Food and Agriculture Organization of the United Nations

WORLD FOOD FORUM | GLOBAL YOUTH ACTION

YOUNG SCIENTISTS GROUP

DIGITAL TECHNOLOGIES FOR MULTIDIMENSIONAL YOUTH ENGAGEMENT IN AGRIFOOD SYSTEMS TRANSFORMATION

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About the World Food Forum

The World Food Forum (WFF) was launched in 2021 as an independent network of partners hosted by the Food and Agriculture Organization of the United Nations (FAO). It serves as the premier global platform to actively shape agrifood systems for a better food future, accelerating the achievement of the Sustainable Development Goals (SDGs). Through youth action, science and innovation, and investment, the WFF forges new paths of action and multi-sector partnerships for agrifood impact at the local, regional and global levels to achieve a more sustainable, resilient, inclusive and hunger-free food future for all.

Within this framework, WFF Global Youth Action was established to harness the passion and power of youth, and to incite positive action for agrifood systems through youth empowerment. It acts as a catalytic movement and driver of youth engagement in food governance, and serves as a knowledge center and innovation lab, fostering and inspiring youth-led solutions. It thus actively contributes to the implementation of the UN Youth 2030 Strategy and enhances youth engagement in the follow-up to the 2021 UN Food Systems Summit.

WFF Global Youth Action is implemented through a set of thematic programmes that leverage intergenerational and cross-sectoral collaboration around Policy, Innovation, Education, Culture and Local Action.

About the Young Scientists Group and its report

The mission of the WFF Young Scientists Group (YSG) is to provide scientific evidence and technical knowledge to the various initiatives of the WFF, and to develop a biannual YSG report on topics of concern to youth related to agrifood systems transformation. After the inaugural year of the YSG in 2022, the second YSG cohort commenced its activities in May 2023 as part of a two-year tenure (2023–2025). The composition of the YSG aligns with the FAO four betters: better production, better nutrition, a better environment and a better life, leaving no one behind. The diversity of YSG members' expertise mirrors the diversity of challenges and solutions associated with achieving agrifood systems transformations and the SDGs.

The 2022–2023 cohort report, *Opportunities and barriers for advancing agrifood systems: Empowering young people for a sustainable future*, emphasized the pivotal role of youth in transforming agrifood systems for a sustainable future. Youth engagement and empowerment is hindered by numerous barriers including limited access to productive resources, services and markets, the diminishing attraction to employment in the agrifood sector and limited meaningful engagement in high-level decision-making processes. To enable youth-led positive change for agrifood systems transformation, the report recommended four key enablers: education, technology, science and policy.

Building on the findings of the previous cohort's report, the 2023–2025 YSG members decided to focus their report on the role of digital technologies in youth engagement in agrifood systems transformation. Through a comprehensive literature review, case studies and a survey capturing youth perspectives, this report demonstrates the multidimensional role played by digital technologies in youth engagement. Firstly, they can be used by youth in projects and activities that facilitate agrifood systems transformation. Secondly, they can be developed by youth to support agrifood systems transformation. Thirdly, digital technologies can be a mechanism for encouraging youth engagement in agrifood systems transformation projects and activities. Finally, digital technologies can be used by youth, and as a means to encourage youth, to engage in decision making. The purpose of the report is to improve the understanding of the role digital technologies play in youth engagement in agrifood systems transformation. The findings may be useful for decision-makers and practitioners seeking to promote youth engagement for agrifood systems transformation.

Contents

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Abbreviations

ACE	Audio Conferencing for Extension
AI	artificial intelligence
FAO	Food and Agriculture Organization of the United Nations
GHG	greenhouse gas
HLPE	High Level Panel of Experts
ICT	information and communication technology
ITU	International Telecommunication Union
NGIN	Next Generation Agriculture Impact Network
NYFC	National Young Farmers Coalition
QT	Respondent to our survey
SDG	Sustainable Development Goal
STB	Science and Technology Backyards
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFSS	United Nations Food Systems Summit
WFF	World Food Forum
YPB	Youth Policy Board of the World Food Forum
YSG	Young Scientist Group of the World Food Forum

Abstract

Youth engagement is pivotal to the transformation of our agrifood systems. Simultaneously, digital technologies have contributed to the development of our agrifood systems and are an increasingly important part of young persons' lives. Digital technologies can therefore play a role in youth engagement toward the transformation of agrifood systems. This report explores this question through a multidimensional approach, offering insights into how youth can (1) utilize digital technologies, (2) develop these technologies, (3) engage in activities and projects through digital tools and (4) participate in decision-making processes through the use of digital technologies, ultimately encouraging their active involvement in the transformation of agrifood systems. The YSG conducted a comprehensive literature review which highlights various relevant case studies, together with a survey capturing the perspectives and experiences of youth. The results show that, for agrifood systems transformation initiatives, digital technologies provide youth with benefits such as being able to conduct tasks more efficiently, reach wider audiences and form collaborations. However, there are challenges related to digital technology use including accessibility to these tools and the need for training and education in using them – both among youth and the collaborators they interact with. Additionally, although digital technologies can increase opportunities for engaging in decision-making, they do not necessarily ensure these. Based on the findings, we recommend policymakers and practitioners: (1) increase equitable access to digital technologies, (2) build capacities for digital skills development and training, (3) enhance youth engagement and inclusivity in decision-making processes which use digital technologies, and (4) engage youth in agrifood systems transformation initiatives involving digital technologies.

Executive summary

Youth engagement is pivotal for agrifood systems transformation. As a diverse demographic group characterized by its transition from childhood to adulthood, youth bring unique perspectives to current challenges facing agrifood systems. Additionally, youth will endure the future consequences of today's decision making, such as those related to climate change and food security. Youth engagement in agrifood systems transformations requires several enabling social, political, financial, technological and scientific factors. This includes recognizing youth rights and agency, as well as investing in education and livelihood opportunities.

This report focuses on the role of digital technologies to support youth engagement in agrifood systems transformation. Digital technologies not only enhance productivity, efficiency of tasks and communication across agrifood supply chains, they also play an important role in the lives of youth. Through a literature review, case studies and a survey capturing youth perspectives, this report discusses how digital technologies in the context of agrifood systems transformation are: (1) used by youth in their livelihoods, research and entrepreneurial projects; (2) developed by youth; (3) a means to further engage youth in transformative initiatives; and (4) used by youth, or are a means to involve youth, in meaningful decision-making processes.

The findings of this report illustrate the benefits of youth using digital technologies in the context of agrifood systems transformation initiatives. These benefits include the ability to reach a wide audience, form collaborations and conduct tasks efficiently. However, both the literature review and survey responses highlight challenges and barriers related to the accessibility of digital technologies for youth. For example, digital technologies are often disproportionately inaccessible to youth in resource-constrained or remote areas, exacerbating the digital divide. Furthermore, there is a need to address knowledge and training gaps amongst youth and their collaborators in using digital tools. While digital technologies may create opportunities for engagement in decision-making, they do not necessarily ensure it.

The findings of this report have implications for research, policy and practice. Researchers may wish to further investigate the perspectives of youth regarding their digital technology use in agrifood systems and how digital technologies may attract youth to the agrifood systems sector and related initiatives. Regarding policy and practice, there is a need for the financing of digital technology distribution and supporting infrastructure. There is also the need to invest in education and training to develop digital skills among youth. By outlining these implications, we highlight an important focus area for decision-makers and other agrifood systems stakeholders to promote youth engagement in agrifood systems transformations. Specifically, we make eight recommendations for policymakers and practitioners which could support and enhance the benefits of digital technologies in youth engagement for agrifood systems transformation.

Eight recommendations

Increasing equitable access to digital technologies:

1) Increase access to digital tools
2) Make digital tools more affordable

Build capacities for digital skills development and training:

3) Institutionalize long-term digital capacity-building initiatives for youth in agrifood systems
4) Tailor digital literacy training to target audiences

Enhance youth engagement and inclusivity in decision-making processes which use digital technologies:

5) Engage regional and international organizations
6) Mitigate risks associated with digital technologies

Attracting youth into agrifood systems transformation initiatives:

7) Expand the evidence base of how factors related to digital technologies attract youth to agrifood systems
8) Encourage youth-led innovation involving digital technologies

Introduction

Current agrifood systems face a multitude of challenges. Principally, agrifood systems seek to provide enough food for the human population while also limiting their impact on the environment (Foley *et al.*, 2011). FAO (2023a) defines agrifood systems as:

> *"...systems [that] comprise the entire range of actors and interlinked activities that add value in agricultural production and related off-farm activities such as food storage, aggregation, post-harvest handling, transportation, processing, distribution, marketing, disposal and consumption. Agricultural production refers to primary crop, livestock, fisheries and forestry production."*

Current agrifood systems are responsible for substantial environmental (Crippa *et al.*, 2021) and human impacts. Without significant changes to our agrifood systems, this will likely preclude governments from meeting climate commitments (Clark *et al.*, 2021) and millions of individuals will remain food insecure (FAO, 2024). As a result, agrifood systems require a multifaceted transformation that improves food security, diets and livelihoods, and which reduces negative environmental impacts (Dengerink *et al.*, 2022; Webb *et al.*, 2022). In 2021, the United Nations Food Systems Summit (UNFSS) included a call to action for this transformation, which also highlighted the need for more inclusive and diverse stakeholder engagement of various persons, organizations and civil groups (United Nations Environment Programme [UNEP] *et al.*, 2023).

An important demographic to consider in agrifood systems transformations is youth or young people. Youth[1] are defined as a group of persons generally between the ages of 15 and 35 (African Union, 2006; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2019), and undergoing a transition from childhood into adulthood (Glover and Sumberg, 2020). Youth constitute a distinct demographic that intersects with various social, cultural and economic segments of the population (Glover and Sumberg, 2020), and may provide unique perspectives for shaping transformative agrifood systems. As active members within their communities, youth often participate in multiple agrifood systems roles, including as producers, processors, employees in the food retail or service industry, entrepreneurs, researchers and activists – as well as being consumers of food (Glover and Sumberg, 2020; High Level Panel of Experts [HLPE], 2021).

This report focuses on youth engagement in the context of agrifood systems transformation, highlighting their pivotal role as agents of change contributing to this transformation (Committee on World Food Security, 2021; HLPE, 2021). With the crucial need for agrifood systems transformation, it is critical that youth are encouraged and provided with opportunities to contribute to this change. Technology can serve as a tool to encourage youth engagement in agrifood systems (WFF, 2023). It has been critical to the advancement of agrifood systems transformation and has improved agricultural productivity, nutrition and livelihoods over the last century (Herrero *et al.*, 2020). This includes advances in mechanization, genetic engineering and food safety (Herrero *et al.*, 2020). Additionally, communication technologies can facilitate the rapid exchange of ideas across regions and the globe, including within agrifood systems (El Bilali and Allahyari, 2018). However, even though technologies and innovations offer opportunities for youth to engage in agrifood systems, it is key to recognize that there are also limitations for youth actors in using these tools, including financial, educational and sociocultural barriers (Curry *et al.*, 2021; Ninson and Brobbey, 2023).

[1] We use "youth" and "young people" interchangeably to refer to people between 15 and 35 years of age throughout this report.

This report aims to explore how digital technologies play a role in youth engagement in agrifood systems transformation. Digital technologies include a wide array of devices which process, store and transfer digital data such as sensors, robotics and analytics platforms (Duncan *et al.*, 2021). These can be instrumental towards improving agricultural productivity and efficiency (Konfo *et al.*, 2023), and facilitating connections between producers and markets (Tauzie *et al.*, 2024). Additionally, digital technologies can make agrifood systems a more attractive sector for youth (Torero, 2021). By exploring the role of digital technologies in agrifood systems transformation, this report aims to highlight their potential to engage youth as key drivers of change in sustainable agrifood systems. The report focuses on digital technologies because they are rapidly shaping the agrifood sector. They not only enhance agricultural productivity and efficiency but also offer potential opportunities for youth engagement and innovation. This report also explores the unintended consequences of digital technologies in agrifood systems transformation, including issues related to the digital divide such as inequitable distribution and adoption.

In considering the roles digital technologies can play towards youth engagement in the transformation of our agrifood systems, we apply a multidimensional viewpoint of engagement. Therefore, digital technological tools can (1) be used by youth as a part of agrifood transformation projects and activities; (2) be developed by youth to transform agrifood systems; (3) be a means to encourage youth to take part in agrifood transformation projects and activities; and (4) be used by youth, or a means to involve youth, in decision-making processes. The following chapters of this report look at youth engagement in agrifood systems transformation (Chapter 1), the use of digital technologies in agrifood systems and associated barriers (Chapter 2), examples of digital technology enhancing youth engagement (Chapter 3), youth perspectives on digital technology use in agrifood systems projects (Chapter 4), and concluding remarks on implications on policy and research with eight recommendations (Chapter 5).


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Chapter 1.

Youth engagement in agrifood systems transformation

The term "youth" does not have a precise definition, but typically refers to individuals between the ages of 15 and 24 (UNESCO, 2019) or 15 and 35 (African Union, 2006). This demographic represents individuals transitioning from childhood to adulthood (Glover and Sumberg, 2020). Such a period is marked by increased responsibility and independence in terms of decision-making and involvement in endeavours. Consequently, youth roles in agrifood systems evolve. Youth may change their consumption patterns, become economically active as producers or distributors, and influence others' food choices and behaviours (Glover and Sumberg, 2020). It is important to note that while this report refers to youth as a major demographic group, it emphasizes viewing youth through an intersectional lens, considering factors such as gender, sexual orientation, economic situation and ethnicity, which can shape youth experiences in addition to age (Glover and Sumberg, 2020).

Youth engage in transforming agrifood systems in various ways. For example, they can be involved in entrepreneurial endeavors, such as initiatives like the World Food Forum (WFF) Youth Food Lab, and they can influence decision-making processes, such as through the Act4Food initiative (WFF, 2024). As "agents of change", youth can contribute to the transformation of agrifood systems through various engagements including their livelihoods, social movements and collective networks (HLPE, 2021) (see Figure 1). These efforts are actively encouraged as critical contributions to shaping our agrifood systems (Committee on World Food Security, 2021; UN Food Systems Coordination Hub, 2021).

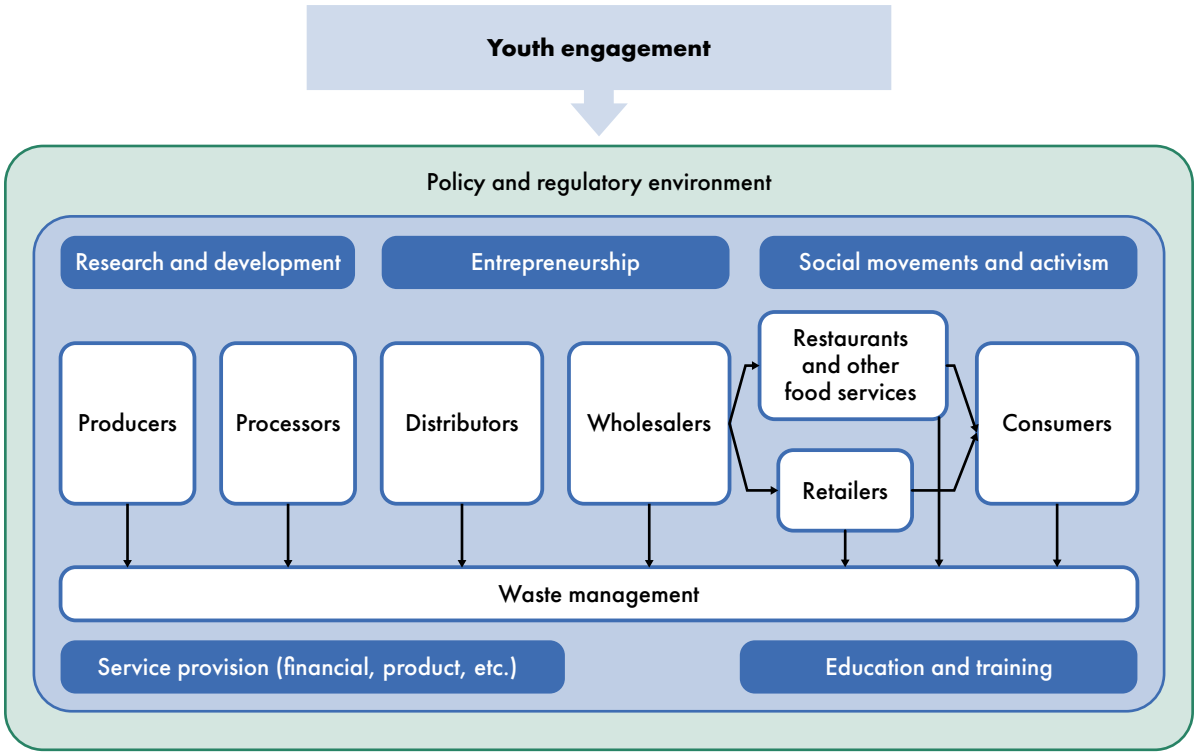

Figure 1. Simplified overview of the involvement of youth across agrifood systems.

Elaborated by: *Ebba Engstrom, WFF YSG Member.* Retailers include both wholesalers and grocery stores

In its report on youth engagement and youth employment in agrifood systems, the HLPE (2021) outlines the ways in which youth engagement is a means to achieve sustainable agrifood systems. However, youth often lack support to achieve sustainable agrifood systems and more dedicated investments and resources are needed to better engage youth in agrifood systems (Geza *et al.*, 2021; HLPE, 2021; Babu *et al.*, 2021). Furthermore, to ensure effective youth engagement, which contributes to the transformation of our agrifood systems, there is a need for this engagement to be meaningful and avoid tokenism – that is, avoiding youth engagement strategies that are purely symbolic in nature (UNESCO, 2019).

In the context of the United Nations (UN), UNESCO (2019) outlined how to better ensure meaningful youth engagement and what principles this relies on. In their report, they emphasised how meaningful youth engagement involves (1) creating a safe space for youth engagement; (2) respecting youth as contributors and knowledge-holders; (3) valuing the contributions and knowledge of youth as those of adults; (4) being inclusive of youth from an intersectional perspective, and encouraging youth to self-organize into structures based on experiences and views; (5) allowing youth to choose their areas of engagement as appropriate; (6) being transparent about what their engagement will entail; (7) ensuring youth have access to necessary and appropriate information in regards to their engagement; (8) providing and creating environments that are youth friendly; (9) letting youth build their own capacities but also attending to required training needs; and (10) encouraging non-youth actors to develop meaningful youth engagement whilst challenging unequal power dynamics between youth and non-youth.

Meaningful youth engagement is therefore not a task undertaken solely by and for youth. It also requires proactive steps to be taken by older generations and for power to be shared between generations (ACT for Youth, 2024). Moreover, meaningful youth engagement can occur at various levels, whereby youth can be consulted on pressing issues, contribute to initiatives and serve as leaders or partners (UNESCO, 2019).

The principles of meaningful youth engagement discussed in this report are in the context of engaging youth in agrifood systems transformation. However, we also recognise the barriers for youth to simultaneously (1) engage as agents or decision makers in agrifood systems more generally and (2) engage in transformative processes in agrifood systems. According to the YSG (WFF, 2023), youth often play passive roles or are excluded from policy-making processes. Different segments of youth also experience different intersectional realities, which can shape their opportunities to engage in agrifood systems (Glover and Sumberg, 2020). For example, Huyer *et al.* (2023) noted that women experience barriers to engaging in decision-making both at the household and community levels due to gender norms. Specifically in farming, women's roles are often overlooked and undervalued because of perceptions about appropriate gender roles, leading to their exclusion from decision-making spaces (Sumner *et al.*, 2017).

Moreover, there is a need for structural support in relation to equitable educational and financial resources to promote meaningful youth engagement in agrifood systems initiatives (Huyer *et al.*, 2023; WFF, 2023). In the case of youth-led private or entrepreneurial initiatives, there are challenges in terms of access to both financial and social capital, especially in the Global South (Green, 2013). For example, according to FAO (2021), a substantial portion of young entrepreneurs in developing countries lack access to formal financial services. This restricts their ability to invest in sustainable farming practices, innovate within agrifood value chains and scale their businesses effectively. Without adequate financial support, youth-led initiatives often struggle to reach their full potential in contributing to transformative changes in agrifood systems.

A major barrier to youth engagement within agrifood systems transformation is also the issue of youth unemployment within the sector, hindering the ability for youth to become engaged in decision-making processes and

transformative engagements to begin with. According to the HLPE (2021), factors influencing this trend include poor access to land, natural resources, infrastructure, finance, technology and knowledge and low remuneration for workers and producers. Negative perceptions and the sector's limited attractiveness, especially in rural areas, are also drivers of this trend (Girdziute *et al.*, 2022).

Facilitating meaningful youth engagement and overcoming barriers will likely require several enabling factors. Some of these factors, such as recognizing the rights of youth, are foundational, while others, like skills training, are more practical (see Figure 2). Recognizing youth as key stakeholders in agrifood systems transformation, as supported by principles of agency, equity[2], rights[3] and recognition[4] outlined by the HLPE (2021), is critical. Building on this, there is a need for education and training amongst youth (HLPE, 2021; WFF, 2023) to engage in an informed manner in shaping initiatives and decision-making. There is also the need for mechanisms and policies that make youth aware of opportunities to engage and be part of decision-making processes (HLPE, 2021), as well as those which provide financial and structural support for entrepreneurial endeavours (WFF, 2023). Additionally, efforts to spread awareness about what meaningful youth engagement entails, such as the points by UNESCO (2019), are pivotal.

At a higher level, additional tools emerge that enable youth to engage in decision-making processes and to drive agrifood systems transformation. One such tool is technology, including digital technologies. These can play a role in communication, fostering collaborations, making agrifood sector jobs more attractive to youth, mitigating negative impacts and producing positive outcomes in agrifood systems (WFF, 2023).

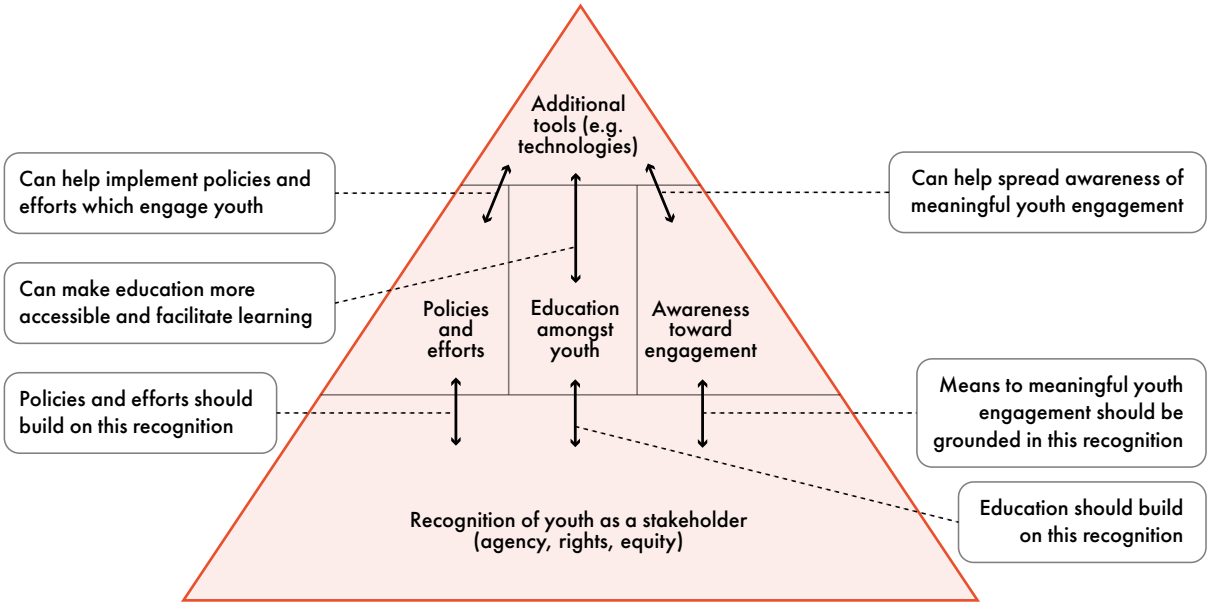

Figure 2. Enablers of meaningful youth engagement in agrifood systems transformation. Examples of how the enablers can interact are displayed in the diagram and are by no means exhaustive. The figure was inspired by the HLPE (2021) (Figure 2, p.11).

Elaborated by: *Ebba Engstrom, WFF YSG Member.*

[2] Equity entails that youth have equitable access to resources and power in agrifood contexts (HLPE, 2021).

[3] Rights refer to a human rights perspective whereby youth have the right to be heard and can challenge the violations of their rights (HLPE, 2021)

[4] Recognition entails that youth have the status of an actor with the ability to exercise agency, are treated equitably and have rights that need to be met (HLPE, 2021).


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Ecology
Latitude
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Latitude 7°49'43"N
Surveyed (ha)*
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Get coordinates 3
Get coordinates 4
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Area to be treated (ha)
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Photos (0)
Latitude : 7°49'43"N
Longitude : 49°29

Chapter 2.

Digital technologies in agrifood systems

Technology in agrifood systems is defined by Alexandrova-Stefanova *et al.* (2023) as, "... the application of science and knowledge to develop techniques to deliver a product and/or service that enhances the sustainability of agrifood systems." Technology is critical to advancing agrifood systems transformation and has contributed to major improvements in agricultural productivity, nutrition and livelihoods over the last century (Herrero *et al.*, 2020). This has been achieved through various mechanisms, including advances in mechanization, genetic engineering and food safety.

2.1. Digital technology use and adoption

Digital technologies refer to technologies which process, store and transmit information in a digital, i.e. binary, format (zeroes and ones) (Pullen *et al.*, 2009). Devices that fall within the category of digital technologies used in agrifood systems include robotics, sensors, and information and communication technologies (ICTs) (Konfo *et al.*, 2023; Salampasis and Theodoridis, 2013; El Bilali and Allahyari, 2018) (see Table 1).

Table 1. Examples of digital technologies used in agrifood systems.

Digital technology	Description	Examples of use
Sensors	Devices that use sensing functionalities to collect data (e.g. pH, material)	Can support farmers in the collection of data and in applying precision farming
Robotics	Steered technologies that can be programmed or controlled to conduct certain tasks	Can support the automation of tasks
Remote sensing technologies (including drone and satellite technologies)	Technologies for collecting and processing geographic and environmental data	Can support the monitoring of environmental health at small and large scales
ICTs	Tools that facilitate communication and information sharing	Can be used by farmers to exchange knowledge about crop production and products
Blockchain technology	Technology that relies on a distributed ledger which records and stores data immutably	Can support the recording of data transparently along supply chains, as well as provide traceability for certification standards
Artificial intelligence (AI) technologies	Technologies that aim to replicate human intelligence	Can be used to recognise and manage disease, weeds, and pests

References: (1) Konfo *et al.*, 2023; (2) Croptracker, 2024; (3) El Bilali and Allahyari, 2018; (4) Zhao *et al.*, 2019; (5) Kutyauripo *et al.*, 2023

Different generations use digital technology in different ways and for various reasons (Pew Research Center, 2020). Millennials primarily use technology for entertainment, while Generation X (persons born between 1965–1980) uses it mainly for practical purposes and information searches (Calvo-Porral and Pesqueira-Sanchez, 2020). Youth are the largest group of technology users, with nearly 70 percent of global youth connected to the internet, compared to just under half (48 percent) of the overall population (Wong *et al.*, 2021).

Within agrifood systems, youth are more likely to use and adopt digital technologies than older generations (Taylor., 2018). A study (Akter and Tan., 2023) found that educated youth in Bangladesh were more inclined to adopt agri-based mobile apps that provide information on crop production and pest control. Additionally, digital technologies provide valuable information to those within the agrifood sector. For instance, courses to support agricultural production delivered online are available to farmers (Xiuling *et al.*, 2023), including young farmers, such as Brazil's Programa Jovem Saber (Youth Knowledge Programme, no date).

Digital technologies create opportunities for young individuals to engage in entrepreneurship within the agrifood sector (Ninson and Brobbey, 2023). They can support the establishment of businesses and foster economic development through platforms such as e-commerce and mobile applications for farm management (Ninson and Brobbey, 2023). Additionally, they can simplify the undertaking of precision farming, vertical farming and weather forecasting, relevant to various agrifood systems ventures (Ninson and Brobbey, 2023).

2.2 Digital technology inclusion gaps

Despite the common assumption that the majority of youth are digital technology users, there are significant disparities in digital technology accessibility among young people. Digital tools are not equally accessible to all due to the heterogeneity of the youth demographic (Forney *et al.*, 2023). The term "digital inclusion gap" here refers to the gap between individuals, households and geographic areas at different socioeconomic levels with regards to both their opportunities to access information and technologies, and their use of technologies for a wide variety of agrifood systems activities (OECD, 2023). This includes differences in technology coverage and adoption in rural and urban areas (Vassilakopoulou and Hustad, 2023). This gap pertains not only to physical access to technologies but also to the educational resources necessary for youth to adopt these tools (Ninson and Brobbey, 2023). Exclusion from these opportunities is due to various barriers, including lacking financial resources, limited access to digital tools and low digital literacy (UN Women, 2020).

For instance, youth in lower-income countries are more likely to face resource gaps in accessing technologies. Angel Gonzalez Sanz, Head of Science, Technology and Innovation in the Division on Technology and Logistics at the UN Conference on Trade and Development (UN, 2023), highlighted this disparity by noting that while 63 percent of the world's population is connected to the internet, only 27 percent of the population in the least developed countries are internet users. In addition, data collected by UNESCO in 2020 (reported on by the International Telecommunication Union [ITU], 2022) highlights that globally, 40 percent of primary schools and 66 percent of secondary schools had access to the internet in 2020. In less developed countries, only 28 percent of primary schools and 35 percent of secondary schools had access to the internet (ITU, 2022). This trend is also seen at the household level – while 87 percent of children and young people worldwide have an internet connection at home, the figure drops drastically to just 6 percent in low-income countries (ITU, 2022).

To enhance the effective utilization of digital technologies, it is crucial to advance network infrastructure, including improving connectivity and expanding broadband coverage. Additionally, attention must be given to aspects of social and political infrastructure, such as enhancing technology access in schools and public institutions, providing comprehensive technology education and training, supporting ICT initiatives for small businesses and addressing the needs of rural areas. Increased government expenditure on digital technologies is also essential for fostering these improvements (OECD, 2023). Along these lines, FAO has advocated in several international forums (such as the ITU/UNESCO Broadband Commission for Sustainable Development, the Internet Governance Forum and the UN Global Digital Compact) to shift the focus from the "coverage gap" to the "adoption gap", focusing on incentives to address demand-side connectivity barriers in rural areas.

Moreover, access to digital technology remains limited for women, especially in developing countries. As of 2020, internet usage among women was 12 percent lower than that of men (ITU, 2021). Although this gap has narrowed in most regions since 2013, it has widened in Africa, where in 2017 women were 25 percent less likely to use the internet compared to men (ITU, 2017). In rural areas, the gender gap in mobile phone ownership has widened due to inadequate access to basic infrastructure and services (IRRI, 2023). For instance, 327 million fewer women than men owned smartphones and had access to mobile internet (Meunier *et al.*, 2022). Simultaneously, digital tools can enable women farmers to increase efficiency, participate in decision-making, improve food security and create new entrepreneurship opportunities (IRRI, 2023; CABI, 2023; WFP, 2023). Initiatives like the Global Network of Digital Agriculture Innovation Hubs launched by FAO (2024) aim to establish in-country innovation hubs supporting farmers and value chain actors (particularly youth and women), in adopting digital innovations.

Innovations and technologies used to promote agrifood systems transformation should embrace the diversity of youth (UN Women, 2020). Indeed, an intersectional approach is essential when developing digital skills and capacities among youth to close the digital literacy gap (UN, 2023). Such an intersectional approach will ensure that all young people can benefit from and contribute to digital advancements (UN, 2023).

Furthermore, the ethical implications of digital technology use must be addressed (Schoentgen and Wilkinson, 2021). Safety and cybersecurity concerns associated with digital technology are paramount. For youth connected to digital technologies, increased digital exposure comes with more online risks including discrimination in digital environments, data sharing and consent infringements, targeting and profiling, privacy and confidentiality breaches, cyber violence, exposure to harmful content and ultimately a broad array of rights violations (UN DESA, 2023). When promoting digital technology use amongst youth, these risks should be taken into consideration.


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Chapter 3.

Digital technologies for youth engagement in agrifood systems transformation

In Chapter 1, this report discussed how youth engagement in agrifood systems can take on various shapes and forms, which also applies to the context of agrifood systems transformation. As such, digital technologies can play a role in various ways towards youth engagement in agrifood systems transformation. This section of the report highlights four areas regarding how digital technologies can play a role in youth engagement towards agrifood systems transformation:

- Digital technologies used by youth in projects or activities that transform agrifood systems;
- Digital technologies developed by youth that transform agrifood systems;
- Digital technologies as a way to engage youth in agrifood system transformation projects or activities; and
- Digital technologies as a means for youth to engage in decision-making for agrifood systems transformation.

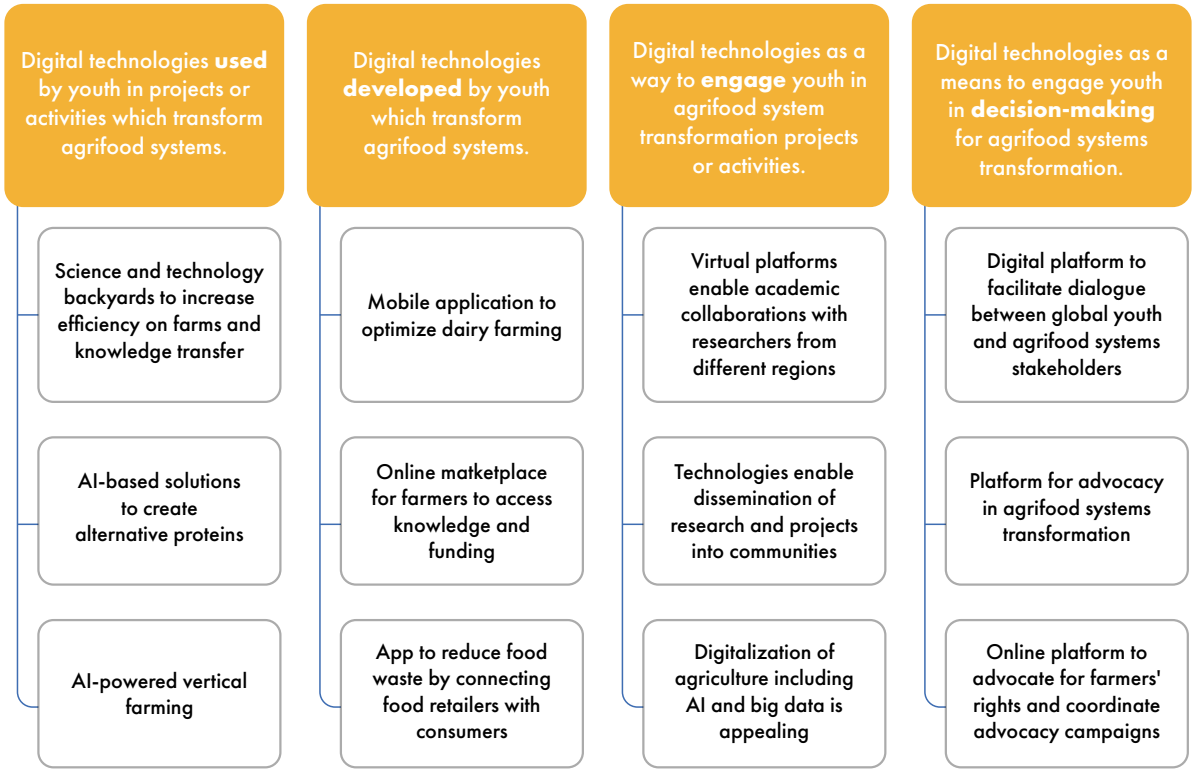

Figure 3. Digital technologies for youth engagement in agrifood systems transformation

Elaborated by: *Tarini Gupta, Ebba Engstrom, WFF YSG Members.*

3.1. Digital technologies as a tool used by youth in projects or activities that transform agrifood systems

Digital technologies, including ICTs such as mobile phones and internet-based tools, play a crucial role in the entrepreneurial and research endeavours of youth aiming to transform agrifood systems. This is because they can contribute to providing environmental, social and financial benefits (FAO, 2022). Below are several case studies which demonstrate how digital technologies are used in specific research endeavours and entrepreneurial efforts by youth to address various challenges of agrifood systems transformation.

Firstly, digital technologies such as AI are used by youth to increase food production and improve food security – a necessity for agrifood systems transformation (Dengerink *et al.*, 2022). For example, Agro2o is a youth-led company using AI to enhance crop productivity in India (Box 1).

Box 1: Agro2o **Country:** India

Overview: Agro2o Smart Garden is a device that allows consumers in densely populated urban areas to grow fresh and healthy herbs and vegetables.

Technology: Agro2o is powered by machine learning and AI algorithms that allow higher yields, faster production, and efficient cost and resource utilization.

Impact: Agro2o empowers individuals and businesses to cultivate their own fresh, nutritious food in cities, thus reducing reliance on long-distance transportation while promoting local food knowledge and sustainability.

Another company, Zindi (Box 2), bridges the gap between organizations needing data science solutions and African data scientists seeking opportunities, including within agrifood sectors. With a community of over 30 000 data scientists, Zindi is actively addressing agrifood systems challenges by leveraging AI and machine learning for impactful solutions.

Box 2: Zindi **Region:** Africa

Description: Zindi is an online platform that links organizations with African data scientists to develop AI-driven solutions for industry sectors including agrifood systems.

Technology: Zindi uses machine learning and data analytics to offer solutions such as predictive crop management and resource optimization, aiding farmers and agrifood businesses.

Impact: By engaging over 30 000 young data scientists and partnering with companies like Google and Amazon Web Services, Zindi drives innovation in agriculture, improving efficiency and productivity in the agrifood sector and increasing youth employment.

Furthermore, various combinations of digital technologies are being used by youth in student projects aimed at developing practical solutions toward agricultural challenges. For example, initiatives like Science and Technology Backyard (STB) (Jiao *et al.*, 2019) (Box 3) combine digital technologies to improve efficiency in production and productivity amongst agriculturists. STB initiatives have led to notable outcomes for smallholder farmers, such as increases in crop yields and improved water-use efficiency (Jiao *et al.*, 2019).

Box 3: Science and Technology Backyards **Country:** China

Description: STB is a hub in a rural area that links knowledge with practices to promote technology innovation and exchange, engaging young university students to translate scientific research into viable, real-world agricultural solutions in smallholder farms.

Technology: STB leverages digital tools including mobile apps, online learning platforms, data analytics and social media, providing real-time information on weather, soil health and crop prices, helping farmers make informed decisions.

Impact: STB solutions have increased crop yields by 10 to 20 percent, improved water usage efficiency by 15 percent, reduced fertilizer application, reduced costs by up to 20 percent, and strengthened connections between young scientists and rural communities. In addition to increasing productivity, STB also enhances student engagement and learning experiences, fostering a connection between academic knowledge and practical application (Jiao *et al.*, 2019).

Youth also use digital technologies to reduce the impacts of agrifood systems on the environment. One way in which the environmental impact of agrifood systems can be reduced is through a shift in consumption patterns towards dietary products that have a lower environmental impact (Willett *et al.*, 2019). Alternative proteins – derived from plants, cultivation or fermentation processes – can be part of this solution (GFI, 2022). One example of a company that develops alternative protein products with the help of digital technologies, and which was founded by a young person, is Protera (Box 4).

Box 4: Protera **Country:** Chile

Overview: Protera is a Chilean startup that has developed "Natural Intelligence", an AI-based process to develop sustainable protein-based ingredients.

Technology: Protera's predictive algorithm is capable of studying and replicating different natural forms of protein, creating several protein-based ingredients.

Impact: Protera's solutions can provide a set of positive impacts, such as more nutritious food, less food waste and higher levels of food safety.

At a socioeconomic level in relation to agrifood systems transformation, there is also a need to increase youth retention in agrifood sectors (Allen *et al.*, 2017). Box 5 illustrates an example of how organizations can leverage digital technologies to increase knowledge and information access amongst youth, which can contribute to retaining rural youth in farm jobs.

Box 5: The Savannah Young Farmers Network **Country:** Ghana

Problem: Rural youth in the Global South lack access to tools and technology to troubleshoot farming problems, which reduces their retention rate in agriculture.

Solution: The Savannah Young Farmers Network is a youth-led, non-governmental organization attracting youth into agriculture through an innovative project called Audio Conferencing for Extension (ACE) in several communities in northern Ghana. ACE focuses on encouraging young farmers to view agriculture as a business, offering insights into becoming successful agripreneurs. ACE employs mobile phones, audio conferencing technology and portable loudspeakers to connect groups of 10 to12 farmers with distant agricultural extension workers and researchers. This two-way communication allows farmers to ask questions and guide discussions to suit their specific needs.

Impact: The ACE project has significantly increased youth employment in agriculture by making the sector more attractive and accessible. More young people are entering the agricultural workforce, viewing it as a profitable and sustainable livelihood.

On a socioeconomic level, the transformation of our agrifood systems should also involve the enhancement of the livelihoods of those working within them (Environmental Defense Fund *et al.*, 2023). Digital technologies can reduce management difficulties and increase economic benefits for those employed in the agrifood sector (Torero, 2021). This includes digitally enabled marketplaces (e-platforms) for agricultural products that can shorten value chains, allow access to new markets and lower transaction costs (World Bank Group, 2019). One example of such a platform being used by youth is Impact Terra (Box 6).

Box 6: Impact Terra **Country:** Myanmar

Problem: Agricultural professions are not often financially rewarding in the Global South.

Solution: Myanmar agritech company Impact Terra developed a smallholder finance pilot scheme. Through its Golden Paddy app, Impact Terra collected digital data on maize farmers. Impact Terra then analyzed the data and used it to populate detailed profiles and segment farmer credit risk for Sathapana's crop loan.

Impact: Detailed profiles fed into a customized farmer credit-scoring model that allowed farmers to apply for credit. During the pilot, 50 percent of the maize farmers repaid their loans early, while the remaining 50 percent repaid the loans at the agreed time.

Finally, efficient youth engagement in agrifood systems transformation from an entrepreneurial perspective can be contributed to by youth's ability to leverage digital payment solutions and mobile lending services (S4YE, 2021) (see Box 7).

Box 7: FarmDrive **Country:** Kenya

Problem: Potentially creditworthy smallholder farmers are often denied loans because they lack the traditional credit profiles that lenders rely on to evaluate borrowers. In addition, digital payment services are not tailored to support young people in agrifood systems, limiting their opportunities to grow and diversify their businesses.

Solution: FarmDrive uses simple mobile phone technology, alternative data sets and sophisticated data analytics to conduct creditworthiness evaluations of smallholder farmers, allowing them to get loans.

Impact: More than one in three beneficiaries of the over 300 000 USD worth of loans disbursed to Kenyan farmers between 2014 and 2018 were young people.

3.2. Digital technologies developed by youth for agrifood systems transformation

Youth can also be developers of digital technologies in the context of agrifood systems transformation. These developments often occur through research and innovation (Amini Sedeh *et al.*, 2022).

Ensuring fair and sustainable livelihoods is crucial in agrifood systems transformation (Environmental Defense Fund *et al.*, 2023). An example of a youth-led entrepreneurial effort contributing to this transformation goal is DigiCow based in Kenya (Box 8). They developed a phone app that can be used to communicate with farmer end-users and provide them with digitized record keeping to improve efficiency in their livelihoods.

Box 8: DigiCow **Country:** Kenya

Problem: Small-scale dairy farmers in Kenya lack expert support, training and tools to increase efficiency and revenue.

Solution: The DigiCow mobile app offers comprehensive solutions for accessing critical information, and optimizing dairy farming processes. The user-friendly mobile app is accessible via smartphones and connects farmers with livestock management experts, veterinarians, artificial insemination services and feed suppliers. It also features a digital training room and enables peer-to-peer engagement among farmers.

Impact: The app has led to improvements in productivity, efficiency and profitability for farmers. Key outcomes include a 42 percent increase in milk production and a 55 percent increase in income for its users. The platform's emphasis on knowledge exchange and peer support has empowered farmers to adopt modern practices and tackle common challenges more effectively.

In the context of improving agrifood systems livelihoods, beyond DigiCow, there are various other entrepreneurial efforts that integrate communication solutions as a part of their digital platforms to give users access to varying services. For example, ThriveAgric in Nigeria aims to increase the accessibility of farmers to agricultural advice, capital and markets (Box 9).

Box 9: ThriveAgric **Region:** Africa

Problem: Access to finance is a significant hurdle for smallholder farmers, who need capital for seeds, fertilizers and other inputs to boost crop yields.

Solution: This agri-tech platform offers farmers access to finance, agricultural advice, business support, and market linkages through an integrated online and offline system. ThriveAgric's Agricultural Operating System (AOS) connects farmers with the necessary funding, resulting in increased productivity and profitability. In addition, the platform allows farmers to sell produce directly to consumer goods and agri-processing markets. By eliminating intermediaries, the marketplace ensures fairer prices for farmers and improves market access, leading to better economic outcomes. The platform's offline functionality is crucial for farmers in remote areas with limited internet connectivity. This inclusivity ensures that even the most marginalized farmers can benefit from modern agricultural practices, bridging the gap in access to essential services.

Impact: The platform increases crop yields, agricultural resilience, market access and incomes.

From an environmental viewpoint, agrifood systems require a large reduction in food loss and waste (FAO, 2019; UNEP, 2020). The fact that one-third of all food produced for human consumption is either lost or wasted (FAO, 2011), highlights the inefficient use of the natural and human resources in the production of agrifood products. Reducing food loss and waste could save between 120 to 300 billion USD annually by 2030 (World Resources Institute, 2023). Digital apps, such as Too Good To Go (2024) and Karma (2024) – which were developed by young persons – may play a role in encouraging consumers to make food choices that reduce food waste (Boxes 10 and 11).

Box 10: Too Good To Go **Region:** Europe and North America

Problem: Urban food retailers (e.g. restaurants, shops and supermarkets) waste food that is still edible and nutritious, mainly because it is due to expire. In the meantime, many consumers in cities struggle to have access to affordable food.

Solution: The Too Good To Go app connects food retailers and businesses with consumers seeking to get access to affordable food. It provides consumers with information on restaurants, supermarkets and shops in specific areas of a city on that day that are offering foods that would otherwise be thrown away, at a reduced price. In addition, the platform provides information to consumers on the environmental contribution of their food purchases by showing the quantity of carbon dioxide emissions avoided. The app can be used for free, ensuring that low-income groups can benefit from it and prevent food waste, thus bridging the gap in access to food.

Impact: The app helps to reduce food waste, improves food affordability and increases equality in food access.

Box 11: Karma **Country:** Sweden

Problem: One third of the food produced is wasted. Food retailers (e.g. restaurants, bakeries and cafes) waste food that is still edible and nutritious. In the meantime, many consumers in cities struggle to have access to affordable food.

Solution: The Karma app connects food retailers and businesses with consumers seeking to get access to affordable food, by providing consumers with information for discounted individual meals in restaurants, cafes and bakeries in cities which would otherwise be thrown away. By informing consumers on individual discounted meals, consumers will know precisely what food they are getting. The app can be used for free, ensuring that even low-income groups can benefit from it and prevent food waste, thus bridging the gap in access to food.

Impact: The app helps to reduce food waste, improve food affordability and increase equality in food access.

Additionally, to enhance environmental and socioeconomic sustainability across agrifood supply chains, there is a need to increase transparency in and of these (Astill *et al.*, 2019). Transparency enables downstream actors and individual consumers to make more sustainable consumption choices (Wognum *et al.*, 2011), while also promoting supply chain traceability and accountability (Astill *et al.*, 2019; Charlebois *et al.*, 2024). Digital technologies such as blockchain can facilitate the documentation of information along agrifood supply chains (Astill *et al.*, 2019). Box 12 showcases an example of a youth-led company that developed a blockchain technology platform to increase traceability along agrifood supply chains.

Box 12: AgriClear **Country:** Nepal

Problem: There is a lack of clarity and transparency along each step of the value chain for agricultural products.

Solution: AgriClear is a project proposed by youth in Nepal to help increase transparency and authenticity along agrifood supply chains. Based on a blockchain platform, it is a digital media tool that helps consumers trace how products are transformed throughout the supply chain with the quick scan of a QR code. It helps consumers understand the value added to each product and ensures transparency in the product flow from farmers to the markets. AgriClear was a finalist in the United Nations Capital Development Fund Financial Innovation Lab Initiative.

Impact: In the long term, this digital system can help consumers trace agrifood products and understand the authenticity of the products.

Another example of how digital technologies are being used to ensure transparency and fairness along agrifood value chains is described in Box 13. Like Agriclear (Box 12), Tracifer, a start-up founded in 2019 (Box 13), uses digital technologies, such as blockchain-powered platforms, to track and validate products across agrifood value chains. As such they offer traceability and visibility of agrifood products and their supply chains, in regards to their social and environmental impacts.

Box 13: Tracifer **Country:** Germany

Problem: Agrifood supply chains are very complex and can be very long, involving many different actors along the value chain. This complicates data availability, accuracy and cross-border regulatory compliance.

Solution: Through blockchain platforms that track and validate food systems products, Tracifer aims to provide transparent data that facilitates data communication between companies and customers. To ensure the authenticity of data and make sure accredited parties verify documentation, the startup relies on third party certifications and auditing activities.

Impact: This digital technology offers traceability and reliable certification standards to companies and consumers, while counteracting fraud in agrifood supply chains and certification issues.

3.3. Digital technologies encouraging youth to engage in transformative agrifood projects or activities

Digital technologies can attract youth to opportunities within the agrifood systems sector. They can incentivize youth to enter the agrifood sector by reducing management challenges and increasing profitability (Torero, 2021). A study that surveyed factors behind youth's motivation to work in agriculture, found that more than 60 percent of the respondents thought that technological innovations increased the attractiveness of the agriculture sector as a place to work in (Girdziute *et al.*, 2022). More so, it has been found that youth may be more disposed to using digital technologies than older generations (Tauzie *et al.*, 2024), which may present opportunities for their engagements in agrifood systems in which digital technologies can play a significant role. Youth that use these technologies can also serve as knowledge or information brokers to older generations, fostering the intergenerational exchange of knowledge and ideas that are valuable across agrifood systems professions (Bentley *et al.*, 2019).

However, as previously highlighted in this report, challenges associated with digital technology use may deter youth from engaging in agrifood systems transformation initiatives. Digital technologies remain inaccessible to many youth, including those in lower-income settings (Vassilakopoulou and Hustad, 2023). Additionally, the use of certain digital technologies necessitates skills development (Torero, 2021), which requires time and resources. Concerns about data privacy are also important to factor in, particularly when initiatives rely heavily on digital data collection (HLPE, 2021).

In encouraging youth to engage in transformative initiatives in agrifood systems, digital technologies can play a crucial role in showcasing and advertising opportunities for youth to engage. For instance, the Next Generation Agriculture Impact Network (NGIN, No date) leverages social media platforms such as Instagram to inform their audiences about transformative agrifood systems initiatives that they can participate in. Additionally, Agirite Social Media Agriculture Influencers (2024) based out of Rwanda uses the platform X (formerly known as Twitter) to showcase transformative initiatives and encourage youth participation in agriculture across the African continent.

3.4. Digital technologies for youth partaking in meaningful decision-making for agrifood systems transformation

Digital technologies can play a role in empowering youth to partake in decision-making processes that shape agrifood systems transformation. Such processes shape policy, regulation and actions at governmental and organizational levels. Digital technologies, like virtual meeting forums, networking platforms, and other ICTs, can allow youth to exchange dialogue with stakeholders and decision makers within the agrifood systems sector.

For instance, during the 2021 UNFSS and its subsequent stocktaking initiatives (UN Food Systems Coordination Hub, no date), (see Box 11), various stakeholders convened to set regional and national commitments related to agrifood systems aligned with the SDGs (UN, 2021). Prior to the official Summit, national and regional dialogues were held. These dialogues were organized by different actors, including independent organizational groups, and provided critical inputs for the Summit process (UN, 2021). Many of these dialogues utilized video conferencing to ensure broad stakeholder engagement, including that of youth (SIANI, 2021a).

Although platforms such as the UNFSS create opportunities for youth to engage in decision-making, the inclusivity of the process has been questioned (SIANI, 2021b). For instance, individuals without access to digital technologies are unable to partake in virtual meetings (SIANI, 2021c). The UNFSS website platform, which is used to host online dialogues, was also largely inaccessible to independent organizations (UN, 2021). Thus, organizations must consider facilitating engagement in decision-making processes through both analogue and digital means, particularly to include individuals who may lack access to digital resources (UN DESA, 2023).

Another initiative that leverages a website-based platform to include youth in decision-making processes is Act4Food (2024). Act4Food, also known as Act4Food Act4Change, is a youth-led campaign established in 2021. Through the campaign's website platform, youth can register to join the campaign, make pledges to their initiatives and highlight actions they would like governments take (Box 14).

Box 14: Act4Food

Description: The Act4Food campaign is a youth-led initiative that aims to raise the voices of youth towards shaping decision-making processes for food systems transformation. The campaign utilizes its platform and integration of social media to encourage youth to join the campaign and pledge action. The platform further displays the actions youth would like for governments and organisations to take.

Outcomes: The Act4Food campaign platform has played a significant role in amplifying youth voices and influencing policy-making on food system issues. To date, it has engaged over 160 000 youth through online pledges. The platform has also facilitated direct engagement between youth stakeholders and decision-making groups. Additionally, it has created online video content in collaboration with the government of Ireland to further influence opinion.

Additionally, a movement called Bite Back (2024) based in the United Kingdom of Great Britain and Northern Ireland (Box 15) is using its website-based platform to share its manifesto which urges decision-makers to address agrifood systems issues that regard youth.

Box 15: Bite Back

Description: Bite Back is a youth activist movement based in the United Kingdom that challenges the current structures of agrifood systems in order to address their negative impacts, especially those that affect young people. In their manifesto, they call for food companies to be held to higher standards to protect children, for all children to have access to nutritious school meals, to incentivize the production and distribution of healthier foods and to align accessibility of healthy foods with net-zero carbon climate policy goals.

Outcomes: As of 2022, the Bite Back movement had seen involvement from activists together with reaching young people in schools and community programmes. Since then, their group has continued to develop and has also called for changes ahead of elections in the United Kingdom.

Similarly, the US National Young Farmers Coalition (NYFC) (2024) (Box 15) runs campaigns to advance the goals of young farmers in the United States of America who are aiming to transform agrifood systems. Their policy agenda is communicated through their web-based platform, which also functions as a direct interface for persons to directly support legislative bills and communicate with members of congress.

Box 16: National Young Farmers Coalition

Description: The NYFC is a network of young farmers and ranchers in the United States who are advocating for land and agricultural reform in order to be able to support agrifood systems transformation. Founded in 2009, the network addresses various topics including land access, climate change, immigration and labour conditions, and agriculturists' mental health. Through their online platform, they inform audiences of their own policy agendas and the campaigns that they are running to influence policy. The platform allows people to easily engage in these campaigns, support bills to influence legislation and more contact policymakers.

Outcomes: Through their initiative and digital platform, the NYFC has been able to launch several campaigns to influence policy and share the stories of young farmers (e.g. in the context of climate change developments).

Beyond initiatives that have made use of ICTs as a part of virtual meetings and web-based platforms to gather opinions from youth to shape decision-making processes, various organizations and actors use social media to influence young people to take part in decision-making processes such as general elections. This includes the NYFC, which uses its Instagram account (@youngfarmers) to encourage youth to engage with their regional Congress representatives, and the Slow Food Youth Network (Slow Food Youth Network, no date). The Slow Food Youth Network is an initiative connecting young people around the world to address agrifood systems challenges. The Slow Food Youth Network also uses its Instagram account (@slowfoodyouthnetwork) to encourage its audiences to vote in elections, such as those of the European Parliament, to influence the transformation of our agrifood systems.

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Chapter 4.

Perspectives on digital technologies for youth engagement from members of the Young Scientists Group and Youth Policy Board

In prior sections, this report described the ways in which digital technologies can play a role in youth engagement toward agrifood systems transformation, highlighted through various case study examples. However, in describing these roles in the context of agrifood systems transformation, it is important to integrate further youth perspectives, including in relation to (1) using technologies, (2) the processes of developing technologies, (3) if and how digital technologies have encouraged engagement and (4) using digital technologies specifically to engage in decision-making processes or to engage other youth in decision-making processes. To do this, the YSG collected the perspectives of its members and those of the Youth Policy Board (YPB) of the WFF using a questionnaire (Newing, 2010). The questionnaire was disseminated online and collected heterogenous voices from youth who come from various geographic regions, and who hold differing professional and educational backgrounds. In total, 15 responses were received. In the following subsections, each respondent is referred to with the reference "QT".

Regardless of the age range, field of expertise, regional context or gender, several common aspects related to the digital technologies used and practical implications of digital technology use, were described by the respondents. More specifically, commonalities included perceived benefits of digital technologies and the challenges faced when using or designing them, the sources of inspiration and purposes for using or developing them, and suggested improvements for the future development of digital technologies. However, from the responses it was identified that different experiences of digital technologies may come about due to, for example, differing infrastructural realities and accessibility to digital technologies.

4.1. Digital technology use in youth-led entrepreneurial endeavours and research

Data analysis tools and software were commonly referred to as the main digital technologies used to collect, analyze and disseminate data in youth-led entrepreneurial endeavours and research. Databases, digital platforms and digital media were also used for training, communication or dissemination purposes.

> *"I find that digital technologies are still integral to how I engage with the agrifood system, including data collection software, outreach tools and methodological tools for my research." [QT9]*

AI tools were also mentioned by some members, who use this type of digital technology for data analysis and the modelling of complex agrifood systems questions.

> *"Data analytics and AI have enabled us to analyze large sets of agricultural data to identify trends, predict outcomes, and make informed decisions, which has been crucial in improving crop yields and developing effective bee feed technologies." [QT5]*

> *"The use of AI enables us to uncover patterns and relationships that cannot be detected with classical statistics alone." [QT11]*

To a lesser extent, other tools cited were remote sensing technologies for research purposes. Furthermore, social media and other digital mediums were used for different purposes such as dissemination, training, advocacy, or branding and promotion of activities.

> *"We use projectors and locally produced digital videos to train farmers in remote areas about sustainable land management practices that they can implement on their degraded lands." [QT2]*

> *"It allows for a wider audience reach through social media platforms, blogs and websites, increasing the visibility and impact of research findings." [QT6]*

Amongst questionnaire respondents, research was one of main reasons for the use of digital technologies in the context of agrifood system transformation initiatives.

> *"I mainly utilize these technologies to create models for predicting scenarios and to carry out pattern recognition." [QT11]*

> *"Thanks to the use of digital technologies (remote sensing, lidar) we are able to get more precise data on our environments to be used as input for specific ecological models capable of assessing ecosystem services; to massively capture data in different time/space scale." [QT7]*

Additionally, communication and engagement were cited as reasons for digital technology use. Respondents mentioned utilizing online platforms to disseminate scientific research to broader audiences including youth and children. Digital platforms like blogs were also highlighted for advocacy and research purposes.

> *"We have actively disseminated our research [...] by hosting online discussions over the past four years, reaching approximately 5,000 people (including youth and women). Additionally, we conduct online questionnaires to collect data for research related to sustainable agri-food systems and rural development." [QT6]*

> *"For advocacy I use either the printed newspaper articles or blogging on websites." [QT12]*

With regards to the challenges faced when using digital technologies, inequitable access to digital technologies was experienced when collaborating with stakeholders in different regions. This includes access to infrastructure that supports the use of digital technologies and addresses training gaps. Researchers have also faced challenges implementing projects that include digital technologies in rural regions or contexts where baseline technology coverage and adoption is low. This was particularly a prominent challenge for projects conducted in rural areas, which involved farmers and fishers and/or which took place in countries or regions without sufficient infrastructural investment to support digital technology use.

> *"One of the primary issues is the low internet connectivity in my home country, which can pose a barrier to implementing innovations that require internet access." [QT2]*

> *"Many farmers and beekeepers have limited experience with digital tools, making it challenging to introduce and implement new technologies." [QT5]*

Lack of knowledge and training support was often described as another barrier towards the use of digital technologies within the context of agrifood systems by respondents. This was often linked to limited access to training and knowledge resources, as well as the technical complexity of some digital tools.

> *"Lack of knowledge from stakeholders, difficulties in calibration, high costs." [QT7]*

> *"Sophisticated training and the high level of skills needed remain a challenge." [QT10]*

> *"Educational/Skills gap in using certain computer-based programmes or apps for research activities are a key barrier to their use." [QT15]*

The financial cost of some technologies was also perceived as a barrier towards their use.

Additionally, in some cases, there were barriers to the effective use of digital technologies due factors such as the lack of data availability to conduct analysis.

> *"From my scientific activities, the main problem lies in the scarcity of data, which hinders our ability to make robust causal inferences. For example, the lack of on-site land restoration data in many African countries, or the absence of long-term food insecurity data series in certain African regions, forces us to depend solely on satellite images, and often incomplete food insecurity data sets. This limitation affects our ability to conduct comprehensive analyses on the impact of land restoration on food insecurity in these areas." [QT2]*

When asked about the benefits of digital technologies in the context of agrifood systems, the main advantage described is their ability to allow for the broader connection and reach of information and persons – making information more accessible. Additionally, digital technologies have increased the efficiency of conducting tasks, in particular those related to analysing complex data and collecting data in underserved areas.

> *"Digital technologies boost our efficiency and enable us to carry out activities that would be unfeasible in remote rural areas of Africa." [QT2]*

> *"Digital platforms expand the reach of researchers, allowing them to gather data from diverse and remote populations." [QT6]*

> *"Digital tools enable more visibility and convincing outcomes to [the] general public." [QT10]*

Other benefits identified by some respondents were associated with how digital technologies present collaboration opportunities through connectivity.

> *"They allow me to work virtually, stay connected with my family and friends and streamline my work." [QT3]*

> *"In terms of communication, digital technology provides instant connectivity through tools like email, instant messaging and video conferencing, bridging the gap between team members, stakeholders and participants regardless of their locations." [QT6]*

Some of the main improvements that respondents would like to see in relation to the digital technologies that they use were associated with increasing their accessibility to additional persons and communities, together with expanding and improving surrounding infrastructure to support their use. This includes the provision of financial support to reduce the costs of digital technologies amongst youth involved in agrifood systems research and rural farmers.

> *"Affordable smartphones and devices, along with subsidies or grants, would enable farmers to invest in these technologies without financial strain." [QT5]*

> *"More enabling environment to support digital technologies to thrive in LMICs [lower-middle-income countries] – power and connectivity issues, funding youth to acquire or develop innovative technologies. And increased integration in research training." [QT8]*

Additionally, it was expressed that there was a need to increase training toward the use of digital technologies and to adapt digital technologies for different cultural contexts to make them more accessible.

> *"Localized content in multiple languages and culturally relevant information would ensure the tools meet the specific needs of different communities." [QT5]*

> *"I would like to access more AI materials and courses related to health in my native language, suitable for different levels of expertise." [QT11]*

4.2. Experiences from developing digital technologies for agrifood systems transformation

Regarding digital technologies developed amongst respondents, these were either digital platforms, webpages or databases, or mobile phone applications. The main reasons for their development were the desire or need to address agrifood systems challenges, to promote communication and engagement activities, and to educate others.

> *"In 2017, my friends and I developed a prototype for a digital agricultural advisor [...] focusing on sustainable land management measures. This Android mobile application encompasses various local techniques for sustainable land management and climate change adaptation. These techniques are illustrated in the mobile app with pictures from model farms, graphical descriptions of their conception process and audio descriptions in local languages." [QT2]*

> *"We are developing a 'map of flavours' for sustainable gastro-tourism [...]" [QT4]*

> *"I developed an online tool (webpage) available for local farmers, aimed at quantifying the input and the impact on environment [...]" [QT7]*

> *"I developed a mobile application for adolescent nutrition education, co-developed an opensource platform to strengthen community of practice in nutrition and food system professional community [...]" [QT8]*

> *"The professional community platform was co-developed to strengthen the research competencies of African early career food and nutrition professionals which was grossly lacking." [QT8]*

It was described how findings from existing literature and research, together with collaborations and partnerships, contributed with inspiration and support toward the development of digital technologies. Furthermore, targeted innovation and research calls and proposals also helped shape this development.

> *"We had already been conducting these training sessions on the ground using physical papers, images and videos. We decided to develop the mobile app, with the aim of disseminating this knowledge more widely." [QT2]*

> *"Collaboration was key to the process as I identified or was invited by other experts or to support the co-creation and contribute." [QT8]*

> *"The partnership with the IT department of my university was key for me." [QT7]*

> *"The project was initiated by us without any initial capital. We did achieve some success in competitions, pitched the idea and presented the prototype at some international ICT4Ag [information and communication technologies for agriculture] events." [QT2]*

However, our respondents also faced challenges in their development processes, whereby the lack of financial capital and support was one of the main reasons mentioned. In some cases, this was the reason for the discontinuation of the development of certain digital technologies. Other types of constraints included lack of knowledge to further technological development and insufficient human resources (e.g. time).

> *"Our attempts to secure funding were unsuccessful. Ultimately, due to other professional commitments, we had to abandon the project. [...] The barriers faced include the lack of seed funds and the need (for us) to find alternative means of income in a country where digital technology has not yet gained widespread acceptance." [QT2]*

On this note, the respondents suggest digital technology development in their cases could have been improved with further support and engagement from stakeholders and investors. Additionally, it is pointed out how digital technologies need to be designed and adapted according to market and societal needs, to ensure their applicability and uptake.

> *"Certainly, consider exploring different financing strategies, such as crowdfunding, or establishing collaborations with development organizations that focus on providing agricultural guidance to farmers." [QT2]*

> *"Ensure that there is a great interest in the stakeholder´s recognizing the value and need to develop or integrate these technologies, that to me is the decisive factor." [QT8]*

As main takeaways from their experiences, the respondents suggested that there is value in building on existing digital technologies rather than developing completely new tools, as well as ensuring simplicity of the tools developed.

"Collaborate, rather than create a new technology, liaise to contribute to developing/ expanding existing technologies, channel more efforts into arousing interest in the use of these technologies than the development." [QT8]

"A small and quick tool can be very effective! We do not need such complicated structures to have effects on farmers." [QT7]

"If we want to implement radical solutions to the agrifood systems problems, we need to think outside schemes and silos." [QT4]

4.3. The role of digital technologies in encouraging youth to engage in agrifood systems

Through the questionnaire the YSG investigated if the availability or opportunity to use certain digital technologies had attracted members to take on their current roles or activities to contribute to agrifood systems transformation. The main tools that incentivized respondents' engagement included AI, mobile phone apps, data and analytics programmes, and web-based services and platforms.

"These technologies have been instrumental in our efforts to support millet cultivation and create awareness among farmers. Mobile apps and data analytics have enabled us to provide farmers with real-time information on best practices, weather forecasts and market prices, which has significantly improved their crop management and yields. This has made millet cultivation more efficient and profitable, encouraging more farmers to adopt sustainable farming practices." [QT5]

The main factors underlying this attraction were an interest in or inspiration of digital technologies and their potential, the opportunities they can provide toward increasing efficiency in the undertaking of tasks, as well as the opportunities digital technologies provide towards encouraging and enabling collaborations that may be of a multi-stakeholder and multi-cultural nature.

"Certainly, consider exploring different financing strategies, such as crowdfunding, or establishing collaborations with development organizations that focus on providing agricultural guidance to farmers." [QT2]

"Digital technology has transformed the way research collaboration works, ...[increasing the] ability to co-create research in a collaborative digital environment, as well as garner[ing] youth and other stakeholders; It made it easy to collaborate together with people from different locations, [there was] less burden as some tedious data collection and analysis process are made light with digital technology [...]" [QT8]

"I was excited by the promise of technology in general for engaging in the food system. It was the digitization of agriculture that first inspired me – particularly precision agriculture innovations like big data to improve farm-level decision-making. Today, I find that digital technologies are still integral to how I engage with the food system, including data collection software, outreach tools, and methodological tools for my research." [QT9]

4.4. The use of digital technologies for decision-making or to encourage decision-making

When engaging with decision-making processes and activities, the main tools used and described among respondents were mobile apps, communication tools and web-based tools that facilitate the sharing of information. Some respondents had also led or contributed to initiatives that encourage youth to take part in decision-making for shaping agrifood systems transformation, and which use digital platforms and tools to support this engagement. In relation to using digital technologies in these contexts, the key benefits reported related to how digital technologies allow for broad and diverse audiences to be reached and engaged.

> *"I have partaken in UN consultancy sessions on Zoom. I also conducted key informant interviews with Member State representatives to understand needs and priorities in agrifood systems transformation when I worked with FAO. This information was an important component of the Regional Overview of Food Security and Nutrition report, which is to be launched." [QT3]*

> *"I have used digital video call tools (webcam, microphone and speaker on my computer) and internet-based call functions to take part in virtual meetings such as [...] UNFSS dialogues to share my thoughts on agrifood systems transformation. Additionally, I have helped host UNFSS dialogues for people to share their thoughts on agrifood systems transformation to shape regional and national commitments to this process." [QT15]*

To a lesser extent, other benefits described were the cost-effectiveness of using the tools, together with their functionality and potential user-friendliness.

> *"Polls on Instagram can engage youth and spark interesting discussion on and offline." [QT4]*

> *"I think it made it easier to be able to host more persons from various regions to take part in these processes to shape decision-making processes (who would have potentially otherwise been left out of the process due to us not being able to accommodate them or them not being able to physically attend in-person). In the same way when I have used these tools – it has sometimes facilitated my own engagement due to being able to access these meetings from anywhere as long as I have sufficient internet connection." [QT15]*

When discussing challenges faced in using the digital tools, the main factors were associated with the inaccessibility of technologies, insufficient infrastructural support for their efficient use and lack of knowledge in how to use the tools. More so, digital technologies may not necessarily ensure that persons are included in decision-making processes if other persons do not have access to these technologies. Additionally, barriers to inclusion may be attributed to the lack of relationships between different actors, but also societal inequalities and power imbalances.

> *"Access is such an obvious issue. I don't experience it, but most voices (e.g. young farmers in rural regions) are unable to partake in these conversations." [QT4]*

> *"Despite hosting virtual meetings these do not necessarily solve all issues related to inclusivity as some persons may not have access to digital tools to attend virtual calls or skill sets to use them. [...] Whilst digital technologies are a tool which can facilitate more open and inclusive decision-making processes, they are not the only solution toward supporting this. Indeed, persons who do not have access to digital technologies or do not have the skills to use them would still not be able to take part in e.g. virtual meetings - and they also do not determine who gets a seat at the table (unless the meetings are open to all). Furthermore, I feel virtual meetings can sometimes make interactions between persons less natural, whereby in-person meetings can more fully support more organic social interactions between persons by allowing persons to read off social cues and body language at times." [QT15]*

Another challenge perceived in using digital technologies to engage youth in decision-making processes is that of low engagement when using digital platforms or virtual meetings, in comparison to in-person meetings.

> *"Sometimes there is low motivation and poor participation when engaging youth virtually than [when engaging] in physical activities, power and internet [are obstacles] as well." [QT8]*

> *"[...] Virtual calls may not support the natural flow of conversation and interaction which in-person meetings can (however, this is subjective)." [QT15]*


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Chapter 5.

Conclusion and recommendations

To conclude, this report has discussed the role digital technologies can play toward youth engagement for agrifood systems transformation through a multidimensional approach. The report has presented case studies which highlight how digital technologies in the context of agrifood systems transformation, (1) have been used by youth as part of research and entrepreneurial activities, (2) have been developed by youth, (3) could potentially attract youth towards engaging in initiatives, and (4) have been used by youth, and to engage youth, in decision-making processes. In drawing on the perspectives from YSG and YPB members, the report showcases how various digital technologies have allowed youth to engage in agrifood systems transformation initiatives. In using digital technologies for purposes such as research and advocacy, YSG and YPB members experienced benefits such as being able to reach broader audiences, increased accessibility of information, efficiency when undertaking tasks, and networking and collaboration opportunities. In terms of decision-making processes, YSG and YPB members similarly described how more people could be reached with the use of digital technologies.

However, in using digital technologies, both the findings from literature and our survey report that there are challenges related to the accessibility of digital technologies by youth and other actors connected to youth. This challenge is especially felt in remote or underserved areas, together with issues pertaining to the digital divide. These include infrastructural limitations and limited investments in technology and training. Survey respondents describe how knowledge and training gaps remain a challenge for them in using certain digital technologies themselves, as well as for some of their contacts and/or collaborators. In the context of decision-making processes, whilst digital technologies may allow for a broader group of persons to be reached, they do not necessarily ensure inclusivity in these processes.

Regarding developing digital technologies, the perspectives of survey respondents reflect viewpoints shared in the literature of difficulties in accessing financial capital and support.

Based on the findings from this report, it is evident that there is a need for research and policies which support the promotion of benefits from digital technologies for youth engagement in agrifood systems transformation, while addressing highlighted limitations. Consensus was reached by the YSG on eight action-oriented recommendations to enhance the use and benefits of digital technologies for multidimensional youth engagement in agrifood systems transformation.

Eight recommendations

Increasing equitable access to digital technologies

1. **Increase access to digital tools** amongst rural youth and youth in underserved areas through investments in broadband and mobile network infrastructure (particularly in rural areas). Such investments should ensure reliable internet access for youth engaged in agrifood systems (Townsend *et al.*, 2023).

2. **Make digital tools more affordable** by implementing subsidies. By making digital services and tools more affordable for youth and rural farmers this will reduce financial barriers toward their use. Additionally, subsidies should be provided to low-income households to access internet services. (S4YE, 2021).

Building capacities for digital skills and training

3. **Institutionalize long-term digital capacity-building among youth in agrifood systems,** through comprehensive support structures such as mentoring, coaching and technical assistance processes. These support initiatives should be implemented through existing community structures (like agricultural producer groups and cooperatives) to expand awareness of digital tools and ensure inclusivity (USAID, 2022).

4. **Tailor digital literacy training to target audiences** by addressing context-specific challenges (such as low connectivity, low literacy or numeracy levels). There is a need to develop localized, culturally relevant training materials and resources in multiple languages to ensure that digital tools meet the specific needs of different communities (USAID, 2022).

Enhance youth engagement and inclusivity in decision-making processes which use digital technologies

5. **Engage regional and international organizations,** including UN agencies, to enable youth to engage in virtual decision-making spaces. Provide youth in agrifood systems training on digital platforms to ensure all voices (especially those with limited access to technology) can effectively engage in digital forums.

6. **Mitigate risks associated with digital technologies** when used by youth, including lack of data privacy, exclusion of low-income individuals, potential job losses and cybersecurity breaches (UN DESA, 2023).

Encourage youth into agrifood systems transformation initiatives involving digital technologies

7. **Expand the evidence base of how factors related to digital technologies attract youth to agrifood systems** sectors and initiatives. This can be achieved by capturing diverse youth perspectives through interviews and ethnographic studies, as demonstrated by Tauzie *et al.* (2024).

8. **Encourage youth-led innovation involving digital technologies** by providing access to financial, e.g. microgrants, and social capital, e.g. mentorship, among youth. Youth disproportionately have lower access to these resources (Green, 2013).

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Glossary of key terms

Agrifood systems

Systems that comprise the entire range of actors and interlinked activities that add value in agricultural production and related off-farm activities such as food storage, aggregation, post-harvest handling, transportation, processing, distribution, marketing, disposal and consumption (FAO, 2023).

Digital technologies

A wide array of devices which process, store and transfer digital data such as sensors, robotics, and Big Data analytics platforms (Duncan *et al.*, 2021), which process, store and transmit information in a digital, i.e. binary, format (zeroes and ones) (Pullen *et al.*, 2009).

Technology for sustainable agrifood systems

Tools for delivering products and/or services that enhance the sustainability of agrifood systems and improve agricultural productivity, nutrition and livelihoods. They entail the application of science and knowledge to develop techniques to deliver a product and/or service that enhances the sustainability of agrifood systems (Alexandrova-Stefanova *et al.*, 2023).

Youth

A group of persons generally between the ages of 15 and 35 (African Union, 2006; UNESCO, 2019), and undergoing a transition from childhood into adulthood (Glover and Sumberg, 2020).

Youth engagement

The process that empowers and enables youth to understand, realize and claim their rights (UNESCO, 2019).

Appendix A: Questionnaire

Short questionnaire to gather lived experiences with digital technologies

Aim

To bring further light to the question of youth perspectives in the context of agrifood systems transformation on different aspects, representing heterogenous voices from various geographic regions and professional and educational backgrounds.

Instructions

The questions are open-ended, and are structured according to four main perspectives in the context of agrifood systems transformation:

(1) the use of digital technologies by youth in projects or activities;

(2) how to develop digital technologies for agrifood systems transformation;

(3) how digital technologies may have encouraged engagement in projects or activities; and

(4) the use of digital technologies for decision-making or that have encouraged decision-making

Members of the YSG and YPB of the WFF can provide their views and experience to one or more of the questions, answering only the ones that apply to their lived experiences.

Questionnaire

General demographic information.

What are the digital technologies you use in your projects and activities for agrifood systems transformation?

What do you use the digital technologies you mentioned in the previous question for in your projects and activities?

Which issues do you face when using digital technology in your projects and activities?

What benefits do you experience when using digital technology?

What improvements easing the use of digital technology in your projects and activities would you like to see in the future?

(1) Digital technology use in youth-led entrepreneurial endeavours and research.

What are the digital technologies you use in your projects and activities for agrifood systems transformation?

What do you use the digital technologies you mentioned in the previous question for in your projects and activities?

Which issues do you face when using digital technology in your projects and activities?

What benefits do you experience when using digital technology?

What improvements easing the use of digital technology in your projects and activities would you like to see in the future?

(2) Experiences from developing digital technologies for agrifood systems transformation.

Have you developed digital technology(ies) in the context of contributing to agrifood systems transformation? If yes, describe what is this digital technology(ies)?

How and why did you decide to develop digital technologies?

What were your sources of inspiration for developing this digital technology?

What resources (e.g., mentorship, capital, etc.) facilitated your process toward developing your digital technology?

What are the barriers to developing your digital technology?

If you were to develop this digital technology again, is there something you would do differently?

What are the key takeaways you learned from developing your digital technology?

(3) Perspectives from youth who have developed digital technologies for agrifood systems transformation.

Did digital technologies encourage you to engage in your roles or projects for agrifood systems transformation?

Why did the available digital technologies encourage you to engage?

Do the digital technologies which may have encouraged you to engage in your agrifood systems transformation project or activities, meet your expectations (e.g. in terms of functionality, ease of use, applicability)?

What digital technologies encouraged your engagement in your project?

(4) The use of digital technologies for decision-making or to encourage decision-making.

Have you used digital tools that engage or encourage youth decision-making for agrifood systems transformation?

What were the benefits you experienced when using digital technologies for decision-making?

Which issues did you face when using digital technology for decision-making?

Have you used digital technologies to encourage or engage other youth in decision-making to shape agrifood systems transformation?

What benefits did you experience in using digital technologies to engage other youth in decision-making?

What challenges did you experience in using digital technologies to engage other youth in decision-making?

Appendix B: Coding methodology for the questionnaire

Coding method

The qualitative research method used was based on thematic analysis, to explore and interpret patterns within the data collected through the short questionnaire. An inductive approach was used, meaning that the thematic analysis was grounded in the qualitative data itself. This approach was chosen to identify patterns and derive key themes and insights solely from the lived experiences of the YSG and YPB members of the WFF, without the constraints of preconceived categories available in the scientific literature.

The research process involved a total of five steps that included the identification, analysis and reporting of patterns (themes) within the data to incorporate in the report.

1. **Data familiarization and coding**
   The data from the short questionnaire was read to note initial ideas, structures and main topics, and to get a deep understanding of the content and context of the dataset. The data set was then systematically coded. The coding process involved identifying features of the data that are interesting or relevant to the four research questions (according to each of the four themes) and labelling the codes into potential themes, providing definitions for each. Five YSG members were involved in this first step, ensuring that no member analysed their own responses.
2. **Search and definition of themes**
   After this initial coding, patterns in the coded data were searched and similar codes were grouped together. These groups formed potential themes. This step was done by one YSG member (leading the data analysis).
3. **Themes revision**
   All identified themes were checked against the dataset to ensure they were supported by the statements made, while they keep the consistency of the dataset. This step involved refining the themes, splitting, combining or discarding them as necessary. This step was done by one YSG member (leading the data analysis) and revised in coordination with two other YSG members involved in the initial coding.
4. **Definition and naming of themes ("code scheme")**
   As the themes were defined, each were further analyzed in the context of the four research questions. This involved determining the essence of each theme and what aspect of the data each theme captures. Based on this, the code scheme was created, according to the structure of each of the four themes (see below). This step was done by one YSG member (leading the data analysis).
5. **Report production**
   The final step involved elaborating and merging the analytic narrative and data extracts, presenting the analysis coherently and insightfully. A description of how they relate to the research questions and existing literature was provided, including data extracts to illustrate each theme. This step was done by one YSG member (leading the data analysis) and revised in coordination with two other YSG members involved in the initial coding.

Code scheme

Theme 1: Digital technology use in youth-led entrepreneurial endeavours and research

Research question: How do youth use digital technologies in projects or activities?

Codes	Sub-codes
Tools	Data analysis tools/software Data bases/platforms Media AI Remote sensing Social media Teaching/Training Advocacy Branding and promotion Research Sensors
Usage	Research Communication and engagement Research/entrepreneurial project Teaching/training Branding and promotion/advocacy/research Management
Challenges	Inequitable access to digital technology Knowledge/training Financial accessibility Resource accessibility Infrastructural challenges Knowledge/training accessibility Technical challenges Plagiarism, piracy or copyright infringement
Benefits	Reach and accessibility of information Efficiency Innovation Accuracy Collaboration Financial benefits User-friendliness
Improvements	Technical accessibility Cultural relevance Equitable access Financial accessibility Infrastructural benefits Tool development Training

Theme 2: Experiences from developing digital technologies for agrifood systems transformation

Research question: How to develop digital technologies for agrifood systems transformation, based on youth's experience?

Codes	Sub-codes
Tools	Platforms/webpages/databases Mobile applications
Purpose	Tool improvement/development Communication and engagement Educational purposes
Inspiration	Research/literature Partnerships/collaborations Own interest Market/society demands Societal challenges/global inequities
Challenges	Lack of financial capital or market opportunities Lack of knowledge sources Infrastructural
Improvements	Stakeholder/investor/market education/marketing Additional inputs/applicabilities Collaborations
Takeaways	No need to reinvent the wheel Value in simplicity Creativity

Theme 3: Perspectives from youth in regards to being encouraged by digital technologies for agrifood systems engagement

Research question: How have digital technologies encouraged youth engagement in projects or activities?

Codes	Sub-codes
Tools used	AI Apps (general) Data programmes and analytics Web-based services and platforms Data analytics Mobile apps and tools for remote use Combinatorial Efficiency Support toward non-digital based activities
Inspiration	Innovation/new approaches Efficiency Collaborative potential Financial Knowledge dissemination
Satisfaction	Encouragement/inspiration Contextual adaptations Knowledge dissemination Impact perceived Accessibility Choice selection Human/analogue factor Impact perceived

Theme 4: The use of digital technologies for decision-making or to encourage decision-making

Research question: How have digital technologies been used for decision-making or to encourage decision-making by youth?

Codes	Sub-codes
Tools	Mobile apps Web-based tools Web-based platforms/databases
Benefits	Reach Cost savings/effective User adapted Functionality
Challenges	Infrastructural Lack of knowledge and training toward use Low engagement Accuracy of information Inequitable access

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