



OPPORTUNITIES FOR YOUTH
IN RURAL BUSINESS AND
ENTREPRENEURSHIP IN
AGRICULTURE



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ABBREVIATIONS

ASSP	Agricultural Sector Strategy Plan
FAO	Food and Agriculture Organization of the United Nations
ICT	information and communications technology
ICT4Ag	information and communications technology for agriculture
IoT	Internet of Things
NAP	National Agricultural Plan of Rwanda
NDP	National Development Plan
NST 1	National Strategy for Transformation
NSYEA	National Strategy for Youth Employment in Agriculture
PARP	Poverty Reduction Action Plan
PNAS	National Sustainable Development Plan
PNISA	National Agricultural Investment Plan
PSTA	Strategic Plan for Agriculture Transformation
SAG	SWITCH Africa Green
SDGs	Sustainable Development Goals
SMEs	small and medium-sized enterprises
TVET	technical and vocational education and training
UGGSD	Uganda Green Growth Development Strategy
UN Women	United Nations Entity for Gender Equality and the Empowerment of Women

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EXECUTIVE SUMMARY

Agriculture provides opportunities for youth to engage in entrepreneurship and innovation. Youth could in turn contribute to efforts towards making agriculture 'smart' through digitization and innovative solutions. Emerging governance models and innovations support the digitization of agriculture, also known as Agriculture 4.0, and a green economy. The models create opportunities for youth to engage in developing and applying digital technologies and innovations to make data-driven decisions in the production, processing and marketing of agricultural produce. A green economy also provides youth employment and stewardship opportunities – namely, opportunities to restore and regenerate ecosystems while preventing degradation of natural resources. However, the governance models and innovations lack inclusiveness and rarely correspond to local needs and constraints. In addition, pursuing digital agriculture and a green economy without addressing gender gaps in accessing digital technologies and acquiring business skills, and women's heavy dependence on natural resources for food security and energy sources, could reinforce existing gender inequality.

The policy context in Mozambique, Rwanda and Uganda is committed to supporting the creation of productive jobs in agriculture. Increased attention is given to energy-efficient technologies and innovations, and harnessing the potential of information and communications technology (ICT) in agriculture. The policy frameworks support a green economy by enabling efficient use of water resources, the use of renewable energy in agricultural activities and agroprocessing, and restoration of degraded landscapes, among other things. The policies also promote renewable energy and water-efficient systems in the livestock sector and agroecological farming. The policy frameworks in Rwanda and Uganda prioritize creating employment opportunities for youth in 'smart' farming and off-farm activities in support of a green economy and the digitization of agriculture.

By and large, youth's involvement in 'smart' farming, such as precision farming and the development, use and application of digital technologies to increase agricultural productivity, efficiency and profitability, seems to be an area of great interest and potential but with limited results so far. This could be attributed to gender inequality, the digital divide and a low level of ICT access, lack of access to markets and other infrastructure issues. Opportunities for youth in the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors differ based on their gender and socioeconomic background. Most of the job opportunities in high-value products and services are taken by educated youth and youth who reside near towns. Women, youth with a low level of education and youth who reside in rural and remote areas have minimal opportunities because of problems with accessing land, lack of access to finance, lack of capacity development efforts near their area, lack of access to digital technologies and low digital literacy. The digital divide affects the engagement of women and girls in value addition, marketing and other activities. Therefore, the study makes the following recommendations.

Capacity development needs for increased youth opportunities in agriculture

- **Digital and business skills among gender groups:** Youth opportunities in agriculture vary depending on acquisition of digital and business skills. Public and private agencies should work towards reducing gender inequality by investing in initiatives to enhance digital literacy (i.e. the ability to identify and use technologies to meet the demands of daily life, solve problems and communicate using digital tools) and business management skills among, for example, young women, youth with primary education and youth with disabilities.

- **Quality assurance and certification schemes:** Governments and the private sector should invest in schemes that ensure the quality of products and brands of youth-led businesses using global labels and standards for increased opportunities in local and global markets.
- **Protect intellectual rights:** Government ministries should encourage creativity, innovation and technological development among youth in agriculture by putting in place mechanisms that provide them with patent rights over their intellectual rights.
- **Explore opportunities for youth in soil health and biodiversity:** This includes opportunities to engage in developing innovations and technologies, and providing advisory services on integrated soil fertility management. Governments and development partners should invest in the capacity development of young men and young women in soil testing and agroecological innovations so that they engage in providing tailored consultancy and advisory services to farmers.
- **Capacity development and empowerment of youth and women in the renewable energy sector:** Interventions by governments and development partners should develop capacities and prioritize women and youth in the generation, production, use and marketing of energy-efficient and clean energy schemes.
- **Capacity development in agroecological farming:** Programmes designed for youth in agroecological farming are lacking. Investments by public and private agencies in such programmes and reaching out to those with limited access to learning platforms would empower youth to engage in sustainable agriculture.
- **Promote mechanisms for addressing the digital divide:** The digital divide could limit the success of innovations and technologies for increased resilience and adaptation to the adverse effects of climate change. Governments and development partners should invest in narrowing the digital divide first.
- **Develop capacities of youth in certification and standards:** Investing in capacity-building in blockchain technologies and other innovations for traceability by public and private agencies would increase youth opportunities in technology development and application, and advisory

services on the certification of quality standards for agricultural produce.

Gender equality and women's empowerment issues for urgent action

- **Invest in women's empowerment:** Women heavily depend on natural resources for food security and energy sources. Initiatives towards a green economy by public and private agencies need to create alternative economic opportunities for women in non-farm agricultural activities and alternative clean energy sources and encourage women's employment in paid and decent work.
- **Inclusive business and governance models:** Ensure the inclusiveness of business models for the equitable and sustainable futures of youth and women in agriculture. Government ministries and development partners should enhance the inclusiveness of digital technologies by engaging less powerful actors in the processes and employing cross-sectional approaches in capacity development to increase impact and equitable outcomes.
- **Ensure gender equality by closing gender gaps:** Ensuring gender equality at the implementation stage of policies is crucial to having an increased impact on youth of different genders and with different socioeconomic backgrounds. It is critical that government ministries act on the recommendations of a series of gender gap assessments by UN Women on the criticality of closing the gender gaps in agricultural innovation for poverty reduction across countries in Africa.

Innovation and technology-related issues relating to action by public and private agencies

- **Diversified and customized technologies and innovations:** Youth opportunities in agriculture would increase with increased investment in digital technologies and innovations that are responsive to local needs and constraints.
- **Gender-responsive digital technologies and innovations:** Digital technologies and innovations can play an important role in addressing gender inequality when their design, development and application takes into consideration the gender-based constraints in agricultural value chains and requirements for a green economy,

including local food, food security, water access and stewardship of landscape systems.

- **Increased investment in a green economy:** At implementation level, interventions to promote a green economy are too dispersed to result in an impact on job creation. Increased investment in green economy initiatives would create more opportunities for youth and women and enable innovations and technologies that are responsive to local needs.
- **Invest in renewable energy infrastructure:** The interest in energy and water-efficient systems in agriculture requires investment in renewable energy infrastructure.
- **Invest in innovation and incubation centres:** Well-equipped innovation labs motivate entrepreneurship and innovation among youth.
- **Promote digital technologies for agricultural small and medium-sized enterprises (SMEs):** Identifying relevant and affordable digital technologies for youth-led agribusinesses would help youth employ innovations and technologies in their agricultural SMEs.
- **Encourage youth entrepreneurship in precision farming:** Youth could engage in entrepreneurship by developing, using and marketing innovations and technologies enabling precision farming.

INTRODUCTION

Creating employment opportunities for youth, who are defined by the United Nations as those aged between 15 and 24 years, is key to achieving sustainable development in Africa.¹ The growing number of youth, who are estimated to account for 60 per cent of the population, brings both challenges and opportunities to the continent.² On the one hand, youth could put pressure on the slow growth of agricultural development, less efficient institutions and poorly maintained infrastructure. On the other hand, they offer huge potential in terms of transforming economies, given their capacities and interests in innovations and technologies for improved livelihoods.³ Youth are drivers and users of innovations, and thus innovations that pay due attention to the aspirations of youth have huge potential to create employment opportunities.⁴

Including youth in innovations in agriculture has dual benefits.⁵ First, the capacity and curiosity of youth to innovate could transform family farms, considering that youth are often aware of new technologies and have the relevant education.⁶ Second, innovations could create business opportunities for youth in the agricultural sector.⁷ Accordingly, efforts are under way, such as the Food and Agriculture Organization of the United Nations (FAO) Digital Innovation aimed at enabling digital innovations for employment creation and empowerment of youth and women

by accessing information, technology and markets.⁸ These opportunities could have increased impact on the improvement of livelihoods when coupled with efforts that address gender gaps in agricultural productivity. Gender gaps often emanate from women's low level of access to agricultural inputs, gender norms biased against women, and women's low level of access to and application and use of digital technologies, such as mobile phones and the Internet.⁹ Closing the gender gaps in agricultural innovation plays a critical role in poverty reduction across countries in Africa.¹⁰

Nevertheless, experiences reveal that innovations and technologies such as artificial intelligence and robotics have narrowed women's opportunities for employment in the agricultural sector. For instance, job losses in the agricultural sector of India following increased automation have exhibited gender inequality, as 45 per cent of women have experienced job losses compared with 26 per cent of men.¹¹ The problem emanates from the lack of inclusiveness of youth and women in the design, appropriation and application of innovative technologies, making them 'unemployable' in digitized agriculture.

- 1 UNDESA (United Nations Department of Economic and Social Affairs). 2018. *World Youth Report: Youth and the 2030 Agenda for Sustainable Development*. New York: UNDESA.
- 2 FAO. 2019a. *NUUS: Field Stories from Africa, Youth Edition*. Rome: FAO.
- 3 BMZ (Federal Ministry for Economic Cooperation and Development). 2017. *One World – No Hunger: Green Innovation Centres for the Agriculture and Food Sector*. Bonn: BMZ; IFAD (International Fund for Agricultural Development). 2019. *Creating Opportunities for Rural Youth: 2019 Rural Development Report*. Rome: IFAD.
- 4 FAO. 2019b. *Proceedings of the International Symposium on Agricultural Innovation for Family Farmers – Unlocking the Potential of Agricultural Innovation to Achieve the Sustainable Development Goals*. Rome: FAO; Yami, M. and others. 2019. "African rural youth engagement in agribusiness: Achievements, limitations, and lessons." *Sustainability* 11 (1), p. 85. <https://doi.org/10.3390/su11010185>.
- 5 Koira, A. K. 2014. "Agribusiness in Sub-Saharan Africa: Pathways for Developing Innovative Programs for Youth and the Rural Poor". Working Paper. Toronto: The Mastercard Foundation.
- 6 BMZ (Federal Ministry for Economic Cooperation and Development). 2017. *One World – No Hunger: Green Innovation Centres for the Agriculture and Food Sector*. Bonn: BMZ.
- 7 FAO. 2014. *The State of Food and Agriculture: Innovation in Family Farming*. Rome: FAO.
- 8 FAO. 2018. "FAO Digital Innovation: Fact sheet." Rome: FAO; Choi, J., M. A. Dutz and Z. Usman (Eds.). 2020. *The Future of Work in Africa: Harnessing the Potential of Digital Technologies for All*. Washington, D.C.: The World Bank.
- 9 UN Women. 2017. *Making Innovation and Technology Work for Women*. New York: UN Women.
- 10 UN Women. 2015. *The Cost of the Gender Gap in Agricultural Productivity in Malawi, Tanzania, and Uganda*. New York: UN Women.
- 11 Madgavkar, A. and others. 2019. *The Future of Women at Work: Transitions in the Age of Automation*. London: McKinsey Global Institute.

The previous governance systems characterized by top-down approaches with limited inclusiveness faced challenges in creating employment opportunities for youth. Past efforts often tended to consider youth as a homogenous entity and failed to respond to the needs and priorities shaped by the gender norms. This situation has called for governments to ensure that the shift to technologies and innovations does not displace women, but rather promotes social capital and encourages investment in integrated approaches towards food security and ecological diversity in the agricultural sector.

Given this, empowering youth and capitalizing on their contributions to the Sustainable Development Goals (SDGs) in achieving gender inequality requires changing the norms and bringing in new models of governance. This situation has led to developing and testing different governance models and innovations, with the hope of providing youth with better opportunities. The next agricultural revolution, referred to as Agriculture 4.0, aims to curb the food scarcity problem globally by improving old technologies.¹² It is also working towards developing new technologies for producing food differently and bringing food from producers to consumers, among other goals.¹³ Given this, digitization of agriculture is central to the shift from the established way of doing agriculture to Agriculture 4.0. This shift aims to use real-time quality data to increase productivity, improve the efficiency of the agricultural sector, and enable a green economy focusing on local food, food security, water access and stewardship of landscape systems.¹⁴

Digitization of agriculture involves technologies and innovations such as blockchain, Internet of Things (IoT), big data and precision farming/smart farming. The demand is often associated with the need to reduce poverty and hunger, improve livelihoods, human health and nutrition, and promote sustainable development, which puts social equitability and

sustainability of the environment and economy at its centre.¹⁵ Digitization of agriculture is characterized by increased use of technologies and innovations in addressing bottlenecks in productivity and marketing, among other things.¹⁶ It is also argued that digital technologies could provide an important platform for solving some of the challenges in the agricultural sector and reinforce the efforts to achieve SDGs by 2030.¹⁷ In this regard, digital agriculture requires meeting the diverse interests and needs of actors to enable gender equality. Furthermore, it requires the concerted efforts of governments in creating an enabling environment for youth employment in agriculture.¹⁸

Creating an enabling environment is crucial to having impactful programmes and projects on youth employment, and to improving the coordination of efforts.¹⁹ For example, identifying enabling environments such as the provision of policies would help in reducing duplicated efforts, using financial and human resources efficiently, and reaching out to the marginalized groups. Policy analysis in the past revealed that existing policies were biased towards opportunities in cropping systems and in the agricultural sector in general.²⁰ However, the emerging governance models and innovations in agriculture show a growing interest in a green economy and digitization of agriculture. This calls for countries to put in place mechanisms for enabling digitization of agriculture and the use of renewable energy in agriculture.

So far, the implementation of Agriculture 4.0 is limited to a few firms, which have adequate capacity to invest in the technologies.²¹ For that reason, there is lack of information on the potential impact of the initiatives supporting Agriculture 4.0 on youth opportunities. Therefore, it is important to examine what the emerging governance models and innovations offer young men and young women. This would help in reducing the potential negative impact

12 Zambon, I and others. 2019. "Revolution 4.0: Industry vs. agriculture in a future development for SMEs." *Processes* 7 (1), p. 36. <https://doi.org/10.3390/pr7010036>.

13 De Clercq, M., A. Vats and A. Biel. 2018. *Agriculture 4.0: The Future of Farming Technology*.

14 FAO. 2018. "FAO Digital Innovation: Fact sheet." Rome: FAO.

15 McIntyre, B. D. 2019. *Agriculture at a Crossroads: Global Report*. International Assessment of Agricultural Knowledge, Science and Technology for Development.

16 Annosi, M. C. and others. 2020. "Is the trend your friend? An analysis of technology 4.0 investment decisions in agricultural SMEs." *Computers in Industry* 109, pp. 59–71. <https://doi.org/10.1016/j.compind.2019.04.003>.

17 FAO. 2018. "FAO Digital Innovation: Fact sheet." Rome: FAO.

18 Filmer, D. and L. Fox. 2014. *Youth Employment in Sub-Saharan Africa*. Washington, D.C.: World Bank.

19 Yami, M. and others. 2019. "African rural youth engagement in agribusiness: Achievements, limitations, and lessons." *Sustainability* 11 (1), p. 85. <https://doi.org/10.3390/su11010185>.

20 Filmer, D. and L. Fox, 2014. *Youth Employment in Sub-Saharan Africa*. Washington, D.C.: World Bank.

21 Zambon, I. and others. 2019. "Revolution 4.0: Industry vs. agriculture in a future development for SMEs". *Processes* 7 (1), p. 36. <https://doi.org/10.3390/pr7010036>.

of the efforts on gender equality. Thus, this study aims to (i) synthesize the literature on emerging governance models and innovations, such as digitization of agriculture and a green economy, for creating opportunities for young men and young women, (ii) assess whether or not the policy contexts favour efforts towards the implementation of a green economy and the digitization of agriculture by reviewing and synthesizing the development plans, policies and strategies relevant to youth opportunities in agriculture, and (iii) document entry points for youth opportunities and women's empowerment in agriculture, with a focus on the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors. The study assesses the gender gaps that need to be closed

so that the next generation of men and women in agriculture are not displaced by the technologies.

The report is organized as follows. Section 2 describes the methods employed in the study. Then, the opportunities for youth in the emerging governance models and innovations are discussed in section 4. A review of the policy context for youth opportunities in the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors then follows in section 5. Section 6 presents the findings of the needs assessment in each of the sectors. Section 7 elaborates on the gender gaps that need to be closed to realize positive outcomes on youth employment, and section 8 presents the conclusions of the study.

Emerging governance models and innovations in agriculture

- Emerging governance models and innovations towards Agriculture 4.0, the next agricultural revolution aiming to curb the food scarcity problem globally, build on a green economy and digitization of agriculture.
- Digitization of agriculture involves technologies and innovations such as blockchain, Internet of Things (IoT), big data and precision farming.
- A green economy provides a governance model that puts sustainable management of natural resources at the centre for economic development.
- Innovations and technologies in soil health and biodiversity have had increased attention in the efforts towards sustainable agriculture.
- Quality assurance and certification schemes encourage sustainable practices and provide domestic and global market opportunities for small businesses.
- Governments need to ensure that the shift to technologies and innovations does not displace youth and women, but rather promotes social capital and encourages investment in integrated approaches to food security and ecological diversity.
- A green economy provides a governance model that puts sustainable management of natural resources at the centre for economic development. It embraces technologies and innovative approaches for integrating the agriculture and energy sectors, and aims to create employment opportunities in an inclusive and sustainable manner.
- A green economy could attract investment from more powerful actors who tend to secure their property rights over natural resources, leaving the livelihoods of women and youth at stake. This situation could undermine the rural communities' stewardship and rights to access natural resources, including water, forests, land and the associated ecosystem services.

METHODS

The study involves a literature review and key informant interviews to gather data on opportunities for youth in rural business and entrepreneurship in agriculture, with a focus on the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors.

The review is based on literature published on new governance models and innovations in the past decade, and the development plans, policies and strategies relevant to youth opportunities in the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors in Mozambique, Rwanda and Uganda. The review involved computerized searches of websites and databases, including ScienceDirect, Scopus, World Bank, FAO, International Fund for Agricultural Development, African Union, African Development Bank, European Union, knowledge for food, Technical Centre for Agricultural and Rural Cooperation knowledge for development, Agriculture & Food Science Research Databases-EBSCO agriculture database, Organisation for Economic Co-operation and Development agriculture library and Apps4Agriculture. Websites of government ministries and youth in agriculture networks, such as the Young Professionals for Agricultural Development, Agriculture Rural Development and Youth in the Information Society, and the Global Youth Innovation Network, were also consulted.

Key words including ‘youth’, ‘young men’, ‘young women’, ‘youth employment’, ‘entrepreneurship’,

‘financial inclusion’, ‘innovations’, ‘mobile apps’, ‘social media’, ‘Science, Technology, and Innovation systems’, ‘digital data’, ‘internet of things’, ‘block chain’, ‘digital market places’, ‘youth platforms’, ‘agricultural market information’, ‘gender equality’, ‘precision farming’, ‘livestock husbandry’, ‘livestock marketing’, ‘energy production’, ‘energy supply’, ‘energy storage’, ‘renewable energy’, ‘solar technologies’, ‘alternative energy sources’, ‘climate-smart approaches’, ‘fisheries’, ‘aquaculture’, ‘national youth policy’, ‘youth employment strategy’, ‘youth in agriculture policy’ and ‘agricultural policy’ were used separately and in combination. Data were synthesized in the thematic areas of a green economy, digitization for agriculture, gender gaps and policy contexts across the respective sectors.

Key informant interviews were used to collect data on the opportunities for youth employment in the three sectors. Data were collected using online Microsoft forms because of the COVID-19 travel restrictions. A purposive sampling technique was employed in selecting informants with first-hand experience, including technical experts from governmental and non-governmental organizations, entrepreneurs (young men and young women), civil society organizations and academicians. In total, 33 key informants representing Mozambique (6), Rwanda (7) and Uganda (20), of whom 40 per cent were women and 60 per cent were men, participated in the needs assessment. Semi-structured questionnaires with open- and close-ended questions were used for data collection (see annex 2).

3.1

LIMITATIONS OF THE ASSESSMENT

Data were collected using online Microsoft forms because of the COVID-19 travel restrictions. It was not possible to conduct face-to-face interviews with potential key informants who had no access to the

Internet, and the online tools did not allow inclusion of those unable to comprehend the questions using online platforms.



4.1

EMERGING GOVERNANCE MODELS AND INNOVATIONS FOR YOUTH EMPLOYMENT IN AFRICA

4.1.1

Opportunities for youth in a green economy

In Africa, economic growth in the past decades has sometimes been ‘jobless’ and associated with greenhouse gas emissions and unsustainable management of natural resources.²² In response, efforts are under way to promote a green economy with the hope of developing an economy that creates employment opportunities in a sustainable manner.²³ Accordingly, measures are also under way in the circular economy, which encourages green businesses by employing innovations for generating electricity from waste from farming processes, as illustrated in the Bio2Watt project in South Africa.²⁴ Other efforts include the development of supportive

policies, such as the Climate Resilient Green Economy of Ethiopia and the Uganda Green Growth Development Strategy (UGGDS) 2017/18–2030/31.²⁵

In the same vein, SWITCH Africa Green (SAG), an initiative launched in 2014, has been promoting an inclusive green economy in African countries, including Burkina Faso and South Africa.²⁶ SAG encourages sustainable consumption and production patterns that generate growth and employment opportunities.²⁷ However, power relations among actors require attention in designing and implementing interventions in this governance model.

Power relations among actors require attention in a green economy²⁸

- A green economy provides a governance model that puts sustainable management of natural resources at the centre for economic development. It embraces technologies and innovative approaches for integrating the agriculture and energy sectors, and aims to create employment opportunities in an inclusive and sustainable manner.
- A green economy could attract investment from more powerful actors who tend to secure their property rights over natural resources, leaving the livelihoods of women and youth at stake. This situation could undermine the rural communities’ stewardship and rights to access natural resources, including water, forests, land and the associated ecosystem services.

22 ILO (International Labour Organization). 2018. *World Employment Social Outlook: Trends 2018*. Geneva: ILO.

23 UNEP (United Nations Environment Programme). 2015. *Building Inclusive Green Economies in Africa: Experience and Lessons Learned, 2010–2015*. Nairobi: UNEP.

24 PAGE (Partnership for Action on Green Economy). 2017. *Green Economy Inventory for South Africa: An Overview*. Pretoria: PAGE.

25 Federal Democratic Republic of Ethiopia. 2011. *Ethiopia’s Climate-resilient Green Economy: Green Economy Strategy*; and NPA (National Planning Authority of Uganda). 2017. *The Uganda Green Growth Development Strategy 2017/18–2030/31*. Kampala: NPA.

26 Green, S. A. 2018. *34 Projects at a Glance: Project Sheet for SWITCH Africa Green Programme*. Nairobi: United Nations Environment Programme.

27 Green, S. A. 2017. *SWITCH Africa Green*.

28 Ostrom, E. 2002. “Common-pool resources and institutions: Toward a revised theory”. *Handbook of Agricultural Economics 2* (Part A), pp. 1,315–1,339; Tandon, N. 2012. “Empowerment of women in a green economy in the context of sustainable development and poverty eradication”. New York: UN Women; SIDA (Swedish International Development Cooperation Agency). 2017. “Green economy – Why, what and how?” Stockholm: SIDA; WWF (World Wildlife Fund) and ILO (International Labour Organization). 2020. *Nature Hires: How Nature-based Solutions Can Power a Green Jobs Recovery*. Gland and Geneva: WWF and ILO.

Investment in infrastructure, technologies and equipment could strengthen the efforts towards maximizing the impact of a green economy on youth employment.²⁹ So far, the investments in a green economy have shown a positive impact on creating ‘green jobs’ while preventing degradation of the environment.³⁰ Although they have been little explored, opportunities exist for youth to innovate in enabling agroecological farming, such as in addressing soil fertility problems and innovations in integrated soil fertility management, thereby promoting soil health and biodiversity.³¹ Above all, renewable energy emerges as a key sector with regard to a green

economy, offering immense potential for innovations to provide low-carbon alternative energy sources.³² The sector is promising as Africa has untapped potential for renewable energy, considering it gets 325 days of sunlight, and only less than 2 per cent of its geothermal and wind power potential and less than 7 per cent of its hydroelectric potential is developed.³³ In addition, increased investment in the applications of technologies in the renewable energy sector could create opportunities for youth to engage in developing and applying innovative approaches in installations and maintenance of energy mini grids and stand-alone systems.³⁴

Green economy creates ‘green jobs’ and prevents environmental degradation³⁵

- Green jobs, defined as transforming economies, enterprises, workplaces and labour markets into a sustainable low-carbon economy providing decent work, could reinforce the efforts towards a green economy.
- Some of the green jobs include environmentally friendly food production, apiculture (i.e. beekeeping for the purpose of producing honey and other products), agroprocessing and energy production.
- Integrated pest management (IPM) and innovations in maintaining soil health and the environment, such as recycling animal manure with vermicompost and using bio-composting, exemplify a sustainable way of entrepreneurship in agroecological farming. Some experiments reveal that vermicomposting could provide farmers with economic incentives for improving manure management in Kampala, Uganda.
- Opportunities for youth emerge in developing technologies and innovations enabling IPM. For instance, digital tools such as the Fall Armyworm Monitoring and Early Warning System mobile app developed by FAO enable the collection of data on pests and early prevention of pest infestation in Africa.
- A green economy provides a governance model that puts sustainable management of natural resources at the centre for economic development. It embraces technologies and innovative approaches for integrating the agriculture and energy sectors, and aims to create employment opportunities in an inclusive and sustainable manner.
- A green economy could attract investment from more powerful actors who tend to secure their property rights over natural resources, leaving the livelihoods of women and youth at stake. This situation could undermine the rural communities’ stewardship and rights to access natural resources, including water, forests, land and the associated ecosystem services.

29 ILO (International Labour Organization). 2013. *Sustainable Development, Decent Work and Green Jobs*. Geneva: ILO.

30 UNEP (United Nations Environment Programme). 2015. *Building Inclusive Green Economies in Africa: Experience and Lessons Learned, 2010–2015*. Nairobi: UNEP.

31 Brzozowski, L. and M. Mazourek. 2018. “A sustainable agricultural future relies on the transition to organic agroecological pest management.” *Sustainability* 10 (6), p. 2023; Mecheo, S. 2020. *Identification of key stakeholders, constraints, and opportunities for youth in agroecology in Kenya, 2020*.

32 UNDP (United Nations Development Programme). 2018a. *Transforming Lives through Renewable Energy Access in Africa UNDP’s Contributions*. New York: UNDP.

33 UNDP (United Nations Development Programme). 2013. *Green Jobs for Women and Youth: What Can Local Governments Do?* New York: UNDP.

34 ILO (International Labour Organization). 2012. *Working Towards Sustainable Development: Opportunities for Decent Work and Social Inclusion in a Green Economy*. Geneva: ILO; Fashina, A. and others. 2019. “The drivers and barriers of renewable energy applications and development in Uganda: A review.” *Clean Technologies* 1 (1), pp. 9–39.

35 ILO (International Labour Organization). 2012. *Working Towards Sustainable Development: Opportunities for Decent Work and Social Inclusion in a Green Economy*. Geneva: ILO; Strietska-Illina, O. and others. 2012. *Skills for Green Jobs: A Global View*. Geneva: International Labour Organization; Ameyaw, D.S. 2015. *Africa Agriculture Status Report 2015: Youth and Agriculture in Sub-Saharan Africa*. Nairobi: Alliance for a Green Revolution in Kenya; Sahrawat, K. L. and others. 2016. “Soil nutrient mapping for on-farm fertility management.” In *Harnessing Dividends from Drylands*. Wallingford: Centre for Agriculture and Bioscience International, pp. 59–77; Lalander, C. H., A. J. Komakech and B. Vinnerås. 2015. “Vermicomposting as manure management strategy for urban small-holder animal farms – Kampala case study.” *Waste Management* 39, pp. 96–103.

Youth engage in innovations in renewable energy and environmental stewardship³⁶

Initiatives on renewable energy create employment opportunities for youth in the design and construction of clean energy schemes, and in the distribution and sales of clean energy, among other things. For instance, initiatives in Uganda promoted women as environmental stewards by empowering them to take an active role in reducing land degradation and increasing resilience to climate change through renewable solar energy sources, and soil and water conservation works.

Similarly, the livestock sector also has huge potential for employing youth in activities from livestock feed preparation to agroprocessing and sales and distribution activities. However, such opportunities require caution in regulating methane emissions. More opportunities for youth employment emerge in apiculture, as observed in successful cases in which youth cooperatives worked on integrated beekeeping and restoration of degraded landscapes.³⁷ Innovative approaches that combine livestock production with biogas development have shown promising results in reducing carbon emissions.

Technologies and innovations enable entrepreneurship and business in agriculture³⁸

In Kenya, innovations enable farmers engaging in animal husbandry and working on dairy farms to supply electricity for cooling and storing milk from biogas facilities. Digital apps for mobiles have been used in creating awareness of good animal husbandry, and dairy production and processing. The digital apps have helped farmers to increase the productivity and efficiency of their dairy farms with minimal carbon emissions.

Green jobs can play an important role in creating employment opportunities that are environmentally and socially sustainable across countries in Africa. These opportunities help in improving the quality of jobs, thereby contributing to the development of decent jobs.³⁹ In South Africa, a green economy has been expected to create an estimated average of 98,000, 255,000 and 462,000 new direct jobs in the formal economy in the short term, medium term and long term, respectively.⁴⁰ Efforts are under way in enabling green innovations such as using solar-powered dryers to prevent post-harvest loss among young farmers growing maize and rice in Ghana.⁴¹ Positive outcomes are also found in fostering youth engagement in green entrepreneurship through competitions of green business.⁴² Youth have opportunities to engage in green jobs, and in driving the green economy through entrepreneurships in low-carbon enterprises and employing innovative approaches to reduce emissions across different sectors.⁴³

36 EEP Africa (Energy and Environment Partnership Trust Fund). 2019. *Profiles of Change: Youth Opportunities in the Clean Energy Sector*. EEP Africa; UNDP (United Nations Development Programme). 2018b. *Women as Environmental Stewards: The Experience of the Global Environment Facility Small Grants Programme*. New York: UNDP.

37 Mekuria, W., G. Gebregziabher and N. Lefore. 2020. *Exclosures for Landscape Restoration in Ethiopia: Business Model Scenarios and Suitability*. Colombo: International Water Management Institute.

38 BMZ (Federal Ministry for Economic Cooperation and Development). 2017. *One World – No Hunger: Green Innovation Centres for the Agriculture and Food Sector*. Bonn: BMZ.

39 ILO (International Labour Organization). 2018. *World Employment Social Outlook: Trends 2018*. Geneva: ILO.

40 Maia, J. and others. 2011. *Green Jobs: An Estimate of the Direct Employment Potential of a Greening South African Economy*.

41 BMZ (Federal Ministry for Economic Cooperation and Development). 2017. *One World – No Hunger: Green Innovation Centres for the Agriculture and Food Sector*. Bonn: BMZ.

42 Harsdorff, M., P. K. Ng'ang'a and G. Waigi. 2012. *Promoting Green Entrepreneurship: First Lessons from the Youth Entrepreneurship Facility in Kenya 2010–2011*. Geneva: International Labour Organization.

43 International Trade Centre of the ILO (International Labour Organization). 2016. *Greening Economies Enterprises and Jobs: The Role of Employers' Organizations in the Promotion of Environmentally Sustainable Economies and Enterprises*. Turin: International Trade Centre of the ILO.

Youth opportunities in green economy

- Youth opportunities in a green economy include involving youth in developing and applying technologies and innovations that enable sustainable management of natural resources.
- Innovations and technologies in clean energy schemes, solar-powered dryers and the circular economy have a positive influence on youth employment and the environment.
- Innovations and technologies accompanying a green economy should embrace the diversity of youth and promote the accessibility of 'green jobs' by youth of different genders and backgrounds.
- A green economy could deprive women from their means of livelihoods, unless the design and implementation of initiatives take into consideration the need for capacity development and empowerment of women.

4.2.1

Opportunities for youth in digitization of agriculture

4.2.1.1 Internet of Things, big data and precision farming

IoT refers to a network to physical objects, such as devices, instruments, vehicles, buildings and other items with electronics, circuits, software, sensors and network connectivity, that enables the objects to collect and exchange data.⁴⁴ IoT enables the generation of huge number of data, whereas big data enables storage, processing and analysis of the data for powerful insights and informed decisions in agriculture.⁴⁵

E-currencies in the region There is an increased realization that agricultural transformation in Africa requires developing and implementing policies based on big data, which cover the complexity of food and agricultural systems. Big data play an important role in transforming agriculture by supporting actions for resilience in times of crisis.⁴⁶ Companies in the agricultural value chains could use big data to store, aggregate and analyse large sets of data, to make informed decisions in their businesses.⁴⁷ Big data have the potential to transform the way agribusiness projects are run and to make precision farming a reality in Africa.

Digital technologies improve farmers access to real-time data⁴⁸

- In Africa, the expansion of digital services in the agricultural sector, such as the use of apps to provide real-time market and agricultural information, supports the aspirations of the tech savvy and young population of Africa, who represent 37 per cent of Internet users.
- Bazafarm, a solar powered IoT device, enabled farmers in Rwanda to access real-time data on soil moisture, temperature and fertility, and supports farmers in making farm decisions, resulting in high yields of crops.

44 Patel, K. K. and S. M. Patel. 2016. "Internet of things-IOT: Definition, characteristics, architecture, enabling technologies, application & future challenges." *International Journal of Engineering Science and Computing* 6 (5); Gokhale, P., O. Bhat and S. Bhaat. 2018. "Introduction to IOT." *International Advanced Research Journal in Science, Engineering and Technology* 5 (1).

45 Tsan, M. and others. 2019. *The Digitalisation of African Agriculture Report 2018–2019*. Wageningen: The Technical Centre for Agricultural and Rural Cooperation.

46 World Economic Forum. 2020. *Data-Driven Food Systems for Crisis Resiliency – White Paper*. Cologne: World Economic Forum.

47 Tsan, M. and others. 2019. *The Digitalisation of African Agriculture Report 2018–2019*. Wageningen: The Technical Centre for Agricultural and Rural Cooperation.

48 ITU (International Telecommunication Union). 2017. "ICT facts and figures 2017." Geneva: ITU; FAO. 2018. "FAO Digital Innovation: Fact sheet." Rome: FAO; FAO. 2019b. *Proceedings of the International Symposium on Agricultural Innovation for Family Farmers – Unlocking the Potential of Agricultural Innovation to Achieve the Sustainable Development Goals*. Rome: FAO.

Digital technologies help in addressing difficulties in accessing finance, information and markets⁴⁹

- Positive experiences of using mobile-based apps such as M-Pesa for businesses and financial services across Africa are documented.
- In Nigeria, a high level of mobile ownership (89 per cent) contributed to the success of the eWallet programme on using vouchers for distributing seed and fertilizer directly to farmers.
- Digital innovations in the agro-forestry, pastoral and fishery sectors could provide youth with an environment for entrepreneurship and innovation.
- The emerging digital technologies such as blockchain and IoT-based solutions have contributions to make in this regard, considering that family farms and the aspirations of youth can be taken into account in their designs, development and applications.

Precision farming employs technologies combining geomorphology, satellite imagery, global positioning and smart sensors.⁵⁰ Unmanned aerial vehicles, also known as drones, brought about opportunities to transform African agriculture by providing real-time data on the crops, livestock and fisheries sectors, among other sectors.

Nevertheless, using drones for agricultural purposes would require the buy-in of policymakers, as it involves relaxing some strict regulations regarding

air regulations. Although some progress has been made in improving the regulatory framework in countries such as Kenya, realizing the impact of drones on the income and livelihoods of farmers might take quite some time in Africa. Similarly, the adoption of precision farming technologies among smallholder farmers producing lower-value crops is minimal; this is attributed to the lack of diverse business models and broad-based technologies for varied cropping systems.⁵¹

Drones support precision farming and financial inclusion⁵²

- Drones and their connected analytics could enable precision farming through (i) monitoring soils and crop health, (ii) enabling early detection of nutrient and water deficiencies, (iii) habitat mapping in fisheries and abundance estimates, (iv) supporting fisheries management, (v) supporting fertilizer application and planning of irrigation schedules, and (vi) providing data for weather analysis.
- Drones could help in addressing some of key challenges faced in agriculture and contribute to early preparedness for the negative impact of climate change, such as droughts and floods.
- Drones could facilitate farmers' access to resources and insurance services, and marketing of produce. For instance, smallholder farmers could have an increased level of access to credit facilities by using data collected by drones on the estimated crop yields.

49 Annan, K. and others. 2016. *African Farmers in the Digital Age*; Maru, A. and others. 2018. *Digital and Data-driven Agriculture: Harnessing the Power of Data for Smallholders*. Rome: Global Forum on Agricultural Research and Innovation; FAO. 2019b. *Proceedings of the International Symposium on Agricultural Innovation for Family Farmers – Unlocking the Potential of Agricultural Innovation to Achieve the Sustainable Development Goals*. Rome: FAO.

50 TWI2050 – The World in 2050. 2019. *The Digital Revolution and Sustainable Development: Opportunities and Challenges*. Laxenburg: International Institute for Applied Systems Analysis.

51 Finger, R. and others. 2019. "Precision farming at the nexus of agricultural production and the environment." *Annual Review of Resource Economics* 11, pp. 313–335. <https://doi.org/10.1146/annurev-resource-100518-093929>.

52 FAO. 2018. "FAO Digital Innovation: Fact sheet." Rome: FAO; IFAD (International Fund for Agricultural Development). 2019. *Creating Opportunities for Rural Youth: 2019 Rural Development Report*. Rome: IFAD.

Digital innovations empower youth and enable entrepreneurship⁵³

- Digital technologies create opportunities for youth by providing them with increased connectivity and empowering them.
- Youth could employ these technologies and build their enterprises in the agriculture sector. Youth who own land and organized youth groups could especially apply these technologies to increase the efficiency, productivity and profitability of their enterprises.
- Youth could get employment as intermediaries between digital technologies and smallholder farmers. They could build their capacities in analyzing big data and provide consultation services across the agricultural value chain.
- Active engagement of youth in analysing and interpreting big data could contribute to the transformation of agriculture.

So far, the processes of technology design and development have not been inclusive, and youth are often seen as mere users of digital technologies.⁵⁴ The amount of attention paid to the empowerment of youth and women in the design, development and application of these technologies is scant, thereby limiting their entrepreneurship and innovativeness in terms of 'smart' agriculture. For instance, women farmers in Rwanda lack extension support and access to innovations and technologies for engaging in gainful employment.⁵⁵ However, inclusiveness is critical for the effectiveness of these technologies and innovations in the efforts towards Agriculture 4.0.

4.2.1.2 Blockchain

Blockchain consists of data sets that are composed of a chain of data packages (blocks) in which a block comprises multiple transactions.⁵⁶ Blockchain enables a decentralized system of data storage, sorting and sharing along the agricultural value chains, and it enables traceability of products.⁵⁷ It uses encrypted codes that can be accessed by those engaging in business in the agricultural sector (i.e. blocks) and serves as a platform on which detailed information about agricultural produce, such as origin, packaging and shipping information, is shared among stakeholders, thereby protecting consumers from frauds.⁵⁸ Besides, it reduces the number of intermediaries, such as banks, in the transactions.⁵⁹

53 IFAD (International Fund for Agricultural Development). 2019. *Creating Opportunities for Rural Youth: 2019 Rural Development Report*. Rome: IFAD; Tsan, M. and others. 2019. *The Digitalisation of African Agriculture Report 2018–2019*. Wageningen: The Technical Centre for Agricultural and Rural Cooperation.

54 FAO. 2019a. *NUUS: Field Stories from Africa, Youth Edition*. Rome: FAO.

55 UN Women. 2019. *Innovation for Gender Equality*. New York: UN Women.

56 Nofer, M. and others. 2017. "Block chain." *Business and Information Systems Engineering* 59, pp. 183–187. <https://doi.org/10.1007/s12599-017-0467-3>.

57 Nižetić, S. and others. 2020. "Internet of Things (IoT): Opportunities, issues and challenges towards a smart and sustainable future." *Journal of Cleaner Production* 274; Torky, M. and A. E. Hassanein, 2020. "Integrating block chain and the internet of things in precision agriculture: Analysis, opportunities, and challenges." *Computers and Electronics in Agriculture* 178.

58 Xie, C., Y. Sun and H. Luo. 2017. "Secured data storage scheme based on block chain for agricultural products tracking." *3rd International Conference on Big Data Computing and Communications (BIGCOM)*; Zhao, G. and others. 2019. "Block chain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions." *Computers in Industry* 109, pp. 83–99.

59 Ge, L. and others. 2017. "Block chain for agriculture and food: Findings from the pilot study." Wageningen Economic Research report. Wageningen: Wageningen Economic Research; Wigley, B. and N. Cary, 2017. "The future is decentralised: Block chains, distributed ledgers, and the future of sustainable development."

Blockchain technology could facilitate business in the agricultural sector⁶⁰

- Blockchain technology has the potential to provide a wide range of benefits to the agricultural sector by (i) presenting opportunities to lower the level of uncertainty between buyers and sellers, and thereby ensuring that sellers are privy to market currencies and values at the farm gate, (ii) increasing the efficiency, transparency and traceability of the transactional exchanges of value and information, and (iii) enabling a simplified, peer-to-peer transaction network and using smart contracts.
- Some of the opportunities in using blockchain in the agricultural sector include smart contracts and crop insurance, land governance, and financial services.
- A combination of blockchain technology and IoT has also showed positive results in enabling precision agriculture and adding control in the management of supply chains (Torky and Hassanein, 2020). For instance, an IoT-enabled three-dimensional food printer helps in collecting and sharing data between consumers and food producers, increasing the efficiency of the agricultural value chains.

Most blockchain solutions developed so far focus on traceability and provenance to ensure food safety and prevent fraud in supply chain management.⁶¹ Applications have been developed using platforms such as Ethereum, Hyperledger Fabric (a blockchain-based fish farm platform) and Hyperledger Sawtooth, and often been used for traceability purposes.⁶² Efforts are also under way to use blockchain solutions to enable smart agriculture. For instance, Hyperledger Fabric has been developed to provide fish farmers with secure storage of a large number of data.⁶³ In addition, an electronic traceability service, TraceVerified, improved the credibility and competitiveness of farmers in Vietnam.⁶⁴

Thus far, the adoption of blockchain and IoT-based solutions in African agriculture has been in its infancy, and awareness of the technology is minimal and limited to countries such as South Africa and Kenya. Some initiatives include traceability of the coffee value chain in Ethiopia and Rwanda.

Digital technologies could provide youth with, for example, the opportunity to trace their produce and an increased level of protection for their brands, and enable producers to have an increased level of negotiation power to ensure equitable and fair sharing of value. Digital technologies could also support inclusiveness of financial services by making them accessible to farmers.⁶⁵ Equally important is the fact that African youth engaging in agricultural value chains often have limited capacities to meet the demand for good-quality products.⁶⁶ Their brands also struggle to stand out because of a lack of accurate data on the production, processing and transport of their products. In response, organic certification services expanded local and global market opportunities while contributing to environmental sustainability, as indicated in the case of Vanuatu.⁶⁷ Thus, initiatives on ensuring quality standards and certifying products of youth-led agribusinesses using globally recognized certification schemes increased employment opportunities for youth in agriculture and food systems.⁶⁸

60 Tripoli, M. and J. Schmidhuber. 2018. *Emerging Opportunities for the Application of Block Chain in the Agri-food Industry*. Geneva: FAO and International Centre for Trade and Sustainable Development; Addison C. and others. 2019. "Opportunities of block chain for agriculture: Brussels rural development briefings." Briefing no. 55. Brussels: Technical Centre for Agricultural and Rural Cooperation. FAO and ITU (International Telecommunication Union). 2017. *E-agriculture in Action*. Bangkok: FAO and ITU.

61 Lin, W. and others. 2020. "Block chain technology in current agricultural systems: from techniques to applications." *IEEE Access* 8.

62 Lin, W. and others. 2020. "Block chain technology in current agricultural systems: from techniques to applications." *IEEE Access* 8.

63 Hang, L., I. Ullah and D.-H. Kim. 2020. "A secure fish farm platform based on block chain for agriculture data integrity." *Computer and Electronics in Agriculture* 170 (1–3).

64 FAO and ITU (International Telecommunication Union). 2017. *E-agriculture in Action*. Bangkok: FAO and ITU.

65 IFAD (International Fund for Agricultural Development). 2019. *Creating Opportunities for Rural Youth: 2019 Rural Development Report*. Rome: IFAD.

66 Koira, A. K. 2014. "Agribusiness in Sub-Saharan Africa: Pathways for Developing Innovative Programs for Youth and the Rural Poor". Working Paper. Toronto: The Mastercard Foundation.

67 Wong, C. 2019. "Case study: Youth opportunities in organic agriculture Vanuatu." Sustainable Development Goals Fund.

68 FAO, CTA (Technical Centre for Agricultural and Rural Cooperation) and IFAD (International Fund for Agricultural Development). 2014. *Youth and Agriculture: Key Challenges and Concrete Solutions*. Rome: FAO.

Inclusiveness is critical to the success of blockchain technology in agriculture⁶⁹

- Blockchain technology has connected key actors in the coffee supply chain and enabled a transparent approach in transactions. For instance, Fairchain Coffee Ethiopia applied blockchain technology to in the coffee value chain. The technology helped small-scale farmers and sellers earn a fair income, thereby supporting high-quality products.
- Moyo Coffee, a Dutch-based company, has employed blockchain technology to collaborate with Ethiopian coffee growers, with the hope of increasing the income of coffee growers with a bonus of 20 per cent of the total sales. Collaboration among actors results in the increased income of coffee growers and encourages farmers who produce high-quality organic coffee.
- More efforts are required to emphasize the need for gender equality and women's empowerment in such initiatives, so that the technologies result in positive and sustainable livelihood outcomes among people of different socioeconomic and gender backgrounds.

Youth often rely on intermediaries to access finance and markets, and face reduced market gains. Blockchain could thus attract business opportunities for youth, as the platform builds trust among actors. Above all, blockchain might help youth and women build good reputations and track records in the marketplace, which could in turn help them access financial services.⁷⁰ Employment opportunities for youth also include providing ICT-enabled extension and advisory services.

Digital divide and gender gap: Africa exhibits a large digital gender gap, as only 20 per cent of women used the Internet in 2019, compared with 37 per cent of men.⁷¹ Poor women in developing countries, including Uganda and Mozambique, are 50 per cent less likely to access the Internet than men in the same communities, and those who use the Internet are 30–50 per cent less likely than men to use the Internet for improving income and participation in public life.⁷² Governments have undergone efforts to create an enabling environment for regulating the use of ICT and promoting access to it.⁷³ However, these efforts are not adequate considering the deep-

rooted inequality in accessing resources and services among society. Thus, reaping the benefits of ICT for employment creation in an environmentally friendly and socially equitable manner could be determined by the level of investments geared towards addressing the digital divide.

Once more, the success of the digital technologies and innovations could be determined by whether or not the processes of design and development focus on inclusiveness. Mechanisms of inclusiveness need to be revisited so that outcomes of Agriculture 4.0 can have a positive impact on the actors involved and mistakes of past agricultural revolutions are not repeated.⁷⁴ The technologies and innovations that take into consideration the aspirations of youth could enable inclusive business models that develop new markets, derive innovation, employ more youth, strengthen value chains and empower the voiceless actors.⁷⁵

69 FAO. 2019b. *Proceedings of the International Symposium on Agricultural Innovation for Family Farmers – Unlocking the Potential of Agricultural Innovation to Achieve the Sustainable Development Goals*. Rome: FAO; Roobeek, A., and W. van Golstein Brouwers. 2014. "Social objective driven enterprises on innovation for sustainability in a collaborative networking ecosystem." Paper prepared for the ABIS I4S meeting at Manchester Business School of the University of Manchester, 7–9 May 2014. Breukelen: Nyenrode Business University.

70 Tripoli, M. and J. Schmidhuber. 2018. *Emerging Opportunities for the Application of Block Chain in the Agri-food Industry*. Geneva: FAO and International Centre for Trade and Sustainable Development.

71 ITU (International Telecommunication Union). 2020a. *Measuring Digital Development: Facts and Figures 2020*. Geneva: ITU.

72 ITU (International Telecommunication Union). 2020b. *Digital Skills Insights 2020*. Geneva: ITU.

73 Resnick, D., X. Diao and G. Tadesse (Eds.). 2020. *2020 Annual Trends and Outlook Report: Sustaining Africa's Agrifood System Transformation: The Role of Public Policies*. Washington D.C. and Kigali: International Food Policy Research Institute and AKADEMYIA2063.

74 Rose, D. C. and J. Chilvers. 2018. "Agriculture 4.0: Broadening responsible innovation in an era of smart farming." *Frontiers in Sustainable Food Systems* 2.

75 FAO. 2014. *The State of Food and Agriculture: Innovation in Family Farming*. Rome: FAO.

Youth opportunities in digitization of agriculture⁷⁶

- Youth are employed in the area of digitization of agriculture as innovators, developers and users.
- Digital technologies could provide youth with, for example, the opportunity to trace their produce and an increased level of protection for their brands, and enable producers to have an increased level of negotiation power to ensure equitable and fair sharing of value.
- Customizing blockchain technologies plays a central role in enabling youth to reap the benefits of the technologies in their businesses and services.
- Smart farming employs digital apps for real-time market and agricultural information, and youth take part in providing consultation and advisory services.
- Innovations and technologies in the digitization of agriculture should consider the aspirations of youth of different genders and backgrounds to ensure a lasting impact on employment and sustainable agriculture.
- Addressing the 'digital divide' through investment in digital literacy and making digital technologies affordable are prerequisites for the success of digitization of agriculture.

76 Giovannetti, E. 2017. "Digital divide and digital multiplier: A paradigm shift through innovation." In *ICT-Centric Economic Growth, Innovation and Job Creation*. A. Sharafat and W. Lehr (Eds.). Geneva: International Telecommunication Union; Unwin, T. 2017. "ICTs, sustainability and development: Critical elements." *ICT-centric Economic Growth, Innovation and Job Creation*. A. Sharafat and W. Lehr (Eds.). Geneva: International Telecommunication Union.

5.1

POLICIES FOR YOUTH OPPORTUNITIES IN AGRICULTURE

5.1.1

Mozambique

5.1.1.1 Policies and youth opportunities in agriculture

Development plans and policies in Mozambique acknowledge the need for inclusive development and job creation, as shown in the government's five-year programme (PQG) for 2020–2024, and the Poverty Reduction Action Plan (PARP II).⁷⁷ The population of Mozambique is youthful; about 46 per cent of the population is younger than 15 years of age, and only 3 per cent is older than 65 years of age.⁷⁸ Hence, realization of the development goals relies on creating opportunities across the agriculture, fisheries, and livestock sectors to address the underemployment challenge faced by the population.⁷⁹ Accordingly, the National Development Strategy (2015–2035) provides a comprehensive approach to developing the agricultural and industry sectors to increase employment⁸⁰. The Rural Development Strategy also underlines the important roles of innovativeness and competitiveness in harnessing the potential of the agricultural sector for economic and social development.⁸¹ Similarly, the Strategic Plan for the Development of the Agricultural Sector and the National Agricultural Investment Plan (PNISA) focus on boosting the productivity and competitiveness

of the sector for food and nutrition security while ensuring gender and social equity.⁸²

The country's Agenda 2025 recognizes skills development of youth and women's empowerment in decision-making processes as important strategies for achieving sustainable development. It also underlines that the low level of productivity and innovativeness of the workforce emanates from the inadequacy of entrepreneurial training.⁸³ In view of this, employment policies and programmes in Mozambique point out that youth unemployment could be addressed through skills development, which enables self-employment across sectors. For instance, the Mozambique Decent Work Country Programme (2011–2015) puts forward that youth employment could be promoted through special programmes such as internships and by supporting self-employment among youth.⁸⁴ The Vocational Training Reform Programme also encourages self-employment among youth and women entrepreneurs.⁸⁵

77 MASA (Ministry of Agriculture and Food Security). 2017. *Mozambique National Agricultural Investment Plan (PNISA): Assessment in 2017*. Maputo: MASA; GoM (Government of Mozambique). 2020.

78 Chitiga, M., I. Fofana and M. Diallo. 2020. "African commitments for agricultural development: Goals and milestones for Mozambique." Working Paper No. 0046. Washington D.C.: African Growth and Development Policy Modeling Consortium.

79 MICOA (Ministry for the Co-ordination of Environmental Affairs). 2007. *National Adaptation Programme of Action (NAPA)*. Maputo: MICOA.

80 MPD (Ministry of Planning and Development). 2014. *National Development Strategy (2015–2035)*. Maputo: MPD.

81 Ministry of Planning and Development, 2007

82 MASA. 2010. (Ministry of Agriculture and Food Security). *Strategic Plan for Agricultural Development PEDSA 2010–2020*.

Maputo: MASA; MASA (Ministry of Agriculture and Food Security). 2017. *Mozambique National Agricultural Investment Plan (PNISA): Assessment in 2017*. Maputo: MASA.

83 GoM (Government of Mozambique). 2003. *Agenda 2025: The Nation's Vision and Strategies*. Maputo: GoM.

84 MITRAB (Ministry of Labour, Employment and Social Security). 2010. *Mozambique Decent Work Country Programme 2011–2015*. Maputo: MITRAB.

85 Jones, S., R. Santos and G. Xirinda. 2020. "Misinformed, mismatched, or misled?: Explaining the gap between expected and realized graduate earnings in Mozambique." WIDER Working Paper No. 2020/47. Helsinki: United Nations University World Institute for Development Economics Research.

5.1.1.2 Policies on renewable energy and climate resilience

The PNISA and the Fisheries Plan (2010–2019) aim to expand and diversify activities in the fisheries and aquaculture sector through diversification such as by developing aquaculture farm enterprises and motorized offshore fishing practices. The Policy and Strategy of the Sea also promotes innovations and technologies to increase the benefits of the fisheries and aquaculture sector for economic and social development.⁸⁶ The policy context reveals support for regulating illegal fish trade to prevent overexploitation of resources.⁸⁷ It acknowledges women and youth as key players of the fisheries and aquaculture sector, such as in marketing and processing fish.⁸⁸ However, policies and strategies put little emphasis on healthy fisheries and resilience systems, which would help in enabling inclusive trade and employment opportunities.⁸⁹

The Development Strategy of the Livestock Sub-Sector (2010–2015) also aims to (i) remove the bottlenecks for agribusiness development in the livestock sector, (ii) increase the productivity and competitiveness of the livestock sector, (iii) enable integrated and sustainable approaches in small-scale and commercial livestock production systems, and (iv) promote enterprise development, such as through engagement of small and medium-sized enterprises (SMEs) in the production and processing of livestock products.⁹⁰ The sector could provide employment opportunities in the processing and marketing of livestock and animal-sourced products could lead to increased employment opportunities.⁹¹ For instance, the intensification of poultry and dairy systems are central to the programme. Intensification

of livestock production (PIPEC) encourages the engagement of SMEs in the livestock agribusiness sector, including in improving the productivity of chicken and eggs, and in addressing the bottlenecks of running a business in the sector.⁹² This provision could help organized women and youth groups to engage in gainful employment in the livestock sector. More opportunities also exist in developing livestock infrastructure and providing consultancy services in livestock production and marketing.⁹³

The policy context provides support for renewable energy, as illustrated in the New Policy on Energy, which aims to improve new forms of sustainable and diversified energy and promote the supply of new energy to support socioeconomic development.⁹⁴ The biofuel policy and strategy also promote the sustainable production of biofuel based on local energy resources and investments supporting food security and income-generating activities.⁹⁵ This provision helps generate employment opportunities for women and youth in the development and services of renewable energy sources such as biogas and clean energy cooking stoves. For instance, the biomass energy sector could promote employment by engaging the population in rural areas in the supply of wood fuels.⁹⁶

5.1.1.3 Policies on ‘green jobs’

The National Sustainable Development Plan (PNAS) reveals support for resilient systems by promoting innovations and technologies for enabling sustainable agroecological farming systems. The PNAS promotes a diversified and job-creating economy through (i) increased efficiency and effectiveness in agricultural production processes,

86 GoM (Government of Mozambique). 2017. *Resolution No. 39/2017 Approving the Policy and Strategy of the Sea (POLMAR)*. Boletim da República, I Série, No. 144. Maputo: GoM. <http://extwprlegs1.fao.org/docs/pdf/moz172386.pdf>.

87 MDP (Ministry of Planning and Development). 2010. *The Fisheries Plan 2010–2019*. Maputo: MDP; MASA (Ministry of Agriculture and Food Security). 2017. *Mozambique National Agricultural Investment Plan (PNISA): Assessment in 2017*. Maputo: MASA.

88 MDP (Ministry of Planning and Development). 2014. *South West Indian Ocean Fisheries Governance and Shared Growth in Mozambique (SWIOFish)*. Maputo: MDP.

89 World Bank and United Nations Department of Economic and Social Affairs. 2017. *The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries*. Washington D.C.: World Bank.

90 GoM (Government of Mozambique). 2015. *Programme of Intensification of Livestock Production (PIPEC) 2015–2019*. Maputo: GoM.

91 MASA (Ministry of Agriculture and Food Security). 2017. *Mozambique National Agricultural Investment Plan (PNISA): Assessment in 2017*. Maputo: MASA.

92 GoM (Government of Mozambique). 2015. *Programme of Intensification of Livestock Production (PIPEC) 2015–2019*. Maputo: GoM.

93 MASA (Ministry of Agriculture and Food Security). 2017. *Mozambique National Agricultural Investment Plan (PNISA): Assessment in 2017*. Maputo: MASA.

94 GoM (Government of Mozambique). 2009a. *Resolution No. 10/2009 Approving the New Policy on Energy*. Boletim da República, I Série, No. 22. Maputo: GoM. <http://extwprlegs1.fao.org/docs/pdf/moz119871.pdf>.

95 GoM (Government of Mozambique). 2009b. *Resolution No. 22/2009 Approving the Policy and Strategy on Biofuel*. Boletim da República, I Série, No. 20. Maputo: GoM. <http://extwprlegs1.fao.org/docs/pdf/moz133816.pdf>.

96 van der Plas et al. 2012. “Mozambique biomass energy strategy”.

and (ii) capacity development and transfer of innovations and technologies in renewable energy in rural areas, among other things.⁹⁷ The Environment Strategy also suggests an integrated framework in which food security and socioeconomic goals consider sustainable approaches, such as using renewable energy sources in agriculture and avoiding overexploitation of fisheries and aquatic resources.⁹⁸

Besides, the National Adaptation Plan indicates the need to promote actions that limit erosion and develop sustainable fishery activities, and actions that reduce greenhouse gases emissions. Furthermore, the National Strategy for Adaptation and Mitigation for Climate Change focuses on making agricultural, livestock and fishery systems resilient, and enabling carbon mitigation and development through improved access to renewable energy sources, and increased efficiency of the energy sector.⁹⁹ However, the Green Revolution Strategy and PARP II have not emphasized environmental sustainability.¹⁰⁰ They also do not focus on addressing gender-based constraints, though youth, women and marginalized groups have been key actors in the fisheries and aquaculture sector.¹⁰¹

In summary, the policy framework of Mozambique provides support to enable the use of renewable energy in the agricultural, fisheries and livestock sectors (Table 1). The policy support could help in meeting the demand for skilled labour in agriculture, promoting youth entrepreneurship in agribusiness and developing innovations and technologies.¹⁰² However, the policies lack focus on women and youth involvement across the sectors. Experience shows that women and youth often have limited access to employment opportunities in high-value fishery and agricultural products.¹⁰³ Among other things, a lack of inclusive renewable energy policies and practices would negatively affect women's assets and livelihoods and aggravate inequality. Enforcement of regulations on illegal fishing without developing integrative approaches that engage women in income-generating activities in the fisheries and aquaculture sector could also do more harm than good to the poor. Thus, failure to address inequality issues and gender-based constraints in each sector reduces the success of the policy provisions.

TABLE 1.
Summary of policy context on youth opportunities

Policy focus	Provisions for youth in agriculture		
	Mozambique	Rwanda	Uganda
Youth opportunities in agriculture	***	***	***
Renewable energy and climate resilience	***	***	***
'Green jobs'	*	**	**
Digitization of agriculture	*	***	**
Gender-specific provisions	*	**	*

* indicates the extent of policy provisions.

97 MITADER (Ministry of Land, Environment and Rural Development). 2015. *National Sustainable Development Programme (PNDS) – Rural, Sustainable and Inclusive Growth*. Maputo: MITADER. <http://extwprlegs1.fao.org/docs/pdf/moz176547.pdf>.

98 GoM (Government of Mozambique), 2007.

99 GoM (Government of Mozambique), 2013. *National Strategy for Adaptation and Mitigation for Climate Change*. Maputo: GoM.

100 Hugé, J. and L. Hens. 2009. "The greening of poverty reduction strategy papers: A process approach to sustainability assessment." *Impact Assessment and Project Appraisal* 27 (1), pp. 7–18.

101 World Bank and United Nations Department of Economic and Social Affairs. 2017. *The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries*. Washington D.C.: World Bank.

102 Cho, Y. and K. Fedá. 2015. "Skills and employability in Mozambique: Implications for education and training policies." Washington D.C.: World Bank.

103 Fan, S. and C. Rue. 2020. "The role of smallholder farms in a changing world." *In The Role of Smallholder Farms in Food and Nutrition Security*. S. Gomez y Paloma, L. Riesgo and K. Louhichi (Eds.). Cham: Springer, pp. 13–28.

5.2.1 Rwanda

5.2.1.1 Policies and youth opportunities in agriculture

Youth unemployment has been a development challenge in Rwanda. More than 50 per cent of the rural youth (16–24 years) are engaged in agriculture. However, youth opportunities in agriculture are constrained by land fragmentation.¹⁰⁴ The policy frameworks emphasize creating employment opportunities for youth. For instance, the National Strategy for Transformation (NST 1), an implementation instrument of the country's vision 2050, plans to create 1.5 million (214,000 annually) decent and productive jobs during 2017–2024. NST 1 points out that the agriculture, livestock and fisheries and aquaculture sectors are key employers of women and youth.¹⁰⁵ Among other things, the fisheries and aquaculture sector employs youth and women in a less productive manner, as the productivity of the sector has limited capacity in breeding and feeding techniques. The livestock sector has limitations on feed supplies and good-quality products.¹⁰⁶ NST 1 aims to build the capacity of farmers to increase the quality and volume of their produce and their productivity, improve farmers' access to finance, and encourage investment by farmers and the private sector.¹⁰⁷

5.2.1.2 Policies on renewable energy and climate resilience

The policy framework recognizes the need to boost productivity and employment opportunities in agriculture through agroprocessing and intensive use of technology, and the need to ensure sustainability in agricultural systems.¹⁰⁸ Similarly, the National Agricultural Plan of Rwanda (NAP) states that attracting the private sector to commercial agriculture could increase the productivity and competitiveness of the sector. Agroecological farming also has policy support because of its

benefits in enabling sustainable agriculture. For instance, promotion of sustainable management of the environment and natural resources for a green economy has been one of the priorities of NST 1. The strategy plans to implement forest and landscape restoration and reduce the dependence on firewood through the expansion of alternative energy sources such as biogas.¹⁰⁹ The National Strategy on Green Growth and Climate Resilience aims to enable low-carbon development through geothermal power generation and integrated soil fertility management.¹¹⁰ The NAP also states the need to address the negative effect of land degradation, land fragmentation and climate change with climate-smart agricultural practices, focusing on high-value products and employing land-sparing technologies. It also encourages farmers to engage in mixed farming, to enable integrated soil fertility management and to reinforce pest and disease management.¹¹¹

The policy framework reveals support for renewable energy by reducing the use of biomass.¹¹² The Rwanda Energy Policy aims to increase the share of renewable energy from hydropower, geothermal sources, solar power and methane gas. It promotes the expansion of clean energy sources and technologies, such as biogas for heating and cooking purposes. The energy policy and strategy also encourage innovative approaches to increasing access to and distribution of renewable energy. The policy encourages the alignment of the energy sector with the goals of a green economy.¹¹³ In this way, renewable energy sources would be applied across agricultural practices. Women would benefit from using renewable energy for energy sources, and clean energy sources help them make more time for other productive employment. Youth could also benefit from the opportunities to develop, use, distribute and sell energy-conserving stoves and solar technologies.

104 MINAGRI (Ministry of Agriculture and Animal Resources). 2018a. *National Agricultural Policy*. Kigali: MINIAGRI.

105 GoR (Government of Rwanda). 2017. *7 Years Government Programme: National Strategy for Transformation (NST1) 2017–2024*. Kigali: GoR.

106 MINAGRI (Ministry of Agriculture and Animal Resources). 2018a. *National Agricultural Policy*. Kigali: MINIAGRI.

107 GoR (Government of Rwanda). 2017. *7 Years Government Programme: National Strategy for Transformation (NST1) 2017–2024*. Kigali: GoR.

108 MINAGRI (Ministry of Agriculture and Animal Resources). 2018b. *Strategic Plan for the Transformation of Agriculture in Rwanda – Phase IV: 19 2018–2024*. Kigali: MINIAGRI.

109 GoR (Government of Rwanda). 2017. *7 Years Government Programme: National Strategy for Transformation (NST1) 2017–2024*. Kigali: GoR.

110 GoR (Government of Rwanda). 2011. *Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development*. Kigali: GoR.

111 MINAGRI (Ministry of Agriculture and Animal Resources). 2018b. *Strategic Plan for the Transformation of Agriculture in Rwanda – Phase IV: 19 2018–2024*. Kigali: MINIAGRI.

112 GoR (Government of Rwanda). 2004. *Energy Policy for Rwanda*. Kigali: GoR.

113 van der Plas et al. 2012.

5.2.1.3 Policies on ‘green jobs’

The Strategic Plan for Agriculture Transformation (PSTA 4) anticipates that increased agricultural productivity could create more jobs across the value chain, including in food processing, food trade and food preparation.¹¹⁴ Accordingly, the strategy suggests the following interventions: (i) the development of subsectors with a high potential for employment creation, such as agroprocessing, meat and dairy; (ii) the provision of support for entrepreneurship among women and youth; (iii) technical and vocational education and training (TVET) skills development; and (iv) the prioritization of digital literacy for all youth, and the development of innovations, among other things.¹¹⁵ The Gender and Youth Mainstreaming Strategy aligns with PSTA 4 in supporting interventions that address gender-based constraints in skills development, access to financial services, access to lucrative agribusiness opportunities and women empowerment in decision-making processes.¹¹⁶ The NAP also emphasizes that market orientation and business skills development of youth and women could help in creating employment opportunities. It also aspires to achieve economic empowerment of women through targeted support for women in technical skills and financial services, such as start-up funds for women in agribusiness and other income-generating agricultural activities.

The policy promotes and incentivized private sector engagement in addressing the feed shortage. Youth could take advantage of the opportunities in animal feed processing activities and exploit opportunities in honey production and apiculture agribusiness.¹¹⁷ In particular, the NAP states that youth could engage in off-farm opportunities, considering their low level of land ownership and the higher relevance of their education to off-farm sectors, such as in some agribusiness activities. Youth could also find opportunities in innovations and technological development for reducing post-harvest loss and supporting sustainable agricultural systems. The NAP prioritizes land-saving production technologies and business models that increase the quantity and quality of produce and animal resources per hectare. It also encourages private sector investment

and provides subsidies for investment in soft and hard infrastructure development in post-harvest management, ICT for agriculture (ICT4Ag), cold storage facilities and controlling soil erosion.

The NAP emphasizes the need to provide specialized training for youth in local and global food safety standards, and in developing appropriate, low-cost packaging and labelling. In this case, youth have opportunities in developing and applying technologies and innovations, and support the efforts towards certified standard products. Youth could also provide consultation services to entrepreneurs and SMEs in the agro-food systems to attract business opportunities. The ICT4Ag strategy puts youth at the centre of e-agriculture and encourages their engagement in agroprocessing and smart farming practices. The strategy also acknowledges the digital divide as a problem and seeks investment in ICT infrastructure for better access and affordability among youth.

Indeed, the policy framework in Rwanda encourages smart farming practices. For instance, PSTA 4 seeks to promote sustainable land husbandry and climate-smart practices. It aspires to achieve resilient agricultural systems by promoting mixed cropping systems and climate-smart soil and integrated watershed management techniques that improve the productivity of land and soil resources, and improving weather and climate information systems. In the same vein, the ICT4Ag strategy promotes the development and application of digital technologies across the farming cycle (i.e. pre-cultivation, crop management and harvesting, and post-harvesting activities). It supports projects on (i) farmer management support systems, such as enabling better crop cultivation practices based on climatic conditions, (ii) agroprocessing management systems, including ICT-enabled coordination and collaboration in value addition among stakeholders, (iii) agro-smart traceability, which ensures productivity and the quality of agricultural products, and (iv) agriculture growth management systems, which involve growth management using sensor network technology.

114 MINAGRI (Ministry of Agriculture and Animal Resources). 2018b. *Strategic Plan for the Transformation of Agriculture in Rwanda – Phase IV: 19 2018–2024*. Kigali: MINIAGRI.

115 GoR (Government of Rwanda). 2017. *7 Years Government Programme: National Strategy for Transformation (NST1) 2017–2024*. Kigali: GoR.

116 MINAGRI (Ministry of Agriculture and Animal Resources). 2019. *Gender and Youth Mainstreaming Strategy*. Kigali: MINIAGRI.

117 MINAGRI (Ministry of Agriculture and Animal Resources). 2018b. *Strategic Plan for the Transformation of Agriculture in Rwanda – Phase IV: 19 2018–2024*. Kigali: MINIAGRI.

5.2.1.4 Policies on digitization of agriculture

The ICT4Ag supports precision farming practices using satellite technologies. It underlines a combined use of technologies providing information for precise applications of fertilizers and insecticides and use of micro-sensors to enhance data sets for precision farming. The ICT4Ag suggests increasing the affordability of ICT and narrowing the digital divide by strengthening the ICT centres providing information and services to farmers at district levels. This suggestion aligns with the emphasis given to youth's increased access to ICT in the National Youth Policy.¹¹⁸ The ICT4Ag also works towards building the digital skills of farmers and enhancing digital literacy as set out in NST 1. The strategy further provides for financial inclusion by employing a supply chain approach for an efficient and cost-effective lending system. The strategy puts forward platforms and applications to enable e-agriculture in Rwanda, including e-Growers Information Management System, e-Inputs, e-Agri-Wallet, e-Trace Dairy and e-Information. Rwanda exhibits a comprehensive policy framework for digital agriculture. Other strategies include increasing the productivity of the crop and livestock sector through agroprocessing for value addition and strengthening the E-Soko+ market information system. Yet again, the dairy strategy and investment plan for the poultry and meat industries pays little attention to aligning activities with the initiatives towards a green economy.¹¹⁹

In summary, the development plans point out that land fragmentation is a key constraint on agricultural development and employment creation (Table 1). For that reason, the policy framework prioritizes creating employment opportunities in smart farming and off-farm activities in support of e-agriculture and a green economy. The support given to digital technologies in agriculture aligns well with the increased global attention. Opportunities could emerge in using blockchain technologies for traceability and certification of quality standards for agricultural produce. Youth could take advantage of these provisions and engage in entrepreneurship by

developing, using and marketing innovations and technologies enabling precision farming.

5.3.1 Uganda

5.3.1.1 Policies and youth opportunities in agriculture

Youth unemployment, attributed to skill mismatches, poses a threat to social and economic development in Uganda.¹²⁰ More than 79 per cent of youth live in rural areas, work in agriculture and are characterized by underemployment on family farms.¹²¹ Young women are more likely to be underemployed on family farms than young men.¹²² Uganda's Vision 2040 and the National Development Plan (NDP II) indicate the need to transform the agricultural sector from subsistence to commercial by making use of the abundant labour force. The National Agricultural Policy of Uganda encourages the engagement of organized farmer groups in value addition and agribusiness in specialized agricultural zones. The development plans and policies also look at youth as opportunities for technological development and innovations towards improved productivity. Increasing the income of farming households from agricultural activities including livestock, fisheries and aquaculture development is also one of the objectives of the National Agricultural Policy.¹²³ This objective could be achieved by enhancing the agricultural knowledge, practices and innovations of youth through TVET centres and innovation hubs.

Youth entrepreneurship and innovation are central to sustainable agriculture in Uganda. The development plans put forward strategies, which include (i) expanding agroprocessing, which has become a mechanism for increasing the competitiveness of the agricultural sector, value addition, employment creation for youth, and empowerment of women and disadvantaged groups, (ii) building the capacities of youth and harnessing their potential for entrepreneurship and innovativeness, and (iii) strengthening cooperatives and collective marketing

118 GoR (Government of Rwanda). 2015a. *National Youth Policy Towards a HAPPI Generation*. Kigali: GoR; GoR (Government of Rwanda). 2015b. *National ICT4RAg Strategy (2016–2020)*. Kigali: GoR.

119 MINAGRI (Ministry of Agriculture and Animal Resources). 2012. *Strategic and Investment Plan to Strengthen Meat Industry in Rwanda*. Kigali: MINIAGRI.

120 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA.

121 NPA (National Planning Authority of Uganda). 2015. *Implementation Strategy for the Second National Development Plan (2015/16–2019/20)*. Kampala: NPA.

122 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2019a. *National Strategy for Youth Employment in Agriculture*. Entebbe: MAAIF.

123 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2013. *National Agricultural Policy of Uganda*. Entebbe: MAAIF.

by farmers for increased entrepreneurship. Initiatives including the Youth Livelihood Programme were also implemented with the goal of harnessing the potential for entrepreneurship among youth.¹²⁴ The National Strategy for Youth Employment in Agriculture (NSYEA) reveals support for interventions agroprocessing and post-harvest handling innovations and technologies for creating employment opportunities, reducing post-harvest losses and increasing the profitability of the agricultural sector. It also puts forward incentives, such as the Youth in Agriculture Fund, which helps youth acquire skills and credits in an affordable manner, and access land and equipment for production and agroprocessing activities.¹²⁵

5.3.1.2 Policies on renewable energy and climate resilience

Special emphasis is given to agroprocessing in aquaculture and livestock farming in Uganda's Vision 2040 and NDP II.¹²⁶ NDP II promotes sustainable use of water resources for irrigation, livestock watering, fisheries and aquaculture.¹²⁷ The Agricultural Sector Strategy Plan (ASSP) supports increasing the level of productivity of the fisheries and aquaculture sector through investments in fish ponds and technologies and innovations for fish breeding and value addition in the sector.¹²⁸ The National Fisheries and Aquaculture Policy promotes best stewardship practices on fisheries and aquaculture resources and putting in place effective information systems for monitoring post-harvest losses and ensuring safety and the quality of the standards of the produce. The policy also encourages environmentally friendly fishing and aquaculture practices for ensuring sustainable use of natural resources.¹²⁹

The livestock sector in Uganda faces shortages in animal feed and a lack of skilled labour in integrated approaches for animal husbandry, soil conservation and integrated pest management practices. The National Animal Feeds Policy aspires to increase animal feed production, ensure the quality of animal feed and lower production costs. Agroprocessing and marketing systems are also not efficient because of a lack of efficient resource use during production and agroprocessing activity costs.¹³⁰ The National Adaptation Plan for the Agricultural Sector identifies the vulnerabilities of these areas to the adverse effects of climate change.¹³¹ The ASSP also encourages sustainable use of water resources and labour-saving technologies in livestock production, on dairy farms, in beef processing and in other agribusiness activities in the livestock sector. It also puts forward renewable energy strategies, including water use efficiency, water recycling and water reuse, which could support the optimal use of water resources in commercial agriculture, including irrigation, and the livestock, fisheries and aquaculture sectors.¹³²

5.3.1.3 Policies on 'green jobs'

A green economy is recognized as a means of economic development, social inclusion and employment creation while maintaining the environment.¹³³ The UGGSD is aimed at enabling resource use efficiency, creating decent green jobs and enhancing social inclusiveness. Enabling a low-carbon economy that safeguards the integrity of the environment and natural resources has become a key strategy towards a green economy. The strategy encourages agroecological farming practices through irrigation and integrated soil fertility management.¹³⁴ The UGGSD supports harnessing the potential of renewable energy sources, such as biomass for domestic and industrial purposes, solar power for on-grid, and exploiting geothermal energy sources

124 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA; NPA (National Planning Authority of Uganda). 2015. *Implementation Strategy for the Second National Development Plan (2015/16–2019/20)*. Kampala: NPA.

125 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries), 2019a. *National Strategy for Youth Employment in Agriculture*. Entebbe: MAAIF.

126 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA; NPA (National Planning Authority of Uganda). 2015. *Implementation Strategy for the Second National Development Plan (2015/16–2019/20)*. Kampala: NPA.

127 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA.

128 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2016. *Agriculture Sector Strategic Plan. 2015/16–2019/20*. Entebbe: MAAIF.

129 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2017. *National Fisheries and Aquaculture Policy*. Entebbe: MAAIF.

130 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2005. *The National Animal Feed Policy*. Entebbe: MAAIF.

131 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2018. *National Adaptation Plan for the Agricultural Sector*. Entebbe: MAAIF.

132 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2016. *Agriculture Sector Strategic Plan. 2015/16–2019/20*. Entebbe: MAAIF.

133 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2013. *National Agricultural Policy of Uganda*. Entebbe: MAAIF.

134 NPA (National Planning Authority of Uganda). 2017.

to support agricultural and industrial development.¹³⁵ The Biomass Energy Strategy of Uganda encourages youth and women involvement in the production of biomass energy and feedstock, and in the production of improved biomass energy technologies, such as cook stoves and fuels.¹³⁶

The National Youth Policy stresses the need for youth involvement in practices promoting a green economy, such as restoration of the degraded ecosystems through afforestation and reforestation.¹³⁷ The NSYEA also provides youth-targeted agricultural advisory and extension services to support youth entrepreneurship and mitigate risks and uncertainties in agriculture. The NSYEA emphasizes the adverse effects of climate change and the need to enhance the resilience of youth-led agribusiness and its ability to adapt. Strategies include the uptake of best practices, innovations and technologies to reduce climate risks to agribusiness and improve the efficiency of climate information services.¹³⁸

The policy framework also encourages standard certification schemes for quality assurance of agricultural produce. For instance, the NSYEA underlines the need to encourage young entrepreneurs to produce high-quality, high-value and safe agricultural products in quantity.¹³⁹ The National Organic Agriculture Policy also works towards reducing the degradation of ecosystems and increasing the productivity and multiple functions of organic agriculture by 50 per cent. Strategies for organic agriculture include creating awareness of organic agriculture standards and certification systems, implementing quality standard certification for the production, processing, transport and marketing of organic products, and promoting cost-effective certification for organic agriculture.¹⁴⁰

5.3.1.4 Policies on digitization of agriculture

The policy context encourages innovations to harness the digital economy by establishing a high-tech city as a hub of technologies and innovations supporting agriculture and industrial development.¹⁴¹ The national ICT policy promotes access to reliable and affordable ICT infrastructure in rural and remote areas to narrow the digital divide among the population.¹⁴² The NSYEA and the National Youth Policy also provide for increased access to ICT for youth engaged in agriculture.¹⁴³ Uganda's Vision 2040 aims to improve weather information systems and halt the decline in soil fertility. It also states that building youth's capacity for ICT tools in global certification standards contributes to increasing the efficiency, effectiveness and global competitiveness of agricultural products and services.¹⁴⁴ The support for a digital economy creates a conducive environment for 'smart' farming practices. In this regard, attention is given to improving the ICT infrastructure and the accessibility and affordability of ICT. The policy framework, however, has limitations in the gender-specific provisions on engaging in a green economy and digitization for agriculture.

In summary, Uganda presents a supportive policy framework for creating youth opportunities in agriculture (Table 1). The policies support a green economy that enables efficient use of water resources, use of renewable energy in agricultural activities and agroprocessing, and restoration of degraded landscapes, among other things. Youth could benefit from developing innovations and digital technologies that support a green economy and agroecological practices such as by employing blockchain technologies for quality assurance and supply management, and by digitizing certification of standards in organic farming.

135 NPA (National Planning Authority of Uganda). 2017; MEMD (Ministry of Energy and Mineral Development). 2019. *Draft National Energy Policy of Uganda*. Kampala: MEMD.

136 MEMD (Ministry of Energy and Mineral Development). 2015. *Biomass Energy Strategy (BEST) Uganda*. Kampala: MEMD.

137 MGLSD (Ministry of Gender, Labour and Social Development). 2001. *The National Youth Policy of Uganda*. Kampala: MGLSD; NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA.

138 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2019a. *National Strategy for Youth Employment in Agriculture*. Entebbe: MAAIF.

139 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2019a. *National Strategy for Youth Employment in Agriculture*. Entebbe: MAAIF.

140 MAAIF (Ministry of Agriculture, Animal Industry and Fisheries) 2019b. *The National Organic Agriculture Policy*. Entebbe: MAAIF.

141 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA.

142 MoICT&NG (Ministry of Information and Communications Technology and National Guidance). 2014. *National Information and Communications Technology Policy for Uganda*. Kampala: MoICT&NG.

143 MGLSD (Ministry of Gender, Labour and Social Development). 2001 *The National Youth Policy of Uganda*. Kampala: MGLSD; MAAIF (Ministry of Agriculture, Animal Industry and Fisheries). 2019a. *National Strategy for Youth Employment in Agriculture*. Entebbe: MAAIF.

144 NPA (National Planning Authority of Uganda). 2013. *Uganda Vision 2040*. Kampala: NPA.

6.1

NEEDS ASSESSMENT OF YOUTH OPPORTUNITIES IN AGRICULTURE

6.1.1

Fisheries and aquaculture sector

6.1.1.1 Youth participation

Youth of different genders and with different family, educational and economic statuses have different levels of participation in the fisheries and aquaculture sector across the target countries. Youth with disabilities and youth who live further away from towns have the lowest levels of participation. Youth's engagement in the sector has seen little success.

6.1.1.2 Youth opportunities

Youth opportunities in the fisheries and aquaculture sector reveal variation depending on the youth's gender and socioeconomic background. Opportunities for youth include pond construction, pond farming, fish harvesting and providing transport services. Opportunities for young women include cage fish farming, tanks close to their villages and marketing of fish. Young women could also contribute to the design of fisheries and aquaculture systems and support the circular economy by ensuring regeneration of fish stocks. Aquaculture and competitive grants such as youth farmer championships create opportunities for entrepreneurship among educated youth compared with less educated youth. Educated youth with better economic status could engage in gainful employment in the construction of ponds and other activities in the aquaculture agribusiness. Youth with disabilities could engage in aquaculture, capacity development activities such as providing training on the production and post-harvest management of fish, and marketing of fish. Youth living further away from towns are short of opportunities in the fisheries and aquaculture sector in the target countries because of the lack of supportive infrastructure for aquaculture development.

Aquaculture provides opportunities for youth

“My father owned a big fish pond at the time when I was 11 years old, this motivated me to dig a small pond as he was getting much money whenever he could sell off the fish. Currently, I own three big fish ponds and I have managed to attend school as well helping my siblings.” (Key informant, Uganda, November 2020)

6.1.1.3 Youth challenges

Youth with different genders and family status face difficulties in accessing start-up capital, land and technical knowledge in the target countries. Youth also face challenges in accessing inputs, such as good-quality feed.

Educational status has influenced youth involvement in the fisheries and aquaculture sector. Youth with a low level of education face difficulties in acquiring the technical skills needed to succeed in the fisheries and aquaculture sector, whereas educated youth tend to underestimate employment opportunities in the sector. Better-off youth seem to be more interested in agribusiness activities with a quick return than fisheries and aquaculture activities. Youth with disabilities face difficulties in accessing the ponds and lakes, and exclusion from negotiating employment opportunities suitable for them in the sector. Youth living further away from towns have limited access to the required knowledge and skills and financial services.

Constraints differ among youth

“The elites find it so difficult to engage in farming as it requires mainly a remote area, whereas the illiterates find it so hard to get the technical expertise and skills. Those who are of economic advantage tend to love quick-paying ventures, yet farming needs patience”. (Key informant, Uganda, November 2020)

6.1.1.4 Past interventions

In Rwanda, interventions to engage youth in the fisheries and aquaculture sector included the transport of fish to towns and cage fish farming along Lake Kivu, the smoking of fish, and the sale of smoked fish in Eastern Rwanda. Success factors included engagement of local governments, ownership of the initiatives, and monitoring of activities. In Uganda, interventions included Operation Wealth Creation, a fisheries training programme, fish feed distribution and fish seed distribution. Achievements included successfully encouraging youth to engage in the sector, efficient use of family land, and increased desire among women and youth to work in an organized group. Enabling factors included farmer engagement and the provision of extension services, continuous technical training, and inputs provided as start-up capital until the business was well established. However, the interventions revealed a weakness in failing to address issues of disability and providing financial support to boost businesses.

Weaknesses arose from limited access to financial resources, a lack of access to land and the poor quality of the training programmes. Constraints were also encountered in accessing inputs, such as seed and feed resources, mainly due to untimely delivery and the poor quality of the inputs. The ‘project’ nature of the interventions limited the success of the interventions because of the difficulty of developing a ‘business mentality’ among youth in the short term. Inadequate funding and failure to prioritize and develop the sector for gainful employment among government and development partners also limited the success of the initiatives.

Initiatives in Mozambique also focused on organizing youth into groups and training them in fish farming. Financial resources targeted youth groups engaging in start-up businesses in the excavation of fish ponds and buying fingerlings and feed resources. The efforts helped some youth to negate their lack of income

by engaging them in the sector. Providing adequate training and start-up kits for organized youth groups and continuous follow-up and guidance contributed to the success of the initiatives. However, a lack of investment in aquaculture development, inadequate funds to support youth, poor market linkages and little attention given to the sector’s development affected the success of the initiatives.

6.1.1.5 Gender considerations in past interventions

Interventions to engage youth in the fisheries and aquaculture sector addressed gender-based constraints to a small extent. The interventions also had limitations, as they did not differentiate between the categories of youth. Interventions that do not consider gender-based constraints and provide mechanisms for women to balance fish agribusiness activities with their daily lives would reinforce gender inequality. For instance, women’s domestic and childcare responsibilities, and their roles in taking care of the old and sick members of the community consume their time and energy. The roles assigned by the community to young men allow them increased access to high-value fish and aquatic resources, which they can exploit, while limiting their engagement in low-paying activities.

6.1.1.6 Digital technologies in fisheries and aquaculture agribusiness

Opportunities for youth engagement in the digitization of the sector include developing youth’s digital and innovation skills for their engagement in digital marketing, and engaging youth in networking and training activities for improved village networks and digital services.

Digital apps in entrepreneurship

The use of digital technologies in the fisheries and aquaculture sector does not seem very common. However, some initiatives are under way, including the use of Abavubi Fisher mobile app in Uganda. Youth who engage in the sector use mobile phone services and farming apps to boost the efficiency of agribusiness activities. Nevertheless, the use of digital technologies in the sector is still minimal, partly due to the low level of affordability of digital technologies across the three countries.

6.2.1 Livestock sector

6.2.1.1 Youth participation

Young women, youth with low family, educational and economic status, and youth who live further away from towns seem to have a low level of participation in the livestock sector. A minimal level of participation in livestock sector is reported for youth with disabilities.

6.2.1.2 Youth opportunities

A wide range of opportunities for youth employment exist in the livestock sector for youth of different genders, socioeconomic backgrounds and locations across the rural–urban continuum. These opportunities include livestock production activities, such as cattle fattening, sheep and goat farming, and working as labourers on animal farms. Agribusiness activities such as animal feed formulation, marketing livestock and animal products, such as milk, yoghurt and roasted meat, and value addition in dairy, chicken, beef, sheep and goat farming are also perceived as ventures for gainful employment. Youth of different family status are perceived to have opportunities to acquire knowledge of modern techniques of livestock production and adopt good practices such as zero grazing to address limited access to a shortage of grazing land. Besides, youth in extended families could be trained and employed on the farms of better-off family members. The efficiency of agribusiness activities on family farms could benefit from youths' innovativeness and interest in developing and applying technologies.

Perceptions about opportunities for youth of different educational status in the livestock sector reveal that youth with a low level of education could succeed in livestock production, marketing and value addition. With some training, they could also work in farm management, record-keeping and slaughterhouses. Educated youth could engage in innovations and technologies to create market linkages and could strengthen business networks using digital technologies. They could also engage in research and development activities for increasing the productivity of the livestock sector. Youth with a better economic status and who own land could invest in rearing animals to sell them in the market, run a butchery business and engage in animal trade. The better-off youth have opportunities in

the production and selling of inputs, such as animal feed, and support the growth of the livestock sector.

Opportunities for youth with a low economic status include providing transport services for animals and animal products, working in animal traction and working as farm labourers. Youth with disabilities could be successful in developing and adopting ICT for the marketing of livestock and livestock products. Those with access to land could invest in animal farms and animal feed production and become farm managers. Access to land seems to be a critical factor for youth to benefit from the opportunities in the livestock sector. Youth who live further away from towns are perceived to have better access to land, pastures and cheap labour, and thus could preferably engage in rearing animals and supplying products to urban markets.

Youth with a low level of education are vulnerable to rural-urban migration, that is, moving from areas with abundant land and opportunities for employment in the agricultural sector to urban areas where they do not have the skills and access to resources needed to create employment opportunities. Youth with a low level of education who reside in rural and remote areas do not have technical skills and access to financial resources to support their businesses in the livestock sector. In contrast, educated youth are often equipped with knowledge of and skills in good livestock farming practices, better access to financial resources, market linkages and access to funding opportunities.

Infrastructure development and incentives are key to exploiting opportunities

- A low level of infrastructure development prevented youth from exploiting the opportunities in agriculture across the sectors.
- Youth would be able to develop technologies and engage in innovations if they had supportive infrastructure, such as affordable ICT, markets, water for production and technologies enabling the control of pest and diseases.

6.2.1.3 Youth challenges

Youth face challenges in accessing land, financial resources and start-up capital. The adverse effects of climate change, such as droughts, floods and the increased problems of animal diseases and pests, also prevent youth from engaging in gainful employment in the livestock sector. Women's engagement in the livestock sector is limited by gender norms, which assume that animal husbandry is an activity for men and not women. More specifically, women and girls tend to have limited skills acquisition in modern practices and access to inputs, and thereby have a low level of productivity and low returns compared with men. Women prefer chicken and small ruminant production, as the activities can be done around homesteads and keeping up with the agribusiness does not require lots of energy. Women's little or no access to land, technical skills and knowledge and financial resources also makes them less competent in the sector than men. Funds to support start-up businesses in the sector are not available to women because of little or no effort made to use platforms accessed by women. The information gap, coupled with women's low level of digital literacy, also means they are unable to keep up with technological advancements in the sector.

Local communities often regard livestock as time consuming and a field for old people because of the difficulty in meeting the demands for land and financial resource, and the long wait for economic return. In addition, educated youth struggle with attitude problems, as the sector is regarded as a 'dirty job' by their peers and communities.

Youth from low-income families face problems with start-up funds and running their business ventures in agribusiness. Poor families can encounter difficulties in waiting for returns of long-term investment, as they might not have alternative means of livelihoods

to meet their immediate needs. Economic return from investment in the livestock sector often tends to be in the long term and might not be attractive to youth who prefer quick returns. Mindset issues undermine employment in the sector, and conflicts such as animal theft and raiding also limit youth engagement in the sector. The poor level of infrastructure, such as a lack of all-weather roads, conflicts over land, inadequate financial support, limited access to extension services and a lack of market linkages hinder youth who reside further away from towns in seeking opportunities for gainful employment in the sector. Youth in urban areas also face difficulties, as they do not have the space and animal feed to engage in livestock farming compared with rural youth.

Youth with disabilities face difficulties in engaging in labour-consuming activities in the livestock sector. They are often prevented from owning land because of discriminatory practices in their communities. They are also discriminated against in accessing funding opportunities, skills development and accessing suitable digital technologies. Initiatives targeting youth also lack adaptability to the needs of youth with disabilities and reveal bias against them, thereby exacerbating the exclusion.

6.2.1.4 Past interventions

Interventions to create opportunities for youth in the livestock sector included skills development in 'modern' approaches of livestock husbandry and engaging in goat and sheep farming for income and livelihoods. Besides, awareness-raising activities emphasized the importance of producing good-quality products for great market value, such as value addition in dairy products. Other efforts focused on organizing youth into groups and providing them with skills and access to resources, such as finance and water for livestock. For instance, the Youth Livelihood Programme in Uganda engaged in the

Women and girls do not own land or livestock regardless of their high labour contribution

- "Youth are seen as a source of labour for the family members. Most of the girls are seen as a source of wealth as they marry off at a young age, the effect of culture where mostly males are the major once looking after family animals. Livestock production is regarded as a male job. From time memorial it is men who own animals not women." (Key informant, Uganda, November 2020)
- "Women are the main contributors for labour in the sector but they do own land and majority do not have capital to invest in the sector. Men on the other hand may have the land and capital but engage in production for their personal gratification not for the good of the family. Majority of men who engage in the sector lack input like improved breed." (Key informant, Uganda, November 2020)

capacity-building of women and girls, providing them with seed money and market linkages.

Achievements of past interventions included increased awareness of opportunities in value addition among youth, increased income and employment in livestock agribusiness, and improvement in food and nutrition security. Success factors included motivation to engage in livestock husbandry, availability of land to support youth employment in the livestock sector, financial resources for start-ups, improved technical skills, knowledge sharing and exchange among youth, and market linkages. Besides, collaborations among government, development partners and communities at different levels contributed to the success of the interventions.

Weaknesses of past interventions included limited funding for ventures and awareness-raising of opportunities within the sector. Factors such as youth's limited access to land, negative attitudes towards taking up careers in the livestock sector, youth's unwillingness to organize themselves into groups, inadequacy of infrastructure such as cooling systems, and limited market linkages reduced the success of the interventions. Besides, youth groups failing to repay loans and a lack of continuous mentorship and follow-up of the youth-led projects limited the effectiveness of the interventions.

6.2.1.5 Gender considerations in past interventions

Gender received minimal consideration in the design and implementation of the interventions. The interventions were not successful in taking gender into consideration. Often, approaches to targeting youth of different gender groups and socioeconomic backgrounds tended to be similar. Treating youth as a homogenous group and undermining gender norms led to negative consequences, such as aggravating inequality and having a disempowering effect

on marginalized groups. For instance, educated young men benefited from opportunities in skills development. Other groups, such as young women, resource-poor youth, uneducated youth and youth with disabilities, did not benefit from capacity-building initiatives in the same way as other groups of youth because of physical limitations, inconvenience of schedules and unsuitable modes of presentation.

Access to family land and finances and decision-making power favour men and exclude women and girls. For instance, women and girls do not inherit family land or have land rights because of customary land tenure systems. Women also do not own livestock, though they are the main contributors of labour in the sector. The gender-based division of labour also assumes that men have the authority to make decisions on livestock husbandry and excludes women and girls from opportunities in the sector.

6.2.1.6 Digital technologies in livestock agribusiness

There is good level of awareness of the digital solutions developed or applied for boosting the productivity of the livestock sector, including drones, e-voucher systems for providing inputs to farmers, farm management systems, marketing apps, record-keeping apps and social media. Uses of digital technologies in livestock agribusiness include the provision of extension services and agro-inputs, record-keeping and marketing of produce. For instance, youth who own phones could use e-vouchers to register and order medicines from vets. Youth also have opportunities to develop digital apps to solve problems in the livestock sector, such as in connecting farmers with vets, digital marketing and providing information on markets, livestock diseases and vaccinations.

Digital technologies provide youth with better opportunities to engage in livestock agribusiness because of youth's high level of education and their

Youth opportunities differ based on gender and socioeconomic background

- “Youths from poor families do not have the means to engage in livestock sector. They face transport and communication challenges. For example, they may not have the means to transport their products to main markets due to lack of money to hire transport. In the end, they get cheated by middlemen who buy livestock cheaply from within the community.” (Key informant, Uganda, November 2020)
- “Males tend to over work the women in that they control most of the earnings from livestock sector. For example, if a woman sold a cow, her husband might forcefully take all the money she has earned and leave her with nothing.” (Key informant, Uganda, November 2020)

capacity to acquire digital skills in a short period of time. Digital technologies increase information exchange, enhance productivity, facilitate marketing activities and save time. Youth living close to towns also use social media, such as Facebook and WhatsApp, for marketing their services and products in the livestock sector. Some youth spend their savings to buy smart phones and use the Internet to access information on markets, innovations and technologies.

Despite this, the extent of the use of digital technol-

ogies in the sector tends to be small because of limited affordability and a low level of ICT infrastructure development. Youth engaging in the livestock sector have limited access to digital technologies owing to the high cost of Internet connectivity and a lack of ownership of smart phones in rural and remote areas. Furthermore, a low level of digital literacy and unavailability of information in local languages make it difficult for youth and women with a low level of education to use digital technologies in the livestock sector.

6.3.1 Renewable energy sector

6.3.1.1 Youth participation

Youth of different genders and socioeconomic status have a low level of participation and success in the renewable energy sector. Youth with disabilities and those who live further away from towns have a minimal level of participation.

6.3.1.2 Youth opportunities

The renewable energy sector provides youth with opportunities for innovations and entrepreneurship. Young men and women could develop innovations and technologies and engage in business incubations. Opportunities also exist in the production, maintenance and marketing of solar technologies and biogas. For instance, youth could work in the solar energy sector and support their communities in assessing, designing and implementing solar technologies. Youth could also engage in the manufacturing of biomass briquettes from agricultural waste, and in developing clean energy stoves. These activities would provide youth with opportunities for employment while offering alternative energy sources, reducing dependence on fossil fuel and protecting degradation of the environment. However, youth would require proper training, access to finance and start-up kits to exploit these opportunities.

Youth could benefit from employment and income-generating activities across the wide spectrum of activities in the value chains in the renewable energy sector. However, it seems that young women, youth with low economic and education status, and youth who reside further away from towns have limited

opportunities compared with educated and better-off young men. Youth have different levels of access, capacities, preferences, and interests for engaging in these activities, implying that gainful employment does not equally benefit all categories of youth. For instance, young women could engage in the production and selling of biogas for cooking for gainful employment and empowerment. Engaging in the production and marketing of affordable solar technologies for lighting would enhance rural electrification and empower rural communities. Youth with own families and youth with low economic status could also benefit from capacity-building opportunities in renewable energy.

Youth from better-off families could take advantage of the availability of family assets, such as livestock and finance, and engage in producing biogas energy. Educated youth have tremendous opportunities in business networks, capacity development in biogas and solar technologies, mentorships, and work experience, and developing and applying apps. They could play critical roles as entrepreneurs, app developers, trainers, and leaders, and provide advisory services for business start-ups. They could acquire digital skills and use the Internet to access information on the innovations and technologies in the renewable energy sector, unlike the uneducated youth. Opportunities for uneducated youth include providing raw materials for biogas production and engaging in the transport and distribution of biogas and solar technologies.

6.3.1.3 Youth challenges

Youth face challenges regarding access to finance, skills development and business networks. Youth have little access to start-up capital to invest in high-cost equipment for enabling renewable energy. Young entrepreneurs encounter difficulties with poor infrastructure networks and market linkages. Youth with disabilities face discrimination, whereas youth in rural and remote areas have difficulties in accessing information on opportunities, skills, technologies and market linkages. Cultural constraints and gender norms prevent women from obtaining gainful employment in the renewable energy sector, as the jobs are assumed to be suitable for men and not women.

6.3.1.4 Past interventions

Achievements of past interventions in the renewable energy sector included increased awareness of innovations and technologies, and developing youth's capabilities in entrepreneurship, agribusiness and life skills. Initiatives on biogas and solar energy sources also created employment opportunities. Some youth engaged in the marketing and sale of solar panels for providing lights, and in enabling digital marketing in the sector. The success factors for past initiatives were the demand for electricity and clean energy in rural areas, and the support of governments in promoting technologies. However, a low level of investment and limited finance to support entrepreneurship hampered the sector's contribution to creating employment. The TEVT centres encountered obstacles to enhancing youth's skills and supporting entrepreneurship in producing, distributing and marketing renewable energy technologies. Higher education institutions also paid little attention to providing practical courses in renewable energy, thus limiting the extent to which human capital could engage in innovation and technological development.

6.3.1.5 Gender considerations in past interventions

Interventions to create employment opportunities for youth in agriculture failed to consider gender-based constraints in their design and implementation. Often, interventions revealed bias towards young men and did not succeed in enabling gender equality and women empowerment. For instance, the majority of participants in skills development initiatives and marketing of renewable energy technologies and innovations are men, since women are busy with reproductive and productive work most of the day. Cultural barriers, venues being further away from areas of residence and the inconvenience of training schedules alongside daily chores contribute to the exclusion of women and girls. Such bias against girls and women would reinforce gender inequality by supporting men's control of energy resources. Stereotypes regarding some skills and courses also affect the capacities and empowerment of women. For instance, young men are expected to engage in well-paying and smart jobs, whereas women are expected to engage in courses leading to less technical and low-paying jobs. Such stereotypes against women and girls contribute to their low level of enrolment in science, technology, and engineering fields, and excluding them from engaging in the development of technologies and innovations in the renewable energy sector.

Youth with disabilities and youth who live further away from towns are excluded from the opportunities in the renewable energy sector. Attitude problems, such as stigmatization and undermining the abilities of youth with disabilities, has led to their exclusion from the renewable sector. Youth in rural and remote areas have little or no access to electricity, the Internet, skills development, digital technologies, mentorships and business networks. On the contrary, opportunities in the renewable energy sector are relevant to rural and remote areas where renewable energy could provide sources of electricity and clean cooking, among other things.

Gender norms and distance from towns affect skills acquisition

- “Youths from poor families do not have the means to engage in livestock sector. They face transport and communication challenges. For example, they may not have the means to transport their products to main markets due to lack of money to hire transport. In the end, they get cheated by middlemen who buy livestock cheaply from within the community.” (Key informant, Uganda, November 2020)
- “Males tend to over work the women in that they control most of the earnings from livestock sector. For example, if a woman sold a cow, her husband might forcefully take all the money she has earned and leave her with nothing.” (Key informant, Uganda, November 2020)

Women and girls have fewer opportunities in agriculture than young men

“Male and female youth have different opportunities. For example, activities that require mobility are usually taken on by male youths. My friend who sells solar panels prefers to deploy male youths as sales executives upcountry because and in sections such as installation while their female counterparts are usually deployed at the shops or pickup points. The reasons vary from women require more money for accommodation to women have children or their fathers do not allow them to travel.” (Key informant, Uganda, November 2020)

6.3.1.6 Digital technologies in renewable energy agribusiness

The renewable energy sector is reported to exhibit minimal use of digital technologies for boosting the productivity of the sector. This situation is

mainly due to a low level of ICT infrastructure in rural and remote areas, and the limited affordability of digital technologies among youth engaging in the renewable energy sector. However, there is an appreciation of the opportunities that digital technologies could bring to the sector by enabling innovations and technological development, and by facilitating financial services, communication, marketing and service provision.

Digital technologies enhance the renewable energy sector

Enabling pay-as-you-go models, mobile money, online platforms, extension and market information services through mobile Short Message Service (SMS) and digital apps could help in digitizing the renewable energy sector. Digital entrepreneurship and digital platforms such as mobile phones, laptops and the Internet could help in enhancing financial inclusion and empowering women and youth to engage in the sector.

6.4.1 Agroecological farming

6.4.1.1 Youth participation

Youth participation in agroecological farming is minimal across the countries. This is associated with the negative attitudes towards agricultural careers, and a lack of access to land and start-up capital. Low economic returns from the sector due to the adverse effects of climate change also contribute to youth's limited engagement in agroecological farming. However, some youth have specialized in niche areas, such as organic farming, and become involved in agroforestry and planting fruit trees, and other tree-planting activities.

6.4.1.2 Youth opportunities

Opportunities for youth in agroecological farming are not supported enough and require youth to acquire and develop their farming skills and experiences. Their engagement in agroecological farming by providing technical expertise to older farmers, producing and marketing inputs and farm products, providing services in agribusiness management, promoting value addition, and developing and applying technologies for agribusiness development contribute to the transformation of agriculture into a healthy and

sustainable sector. Youth can engage in campaigning, mobilization and demonstration, and support efforts to achieve increased farm productivity with reduced environmental degradation. The large proportion of youth in the population and youth's growing interest in adopting agroecological farming signals a positive future for the sector. Increased investment in the enabling infrastructure by governments could expand youth opportunities in gainful employment in the sector. The growing promotion of healthy food habits in cities has increased the demand for products of agroecological farming.

Besides, youth could engage in entrepreneurialships in specialized agricultural products, markets and services, and enhance their competitiveness by using locally available materials and reduce their production costs. The use of digital platforms could also increase youth opportunities by facilitating market linkages for youth engaging in agroecological farming. In fact, digital technologies provide youth with opportunities to engage in the production and marketing of agroecological products such as organic meat, and horticultural and dairy products.

More opportunities exist for youth in the circular economy, such as using agricultural and organic waste to create compost, thereby protecting the environment from chemicals. Youth have opportunities in enabling agroecological farms by integrating the livestock sector with cropping systems, which involves converting waste into food and energy. The production of energy from integrated farms using animal waste and crop residue could be used as a source for lighting, cooling and clean cooking. Youth could also engage in producing animal feed from crop residue and address critical constraints to boost the productivity of the livestock sector.

Youth are inspired by their successful peers and role models

“Young people should be supported to participate in agriculture. Peer-to-peer learning generates excellent results. For example, at Omia Agribusiness we have worked with young people as agents to inspire others in the community to appreciate agribusiness. And vegetables in particular have been key since they have shorter maturity, high yields per unit area, higher market prices and even higher demand.” (Key informant, Uganda, November 2020)

6.4.1.3 Youth challenges

Challenges in agroecological farming for youth of different genders and socioeconomic backgrounds include little or no access to land and financial resources, and limited skills, knowledge of the technologies enabling agroecological farming and access to appropriate and affordable technologies. In addition, youth have limited access to markets and business networks and to mentors in agroecological farming. The sector promotes social inclusiveness on paper, but in practice the level of inclusiveness is limited, as youth differ in their land rights, access to productive resources and knowledge. Youth also differ in their interest in innovations and technologies, and the sector exhibits a low level of development of extension services and lacks sustainable working systems for all.

Youth working on family farms also do not have the authority to make decisions about agroecological farming, such as using drip irrigation for efficient use of water resources, organic fertilizer, and biological

methods of pest and disease control. As a result, youth who have access to but no ownership of land face challenges in investing in low-carbon and sustainable agribusiness. In addition, agroecological farming might not attract youth who are interested in quick economic returns and could not invest in a sector that requires effort and patience.

Land constraints limit youth's engagement in agroecological farming

“Inaccessibility of un-utilized arable land for the millions of young people who love to join the sector only to be limited by their lack of land ownership and inability to access farmland for leasing and smallholder farmers having low access to agricultural technologies that could enhance their production capacities.” (Key informant, Uganda, November 2020)

Youth also struggle to meet the required quality standards for their farm produce. This situation emanates from the lack of proper equipment and reliable market linkages, limited access to reliable market information and services, and a low level of digital marketing skills. Fluctuations in market price and uncertainties posed by climate change also discourage farmers from exploiting the opportunities in agroecological farming.

6.4.1.4 Digital technologies in agroecological farming

Access to digital technologies in agroecological farming differs among youth with different genders and socioeconomic backgrounds. Digital technologies that are important to the sector include smart phones, computers, Internet connectivity, machinery and tools for small-scale irrigation. Youth have different levels of access to information, openness to trying out new and improved technologies and innovations, digital skills and experience of digital technologies. Although the fact that the rate of adoption of digital technologies among youth is higher than among adults is promising, a good number of youth in rural and remote areas do not have digital literacy skills and access to affordable Internet facilities and digital technologies. Digital technologies and Internet connectivity do not seem to be affordable for the majority of youth. The digital divide is more pronounced among uneducated youth and women in rural and remote areas engaging in the agroecological farming sector.

Gender norms and gaps in digital literacy further prevent women and girls from engaging in the development, use and application of digital technologies and innovations. Yet again, less fortunate youth, such as youth with disabilities, youth in rural and remote areas and women, often lack digital skills and are likely to be excluded from employment opportunities. Young women in rural and remote areas also have difficulties in benefiting from opportunities in digital agriculture because of their productive and reproductive roles, as well as their vulnerability to the risk of early marriage.

Equal access to digital technologies and innovations among youth of different genders and socioeconomic backgrounds would have been beneficial in terms

of agroecological farming. Young men tend to have a higher level of access to digital technologies and innovations than other categories of youth. For instance, educated youth and youth who reside near towns have better access to digital technologies and knowledge-sharing platforms. This situation helps them grab opportunities in the sector much faster and improve their income and livelihoods. A lack of agroecological learning centres, poor development of ICT infrastructure and a lack of culture in entrepreneurship in digital agriculture aggravate the gender divide among youth in agroecological farming. Besides, constraints related to digital technologies affect youth's efforts to compete in the sector by providing good-quality services and products.

Youth have difficulties in accessing digital technologies

- It is still difficult in some communities for youth to own digital tools to enable them to access relevant information about agroecological farming, because most of these tools are expensive and most youth live in remote areas that are hard to reach.
- Youth from rural areas have poor access to digital platforms that share knowledge, opportunities and linkages compared with youth in urban areas.
- Female youth in rural areas tend to be occupied with housework and do not have access to digital technologies. They are also at a risk of early marriage and not realizing their full potential.

7.1

GENDER GAPS TO BE ADDRESSED FOR YOUTH OPPORTUNITIES IN AGRICULTURE

The gender-based constraints in accessing digital technologies vary across youth with disabilities, youth with different economic status, and locations across the rural–urban continuum.¹⁴⁵ Gender norms limit the opportunities of women in digital agriculture. Women and men tend to have different needs, opportunities and constraints regarding accessing information, tools and skills.¹⁴⁶ Women usually engage in production and low-technology activities, such as packaging and post-processing activities.¹⁴⁷ For instance, women in Ethiopia engage in post-harvest activities around the home and alongside domestic chores and childcare, and thus have little or no access to digital technologies and business skills development.¹⁴⁸ The poor development of ICT infrastructure results in a low level of adoption of smart phone technology in farming communities in Uganda and reliance on radio for climate information services.¹⁴⁹ Such constraints exclude women from the opportunities in digital agriculture because of gender norms that give young men the image of being ‘tech affiliated’, compared with women who have little or no digital literacy.¹⁵⁰

Youth with low-income levels and with only primary education often have difficulties in accessing advanced digital technologies.¹⁵¹ The lack of skills, coupled with poor development of ICT infrastructure, the high prices of wireless technologies and limited availability of digital technologies in local languages, could prevent the poor and less educated youth from accessing these technologies.¹⁵² For instance, youth who lacked secondary education had limited opportunities in the initiatives in Uganda and Rwanda to create employment opportunities in private sector extension and advisory services.¹⁵³

Uptake of digital technologies among women farmers in sub-Saharan Africa is low (estimated at 25 per cent), though they disproportionately contribute a higher amount of labour to the farming sector.¹⁵⁴ The gender inequality in accessing digital technologies implies that young men and young women with little or no access to the information and skills needed to catch up with advanced digital technologies and who lack knowledge of intellectual rights could be excluded from opportunities in digital

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agriculture.¹⁵⁵ For instance, the low level of awareness of and skills in developing and adapting blockchain technology might limit the youth from embracing the technology and applying it in their businesses. Youth equipped with the required skills in technologies and business fit better into a green economy than the less skilled youth.¹⁵⁶ This would in turn determine whether the different categories of youth would drive, catch up with or lag behind the efforts towards Agriculture 4.0.¹⁵⁷ For that reason, addressing the gender gap in accessing and acquiring the relevant knowledge, skills and tools would be required to get the best out of the digital economy in Africa.

A green economy could also affect young women differently, as they are more dependent on natural resources for their income and livelihoods.¹⁵⁸ The transition to a green economy would likely be accompanied by changes in the labour market.¹⁵⁹

Changes are expected in the labour market as new job opportunities emerge, some jobs change their form to adapt to the demands of a green economy, and quite a number of jobs are potentially lost or replaced with digital innovations.¹⁶⁰ It is likely that women, most of whom do not have the skills to cope with the changes, might not have equal access to employment opportunities in a green economy. So far, discussions on a green economy and digitization of agriculture have paid inadequate attention to addressing gender inequality in accessing information, acquiring digital and business skills, and economic empowerment.¹⁶¹ Pursuing initiatives without addressing gender gaps could reinforce existing gender inequality and undermine women's empowerment. Thus, addressing these gender gaps is a prerequisite for the success of initiatives towards Agriculture 4.0 and a green economy.

Gender-based constraints in emerging governance models and innovations

- Gender gaps prevail in accessing digital technologies and acquiring business skills, and women's heavy dependence on natural resources for food security and energy sources could reinforce existing gender inequalities.
- Youth with low-income levels and with only primary education often have difficulties in accessing advanced digital technologies.
- Gender norms limit the opportunities of women in digital agriculture, as women have different needs, opportunities and constraints with regard to accessing information, tools and skills.
- It is likely that women, most of whom do not have the skills to cope with changes in the labour market, might not have equal access to employment opportunities in a green economy.
- Pursuing initiatives without addressing the gender gaps might reinforce existing gender inequality and undermine women's empowerment.

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8.1

CONCLUSIONS

The study examines opportunities for youth in agriculture in the context of emerging governance models and innovations in the sector. The study also presents the relevant policies for enabling youth opportunities in agriculture and highlights the gender gaps that need to be closed to get the best out of the emerging governance models and innovations. The review reveals that the digitization of agriculture and a green economy could create new employment opportunities for youth. Opportunities in the digitization of agriculture derive from increasing the efficiency, productivity and profitability of the activities in the agricultural value chains. Digital technologies such as IoT, big data, precision farming and blockchain have the potential to redress constraints in the production, processing and marketing of agricultural products. Exploiting the potential of these technologies can play a key role in ensuring food and nutrition security in the face of climate change. Youth's interest in digital technologies would also strengthen efforts to transform the agricultural sector.

Nevertheless, access to digital technologies is minimal and not customized to the needs of the actors in the agricultural value chains in Africa. The lack of inclusive processes for engaging youth and women in the design, development and application of digital technologies could also limit the success of these technologies in Africa. A green economy could also employ a good number of youth while preventing overexploitation of natural resources. Yet again, the initiatives so far have lacked inclusiveness, and little has been done to consider the interests of different gender groups in the initiatives. Thus, addressing gender inequality in dependence on natural resources, access to digital technologies, digital literacy and business skills without aggravating the existing gender inequality problem should be a prerequisite for the success of initiatives towards Agriculture 4.0 and a green economy.

The policy context in Mozambique, Rwanda and Uganda supports youth employment in the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors. The policies support youth employment in agriculture and

acknowledge the potential of youth in transforming agriculture through technologies and innovations. The policy frameworks support a green economy by enabling efficient use of water resources, the use of renewable energy in agricultural activities and agroprocessing, and restoration of degraded landscapes, among other things. The support given to digital technologies in agriculture aligns well with the increased global attention. Opportunities could emerge in using blockchain technologies for traceability and certification of quality standards for agricultural produce. Youth could take advantage of these provisions and engage in entrepreneurship by developing, using and marketing innovations and technologies enabling precision farming. Differences are observed among countries in the level of attention given to youth and women in their policies, strategies and programmes.

The policy frameworks prioritize creating employment opportunities for youth in smart farming and off-farm activities in support of e-agriculture and a green economy. There is a gap in the policy support in Mozambique, as the policies pay little attention to specifically targeting women and youth involvement across the sectors. The policy framework of Uganda also has limitations in the gender-specific provisions on engaging in a green economy and digitization for agriculture. Similarly, the dairy strategy and investment plan for the poultry and meat industries in Rwanda also paid little attention to aligning activities with the initiatives towards a green economy.

By and large, youth's involvement in smart farming, such as precision farming and the development, use and application of digital technologies to increase agricultural productivity, efficiency and profitability, seems to be an area of great interest and potential but with limited results so far. This could be attributed to gender inequality, the digital divide and a low level of ICT access, markets, and other infrastructure. Opportunities for youth in the fisheries and aquaculture, livestock, renewable energy and agroecological farming sectors differ based on their gender and socioeconomic background. Most of the job opportunities in high-

value products and services are taken by educated youth and youth who reside near towns. Women and youth who reside in rural and remote areas have minimal opportunities because of problems with accessing land, lack of access to finance, lack of capacity development efforts near their area, lack of access to digital technologies and low digital

literacy. The digital divide affects the engagement of women and girls in value addition, marketing and other activities. Future interventions should prioritize gender gaps and the digital divide so that agriculture becomes a profitable, sustainable and inclusive sector with increased efficiency in the use of water and energy resources.



ANNEXES

Annex 1. List of people contacted

Name	Sector	Country
Dr Wilson Rutaganira	Fisheries and aquaculture	Rwanda
Kisawuzi Joseph	Fisheries and aquaculture	Uganda
Edson Mussa	Fisheries and aquaculture	Mozambique
Ronald Se	Fisheries and aquaculture	Uganda
Gracinda Mataveia	Fisheries and aquaculture	Mozambique
Moses Kakanu	Fisheries and aquaculture	Mozambique
Ogwang Yafesi	Livestock sector	Uganda
Amuku Isaac	Livestock sector	Uganda
Sandra Akello	Livestock sector	Uganda
Natwijuka Brian	Livestock sector	Uganda
Grace Bwogi	Livestock sector	Uganda
Goretti Amuriat	Livestock sector	Uganda
Esther Nyanzi	Renewable energy	Uganda
Alex Uwizeye	Renewable energy	Rwanda
Babine Winnie	Renewable energy	Uganda
Lourenco Moio	Renewable energy	Mozambique
Nakazzi Betty	Renewable energy	Uganda
Ana Maria da Conceição Salvador	Renewable energy	Mozambique
Josephine Okot	Renewable energy	Uganda
Elizabeth Asiimwe	Renewable energy	Uganda
Innocent Dusanganywamahoro	Agroecological farming	Rwanda
David Nsengimana	Agroecological farming	Rwanda
Agaba Derrick	Agroecological farming	Uganda
Kirabo phionah	Agroecological farming	Rwanda
Jean Damascene Musangamfura	Agroecological farming	Rwanda
Charles Bwanika	Agroecological farming	Uganda
Juvenal Kabagambe	Agroecological farming	Rwanda
Hitesh Limani	Agroecological farming	Mozambique
Jarc Tusiime	Agroecological farming	Uganda
Julian Barungi	Agroecological farming	Uganda
Kabiito Denis	Agroecological farming	Uganda
Iganachi Razaki Omia	Agroecological farming	Uganda

Annex 2. Sample questionnaire used for data collection

Introduction

This study aims at identifying opportunities for youth employment, entrepreneurship and innovation in the agriculture sector. We are very interested to hear the voices and perspectives of young men and young women. You are identified as a key informant with knowledge and first-hand experience of the topic, and we would like to gather your insights to inform our future programming work in the region. We would like to thank you in advance for taking the time to participate in this research process. Your participation in this research is voluntary. All information you provide during the interview session will be treated confidentially.

Information on key informant

Name.....

Age.....

Sex.....

Marital status – single/married/divorced/widowed/

Educational status.....

Name of current educational institution (if relevant).....

Area of expertise or specialization.....

Years of experience in the field

Owner of land – yes/no/; if yes, type of land ownership – private/family land/others.....

Owner of farming business –yes/no/

Owner of cell phone – yes/no/

Owner of laptop – yes/no/

Have access to the Internet – yes/no/; if yes, from where? Home/community centre/business centre/
other.....

Owned a website – yes/no/

Uses social media – yes/no/; if yes, types of social media used.....

Uses apps – yes/no/, if yes; types of apps used.....

Developed any apps – yes/no/; if yes, types and purpose of the apps.....

Country and city or region of residence.....

Email.....

Phone No.....

Youth opportunities in the fisheries and aquaculture sector

1. To what extent do different categories of youth (please see table below) participate in the agriculture sector in your area?

Youth with different:	Extent of participation	Please explain with examples
Gender	[Great extent/Somewhat/Very little/Not at all]	
Family status	[Great extent/Somewhat/Very little/Not at all]	
Educational status	[Great extent/Somewhat/Very little/Not at all]	
Economic status	[Great extent/Somewhat/Very little/Not at all]	
Disability	[Great extent/Somewhat/Very little/Not at all]	
Distance from town	[Great extent/Somewhat/Very little/Not at all]	
Other(s), if any?	[Great extent/Somewhat/Very little/Not at all]	

2. What opportunities exist for different categories of youth (please see table below) to engage in the agriculture sector?

Youth with different:	Opportunities	Please explain with examples
Gender		
Family status		
Educational status		
Economic status		
Disability		
Distance from town		
Other(s), if any?		

4. What challenges do the different categories of youth (please see table below) face in engaging in the agriculture sector in your area?

Youth with different:	Challenges faced	Please explain with examples
Gender		
Family status		
Educational status		
Economic status		
Disability		
Distance from town		
Other(s), if any?		

6. In your opinion, how successful are the different categories of youth (please see table below) in engaging in the agriculture sector?

Youth with different:	Extent of success	Please explain reasons of success/failure
Gender	[Great extent/Somewhat/Very little/Not at all]	
Family status	[Great extent/Somewhat/Very little/Not at all]	
Educational status	[Great extent/Somewhat/Very little/Not at all]	
Economic status	[Great extent/Somewhat/Very little/Not at all]	
Disability	[Great extent/Somewhat/Very little/Not at all]	
Distance from town	[Great extent/Somewhat/Very little/Not at all]	
Other(s), if any?	[Great extent/Somewhat/Very little/Not at all]	

8. Please indicate the key interventions that created employment opportunities for the different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in the agriculture sector in your area?

.....

9. What are the achievements of the interventions with regard to creating employment opportunities for the different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in the agriculture sector?

What are the reasons for success?

.....

10. Please explain who the main mentor or promoter of your interest has been in the agriculture sector.

.....

11. What are the weaknesses of the interventions with regard to creating employment opportunities for the different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in agriculture?

.....

What are the reasons for failure?

.....

12. What are the main gender-based constraints for youth employment interventions in the agriculture sector?

Please explain with examples.

.....

13. To what extent do the youth employment interventions address the gender-based constraints of youth in engaging in the agriculture sector?

[Great extent/Somewhat/Very little/Not at all]

Please explain with examples.

.....

14. How can the youth employment interventions be strengthened to create employment opportunities for the different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in agriculture?

.....

15. Which economic activities in your area use digitized information and knowledge?

.....

16. Are you aware of any digital solutions developed or applied to boost the efficiency of the agriculture sector? Yes/no

If yes, please explain with examples.

.....

17. How do different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) access digital technologies for boosting efficiency of agriculture?

.....

18. How do you evaluate the affordability of digital technologies among youth engaging in agriculture?

[Very affordable/Somewhat affordable/Affordable to a small extent/Not affordable]

Please explain with examples.

.....

19. What opportunities do you see for different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in developing or applying digital technologies in agriculture?

.....

20. How do you define a green economy?

.....

21. Are you aware of any efforts made towards a green economy (i.e. low carbon, resource efficient, socially inclusive) in your area? Yes/no

If yes, please explain with examples.

.....

If yes, what opportunities do you see for the different categories of youth (e.g. gender, family status, educational status, economic status, disability, distance from town) in a green economy?.....

22. Is there anything further you would like to contribute that has not been covered in this questionnaire? If yes, please explain.

.....

Thank you for participating in the study!



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