihoods of mountain settlements in the Himalayan zone. The voluntary label endowed the products with a differentiated presence and transformed farmers' livelihoods. With the labelling, the production of Jumla's mixed beans doubled, the price increased by 20 percent and 13 percent more women farmers are engaged in the sector. The label's success in Nepal has laid the groundwork for effective collaboration among different stakeholders.

AGROECOLOGY AT THE HEART OF LOCAL DEVELOPMENT: THE EXAMPLE OF THE KAYDARA AGROECOLOGICAL SCHOOL FARM

Youth in the developing world often shy away from agriculture, opting instead to migrate to urban centres or foreign countries in search of employment opportunities. The Kaydara Agroecological School Farm, created in 2007, pioneered a youth employment programme to counter rural depopulation while also working to salvage the remaining 30 percent of cultivable land in the village of Fimela in Senegal. The programme introduces students to a new approach to agriculture based on agroecological principles. Young villagers are trained to optimize production, restore soil fertility, protect the environment and manage water efficiently. Through the local municipality, youth in the programme are provided with the capital inputs needed to become rural entrepreneurs. Following an innovative partnership with municipalities, graduates of the programme are granted land titles of 1 hectare, allowing them to develop their agroecological farms while contributing

to the community's reforestation efforts. Presently, 21 such small-scale farms are being constructed with the objective of creating a feeding belt around Fimela.

ALLANBLACKIA SEED OIL: FROM A WILD-HARVESTED SEED TO YOUR MORNING TOAST

Rural farmers often find they have limited sources of sustainable income, but new uses of the Allanblackia seed oil are providing lucrative opportunities for the next generation of Tanzanian agribusinesses. The Allanblackia tree grows in tropical rainforests across Africa, and of the nine tree species, two are native to the United Republic of Tanzania.

Compared with traditional oils, Allanblackia seed oil is rich in nutrients, low in saturated fatty acids and high in monounsaturated fatty acids, attributes that are beneficial to cardiovascular health. Allanblackia seed oil can be used in food products, such as spreads and ice cream, as well as in personal care products, including creams and lotions. Multinational companies have demonstrated great interest in the development of a sustainable supply chain for the oil, making the United Republic of Tanzania uniquely suited to fill a growing demand for this versatile resource.

The budding Allanblackia supply chains in the country are contributing to poverty alleviation and the conservation of biodiversity, giving local farmers a chance to increase their incomes through low-risk access to international markets.

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Fidelis Rutatina, from Novel Development Tanzania Ltd, presents the Allanblackia story to participants.

THE RYTHU BANDHU SCHEME IN TELENGANA, INDIA

During the rainy "kharif" season of 2018–19, the Government of Telangana State implemented the Rythu Bandhu Scheme. As India's first direct farmer investment support scheme, the founding objective was to asssist farmers and farming families to increase agricultural productivity and break the vicious cycle of rural debt and poverty, endemic in Telangana State.

Twice a year, a grant of INR 4 000 per season/acre is provided to support farm investment and the purchase of inputs. Rythu Bandhu specialists oversee distribution of these funds, and support the system by collecting data on uses of the grants and develop a rapport with farmers to ensure successful crop planning. Operations are also supervised at district and state levels by specially appointed officers, acting as an added support system.

A mobile application, linked to the Rythu Bandhu web portal, has been developed to assist with timely distribution of funds. The scheme is projected to continue past this first season, and will further support farmers escape the cycle of rural debt, while allowing them to establish sustainable and profitable agricultural ventures.

CLIMATE AND WEATHER INFORMATION FOR ARTISANAL FISHER FOLK TO MANAGE EXTREME WEATHER RISKS AT SEA

The Senegalese fisheries sector has witnessed a boom in the last 20 years. Overfishing and uncontrolled fishing activities have posed major problems for the long-term sustainability of the sector. In addition, Senegal is vulnerable to climate change, the effects of which have caused immense damage to fishing materials and countless fisher fatalities.

Climate information services (CIS) are meteorological forecasts tailored to the needs of fishers, providing timely guidance to weigh the risks and take appropriate measures before venturing out to sea. Examples of CIS include high tides and swell, extreme wind events and reduced visibility. They are disseminated through SMS, voice calls, radios and vigilance flags. Launched in 2016 under the leadership of CCAFS (a CGIAR program), CIS have helped reduce the untimely deaths of fishers at sea. Covering all the coastal zones of Senegal, the success of CIS has prompted other coastal countries in west Africa to request climate information production for their fisheries sectors.

LOW-COST WOODEN GREENHOUSES FOR HIGH-QUALITY VEGETABLE PRODUCTION IN EL SALVADOR

In 2007, farmers in El Salvador invested in low-cost wooden greenhouses in order to produce high-quality vegetables year-round. The greenhouses were originally introduced in El Salvador after the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES) established a demonstration farm. The greenhouses use netting on the walls to prevent virus-transmitting insects, plastic on the roof to avoid bacteria and fungi caused by high humidity, and coconut fibre instead of soils to avoid soil diseases. With this system, the farmers are able to produce vegetables such as tomatoes, bell peppers and cucumbers all year.

After ten years of success, the farmers created a cooperative to expand their agribusiness. The low-cost wooden greenhouses were well-suited for sustainability and scalability, and the farmers were able to achieve significant social, economic and environmental improvements with minimal inputs and resources, such as land and water.

Many central American farmers depend on agriculture for their livelihoods and find it difficult to produce sufficient crop yields year-round. Accessible and affordable solutions like the wooden greenhouses allow these farmers to have financial security despite traditionally shorter growing seasons or extreme climate events.

CORRALONES: SEMI-ROOFED SHELTERS TO PROTECT CAMELIDS FROM EXTREME WEATHER AND CLIMATE EVENTS IN THE PLURINATIONAL STATE OF BOLIVIA

Llama camelid livestock are essential for the food security and nutrition of many indigenous cultures around the world. Camelids also provide organic fertilizer, transport and fibre while emitting less methane than cows or sheep. In the Bolivian eco-region of the Altiplano, raising camelids is key for the livelihood resilience of smallholders. Unfortunately, camelid herds are often affected by cold waves that make them vulnerable to diseases and lead to increased mortality rates. The introduction of semi-roofed structures called corralones, along with veterinary pharmacies that provide additional treatments, aim to enhance the resilience of camelids in the face of snow, frost and hailstorms.

Although most farmers in the Altiplano region were initially unable to cover the costs of building the corralones themselves, financial support from the municipality ensured the implementation of this solution. Farms with corralones saw a significant reduction in livestock mortality, which in turn resulted in an increase in livestock production and related income. Cost–benefit analyses clearly prove the benefits gained from the use of corralones, with promising potential to upscale the innovation.

GUATEMALA'S NEW, NUTRITIOUS BEAN VARIETY

Beans and maize are the main staples of the "Dry Corridor" of Guatemala, an area known for its drought conditions, often posing a risk of malnutrition for the population as the crops they rely on are severely impacted by drought. In response to these challenges, Guatemala's National Agricultural Research Institute partnered with the International Center for Tropical Agriculture (CIAT) and HarvestPlus to develop a biofortified bean designed to provide an agricultural solution to the Dry Corridor's nutrition problems. The Chortí bean has high iron and zinc contents, an important addition to the local population's diet. It is resistant to many pests, to the mosaic virus and to drought.

To accelerate introduction of the Chortí bean, the EU-funded Capacity Development for Agricultural Innovation Systems (CDAIS) project facilitated capacity development through an innovative partnership composed of Atescatel (a seeds cooperative), APALH (a producers association), local governments, public health centres and the BioFORT platform (a network on biofortification for improved diets). It is expected that this experience, along with efforts to disseminate information about the bean's properties, will help populations in other areas that struggle with malnutrition.

GOING TO THE VIRTUAL FARMERS' MARKET IN ZAMBIA

Rural smallholder farmers face numerous obstacles, particularly in accessing stable markets with fair prices for their crops. The Virtual Farmers' Market (VFM) is an app-based, e-commerce platform that builds on the global telecommunications revolution to provide business opportunities and improved livelihood solutions for smallholders. VFM is based on the same logic as popular exchange platforms such as Ebay and AirBnB, by connecting farmers with buyers and other stakeholders.

In May 2017, a pilot of the app was launched in Zambia named Maano, meaning intelligence in the local Tonga language. Developed together with Zambian farmers and market actors, Maano has reached over 1 000 smallholders. During the pilot harvest season over 100 transactions were made, with 150 metric tons of produce worth USD 50 000 traded through the app. These results from Zambia are expected to at least triple in the coming harvest seasons, as communities gain greater familiarity with the technology. Meanwhile, preparations are underway to launch the VFM platform in several other countries.

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Ahnna Gudmunds (centre) and Li Xiong (right), both from the World Food Programme, discuss the VFM story with Mwila Kangwa (left), from Agripredict, Zambia.

BLOCKCHAIN TECHNOLOGY IN THE COFFEE VALUE CHAIN FOR SMALL-SCALE COFFEE PRODUCERS IN ETHIOPIA

Fairchain Coffee Ethiopia aims to create shared value and end government aid to small-scale coffee growers by cutting out intermediaries and returning profits to the coffee growers themselves. Blockchain enables the supply chain to become more transparent, highlighting inequalities between different parts of the supply chain.

Blockchain connects all stakeholders in the supply chain from the beginning, and the transparency allows consumers to choose sustainable products from companies with inclusive business models. Each individual within the supply chain can earn a fair income as a result of business models that focus on high-quality, normal-priced coffee. Workers are paid above market standards, are given training and are empowered to increase the quality and outputs of their agribusinesses.

With an ambitious economic, social and environmental business model, blockchain allows coffee growers and sellers to benefit in proportion to their role in the coffee market, rather than perpetuating a system that primarily benefits the countries that buy the coffee. This blockchain application can be scaled globally, creating a standardized system that can be applied in other countries and to other supply chains.

USING AGRIBUSINESS INCUBATOR PROGRAMMES FOR YOUTH EMPLOYMENT IN NIGERIA

There is a lack of jobs for the young population in Africa, making them vulnerable to poverty. Youth Agricultural Park, a pioneering agribusiness incubator, was designed by the International Institute of Tropical Agriculture specifically for young people interested in agri-entrepreneurship. It provides land and key farming services at reasonable rates. The programme's unique features lie in incorporating the diverse yet complimentary skills of young people, developing ICT tools and using innovative means to cut out the intermediaries.

Youth are empowered to create jobs for themselves and others along the value chain. The Youth Agricultural Parks have created over 300 independent agribusinesses, each employing another three to five youths. The multiplier effect of jobs created through start-up enterprises is a major landmark of the initiative.

ZANZIBAR SEAWEED CLUSTER INITIATIVE: BIOECONOMY FOR INCREASED RESILIENCE OF WOMEN FARMERS IN THE UNITED REPUBLIC OF TANZANIA

Zanzibar is one of the world's top exporters of dry seaweed. On an island where female employment opportunities are scarce, over 80 percent of seaweed farmers are women. When seaweed crops started dying in 2014 due to rising sea temperatures, it prompted a worrying downward trend in production. The Zanzibar Seaweed Cluster Initiative is one of more than 70 clusters being promoted by the Government of the United Republic of Tanzania in their push to revitalize the bioeconomy. Women farmers have since adapted their cultivation methods and processes in response to climate change, moving to deeper, cooler waters. Staff from a local university have taught the farmers about innovative harvesting methods in these waters as well as processing value-added products which reap greater profits than exporting the raw biomass. Women farmers have seen their incomes skyrocket from USD 0.18/kg of raw seaweed to USD 13.4/kg for soap.

BIOSPG: BURKINA FASO'S PARTICIPATORY ORGANIC LABEL SYSTEM

To combat the rising number of hungry and malnourished people on the planet, a scaled up agricultural production model would seem the obvious answer. Burkina Faso, however, is rethinking this approach and looking to the ingenuity of ecosystems and working on a human scale, as the solution. BioSPG (Systeme Participatif de Garantie – Participatory Guarantee System, in English) is one of the first organic labelling schemes in the country; presenting an inexpensive, alternative biological certification system, adapted to the local context.

Founded on rigorous organic farming standards, and based on the principles of agroecology, the participatory, multi-actor approach makes it unique among certification systems. The labelling process is carried out at different levels on the ground and involves different actors from across the agricultural production chain. The process relies on cooperation and trust between stakeholders, with preventive mechanisms built-in to ensure the integrity of products and the improvement of farming systems. Twenty-three sites are currently BioSPG certified in six regions, with a total of 286 producers participating, 64 percent of whom are women.

FIGHTING PLANT PESTS AND DISEASES IN UGANDA

In recent years, increased incidents of pests and disease have devastated Ugandan crop fields, threatening farmers' harvests and livelihoods. In response, a digital early warning system called Fapp was developed using smartphones and drones that work in tandem to map large fields and identify areas affected by pests or disease.

Fapp is the fruit of Hansu Mobile Innovations, a start-up founded by three young Ugandan developers. Analyses from the app follow with the appropriate prescriptive course of action: either sustainable pesticides can be recommended to farmers or the service can also alert neighbouring farmers, suggesting methods of containment and ways to manage risks. In development since April 2018, Fapp was first piloted in the summer of 2018 to hone the features of the service to the real needs of farmers.

CLIMATE-SMART TECHNOLOGIES: AUTOMATING PROCESSES FOR RICE PRODUCERS

Benin is one of Africa's top rice importers as, due to various restraints, local producers are unable to keep up with demand. Recognizing the potential to develop this market and lessen dependence on foreign imports, young Beninese farmers and entrepreneurs founded the start-up AfriRice Agrobusiness. The company specializes in the development of technologies and strategies to optimize agricultural processes in Africa.

In 2008, in consultation with rice farmers from northern Benin and women processors, who traditionally work by hand, two new technologies were developed for the sector, the biolaye thresher and economical fireplaces that use rice husks as fuel instead of wood. These climate-smart and sustainable solutions, targeted to family farmers, have contributed to increased rice production, yields and household incomes.

The technologies have also decreased the hard manual labour for women. To date, these innovations have reached 8 508 rice farmers and 4 766 women processors in Benin. AfriRice Agrobusiness is currently working to provide rice industry actors with AppRice, a mobile application which makes it possible to follow operations at all stages of harvests and locate agricultural machinery suppliers.

This book represents the proceedings of the first International Symposium on Agricultural Innovation for Family Farmers which FAO organized at its headquarters in Rome, Italy, on 21–23 November 2018. FAO convened the symposium to provide inspiration for innovation actors and decision-makers to unlock the potential of innovation to drive socio-economic growth, ensure food and nutrition security, alleviate poverty, improve resilience to changing environments and thereby achieve the Sustainable Development Goals. It was attended by 540 participants, including 286 delegates from 92 member countries.

The proceedings provide a record of the main highlights of the symposium, including the opening plenary session; high-level ministerial segment; innovation fair, with 20 success stories of agricultural innovation; and six highly interactive parallel sessions and two special events dedicated to youth and to chefs and family farmers. During these different sessions, participants shared their experiences, knowledge and examples of agricultural innovation in different sectors; they also discussed the drivers and key factors contributing to success, as well as the main constraints for agricultural innovation.

The symposium was organized by FAO in collaboration with other key actors in agricultural innovation, including the International Fund for Agricultural Development (IFAD), European Alliance on Agricultural Knowledge for Development (AGRINATURA), Consultative Group on International Agricultural Research (CGIAR) and Tropical Agriculture Platform (TAP). The symposium recognized the central role of family farmers in agricultural innovation. It recommended, *inter alia*, that the capacity of family farmers to innovate be strengthened; inclusive research and education systems that facilitate innovation for family farmers are needed; bridging institutions be strengthened; and that integrated policies and increased investments are needed to create an enabling environment for innovation and scaling up. It also recognized the unique role and potential of youth in agricultural innovation.

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ISBN 978-92-5-131504-0

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CA4781EN/1/05.19