

REVIEW

Open Access



Factors influencing gender and youth integration in agricultural research and innovation in Africa

Mastewal Yami^{1*} , Oyewale Abioye², Sougrynoma Zainatou Sore², Aline Mugisho² and Tahirou Abdoulaye³

Abstract

Integrating gender and youth in Agricultural Research and Innovation (R & I) is important for strengthening the impact and inclusiveness of the research initiatives. The integration is more critical in Africa due to the prevalence of exclusive gender and age norms that undermine the place and role of women and youth in the food systems. The consideration of women and youth as 'helpers' instead of farmers aggravated inequalities in accessing and controlling over land and other resources, opportunities for income and employment, and decision-making processes. Gender and youth integration are also central for achieving equal economic and social outcomes in the agricultural sector. There is increased recognition among the research and development community that effective gender and youth integration in R & I would help increase the adoption of products, services, and processes of R & I. In addition, gender and youth integration helps in the promotion and dissemination of R & I as well as in increasing accessibility of innovation and technology by end users. This study examined current discussions on gender and youth integration across projects with particular emphasis on the Food and Nutrition Security and Sustainable Agriculture (FNSSA) project database. The desk review was supplemented by 30 interviews with key informants in FNSSA projects across Africa including Benin, Democratic Republic of the Congo, Cameroon, Ghana, Madagascar, Nigeria, Kenya, Senegal, Sudan, Togo, and Uganda, and an interactive workshop with key stakeholders working on gender and youth integration issues across Africa. The study used the gender integration continuum conceptual framework, which was spearheaded by the Interagency Gender Working Group (IGWG). This framework was proposed to critically examine the different approaches across the continuum to increase the understanding of how gender integration, or the lack of it, determines the impact of the R & I projects on women and youth. The findings suggest that gender and youth inclusion was primarily project-based and was strongly tied to donor requirements. Meaning, projects that strongly included women and youth were mainly designed to target them as a primary or the only target. Some R & I projects made promising efforts in developing youth and gender-specific work packages as well as action plans outlining the end-to-end engagement of men, women, and youth in R & I. However, there was an imbalance in gender integration vis-à-vis youth integration as youth got little consideration in the R & I policies and practices, thereby reinforcing intergenerational inequality. Factors limiting youth and gender integration in R & I included inadequate gender expertise and competence and women and youth's insufficient access to leadership roles, therefore, limiting their participation at decision-making levels. In conclusion, gender and youth inclusion and participation in R&I requires a holistic approach, one that considers the critical role they can play in innovation scaling. Consequently, there is a need for increased investment in translating the products and processes of R&I interventions

*Correspondence:

Mastewal Yami

mastewalyami@yahoo.com

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

into opportunities for entrepreneurship and employment. Intersectional lens is also needed for meaningful involvement of different community groups in the R&I interventions, and for reducing the different causes of inequalities and marginalization that hamper transformation of Africa's food system. This could be an entry point for increasing the positive impact of R & I projects on livelihoods, gender equality, women's empowerment, and entrepreneurship.

Keywords Gender equality, Inclusiveness, Social norms, Scaling up, Women's empowerment, Youth empowerment

Introduction

The rapid population growth in Sub-Saharan Africa (SSA) has led to increased demand for food (Sakho-Jimbira and Hathie 2020). More than a third of Africa's population is 15–34 years old, and brings both challenges and opportunities to the continent such as increased demand for food, infrastructure, employment and entrepreneurship (FAO 2019; Rocca and Schultes 2020). The COVID-19 crisis also negatively and disproportionately threatened the livelihoods of women and youth (Rafaeli and Hutchinson 2020). Meeting the growing demand for food and entrepreneurship requires raising yields and productivity of the farmlands in a sustainable manner (AGRA 2015). However, low crop productivity hampers efforts to meet the food requirements of the growing population in SSA (Giller 2020). Whether SSA addresses the low productivity problem depends on the pace of Research and Innovation (R & I) for boosting crop productivity and building resilience among small-scale farmers (AGRA, 2021).

In light of this, national agricultural research institutions, development partners, and international research institutions, including the International Institute of Tropical Agriculture (IITA) invested resources in developing innovations for increased crop productivity, including good quality seeds, disease-resistant varieties, and farm management approaches (IITA 2015, 2017; Nyabam et al. 2018). Projects have also been implemented under the FNSSA Roadmap, several projects supporting food and nutrition security in Africa. Evidence shows that the innovations and technologies are often technically effective in increasing crop productivity, reducing rural poverty, and improving livelihoods (Abdoulaye et al. 2018). Yet, the uptake of the innovations and technologies by farmers has been low due to the poor integration of gender and youth issues and socio-cultural constraints (Farnworth et al. 2020). For instance, youth with a low level of education and youth who reside in rural and remote areas have minimal opportunities for entrepreneurship because of problems with accessing land, finance, capacity development efforts near their area, and low access to digital technologies and digital skills (Yami 2021).

There are diverse definitions of innovation across different disciplines. In this study, innovation is understood as a new or significantly improved product (good or service), or process, a new marketing method, or a

new organizational method in business practices, workplace organization or external relations (OECD 2005). Research and Innovation play an essential role in triggering smart and sustainable growth and job creation. Research is central to producing new knowledge, thereby developing new and innovative products, processes, and services, which enable higher productivity, industrial competitiveness, and ultimately prosperity (Edwards-Schachter 2018; Singh and Aggarwal 2021). Research and innovation work crosses borders between science, policy, and society with the purpose of catalyzing changes towards food system transformation (Aline and SDDirect 2017).

Different approaches can be used to realize R & I. For instance, Responsible Research and Innovation (RRI) is an approach that refers to R & I that is ethically acceptable and socially desirable (Von Schomberg 2013). In the context of this study, R & I refer to the process of knowledge creation and its use in developing novel and tangible products, services, and processes supporting food and nutrition security in Africa. Research and innovation are understood as a two-way process in which research leads to innovative solutions to address the problems of food and nutrition security, and the innovations in turn could be inputs for research and/or inventions.

It has emerged that R & I systems that do not take the gender norms, women's agency, and local structures which define access to and control over resources into consideration may end up exacerbating gender inequality (Petesch et al. 2017; Witinok-Huber et al. 2021). Woodhill et al. (2022) showed that a lack of inclusive approaches in R & I systems could lead to elite capture of the emerging opportunities due to their ability to take the risks of adopting new technologies. Among others, Schillo and Robinson (2017) underlined the importance of reducing the negative impact of innovations in aggravating inequality through inclusive approaches. Limited attention to women and youth in R & I systems in turn marginalizes women and youth from taking up opportunities for income, food security, nutrition improvements and entrepreneurship. Such a lack of inclusiveness of youth and women in the design, appropriation, and application of innovative technologies could reduce their access to employment and entrepreneurship opportunities

(Sumberg and Okali (2013), Sumberg et al. (2012), Sumberg et al. (2015)Madgavkar 2019).

Past studies on R & I processes focused on analyzing determinants of adoption and exploring mechanisms for increased adoption through innovation platforms (e.g. Pamuk & Van Rijn 2019; Totin et al. 2020; Wairimu et al. 2021). For instance, Mmbando et al. (2021) analyzed the factors that influence the adoption of improved technologies of mung bean production. The study indicated that household characteristics, including gender and size of household, influenced the adoption of the technology. However, little attention was given to integrate gender and youth issues in R & I for supporting sustainable food systems. The African Union and The European Union (AU-EU) innovation agenda also identified the need for closing the gender gap in R & I by promoting inclusive approaches (AU-EU 2022). Synthesized evidence that shows experiences of gender and youth integration in R & I systems is lacking, thereby limiting our understanding on what makes a gender-responsive R & I system.

This study aims at outlining how the current policies for R & I in FNSSA are described in the AU-EU partnership, including its relation to gender, youth and entrepreneurship, and compare these with recent scientific findings. The study also examines R & I instruments or initiatives could be applied to foster positive impact for women, youth, and entrepreneurship on the ground. Furthermore, the study explores what the main barriers to overcome are, and proposes topics for further research that bring R&I to scale in an inclusive way, taking forward existing successful programs and projects between AU and EU partners.

Conceptual framework

This section outlines the evolution of concepts and practices in gender integration in R & I supporting food and nutrition security in Africa, followed by discussion on the approaches used for youth integration in R & I. The relevance of gender and youth integration for sustainable agricultural systems aligns with international frameworks such as the United Nations Sustainable Development Goals (UN SDG) 5 gender equality, and SDG 10 (reduced inequalities) and the Convention on the Elimination of all forms of Discrimination against Women (CEDAW) that underlines on empowerment of women in social and economic activities. Regional frameworks such as the African Union Solemn Declaration on Gender Equality in Africa (SDGEA) and the Agenda 2063 also emphasizes on the need for gender equality for realizing development in Africa. The past two decades witnessed the shift in the understanding of gender in agricultural research that gender consideration is not just what men and women are assigned to do, rather a cumulation of gendered roles and

responsibilities, agency of men and women, and gender norms. Efforts were accompanied with the application of frameworks such as the Harvard Analytical Framework that helps in identifying the gendered roles and constraints (Ludgate 2016). In addition, methodological tools such as the 'web of institutionalization' which helps in identifying conditions that support the institutionalization of gender in policies and practices were employed in gender mainstreaming (Levy 1996). The tools were of huge importance in understanding the experiences of men and women in social structures and the power relations at different levels, and proposed elements to be considered in developing gender mainstreaming strategies that suit the context (Kanji 2003). Kabeer's framework also enabled analysis of agency, social institutions, and power relations at micro, meso, and macro levels, and in devising mechanisms for addressing constraints for gender transformation (Kabeer 1994; 1995).

Regardless of the efforts, little has changed in the urgency of achieving gender equality and women's empowerment across different dimensions of the agricultural sector (Danielsen et al. 2018). More recently, the research and development communities have realized the need for adopting transformative approaches that aim at addressing the root causes of gender inequality at a structural level (Mullinax et al. 2018; Tavenner and Crane 2022). This approach involves changing the constraining gender norms and discriminatory institutions such as customary institutions that deprive women of their rights to access and use land (Anunobi 2002; Rietveld et al. 2022). The same works for structural constraints that widen the gender gap in accessing knowledge, skills, and information (Croppenstedt et al. 2013). This approach shows a shift from looking at women and men in isolation to addressing the constraints that create and reinforce inequality.

Besides, there has been a long-established tradition of considering gender issues only as concerns of researchers from social science and humanity fields. This tradition, coupled with the negative attitude and the low status given to gender in R & I have also contributed to the low achievements. Even then, efforts have been made in a few national and international agricultural research institutions, such as the Consultative Group on International Agricultural Research (CGIAR) centers in developing strategies for gender and youth integration and in raising awareness on gender among biophysical researchers. For instance, the GENNOVATE Initiative (2014–2018) played instrumental role in understanding gender gaps in R & I and how social norms and agency shape engagement of women, men, and youth in R & I activities (Petesch et al. 2017; Rietveld et al. 2022).

The AU-EU FNSSA initiatives also invested in R & I that respond to the constraints of women and youth in rural areas (e.g. CassavaGMarket 2017). However, the efforts are insufficient considering the extent of the problem and the difficulty in breaking the 'norms' among the research and developing communities. More is needed to reverse the trend of labeling gender as a cross-cutting issue with minimal funding and interest. To be fair, researchers interested in applying a gender-responsive approach were unable to meet their goals due to lack of competence on gender-responsive research among researchers, lack of incentives, and inadequacy of mechanisms supporting gender and youth integration in the R & I.

In a similar way, youth has been a somehow 'forgotten' topic in R & I in agriculture. There was little understanding of youth's contribution to agriculture and how agricultural transformation affects their livelihoods, income, and career aspirations. It is only recently that the 'youth bulge' in Africa alarmed governments and development partners on the urgency to find ways for engaging youth in employment and entrepreneurship for socio-economic development, and ensuring stability in the region (e.g. Anyidoho et al. 2012; Anyanwu 2016; Fox et al. 2020). In this regard, the little attention given to heterogeneous backgrounds and interest of youth, and the use of *'one size fits all'* approaches in targeting youth led to limited outcomes (Yami et al. 2019). It is understood that youth have unique opportunities and challenges in R & I. Yet again, youth differ in gender, location, religion, marital status, educational status, and disability condition, among others, and whether they succeed in R & I could depend on their access to resources, agency, empowerment, and access to opportunities for employment and entrepreneurship.

There is a consensus on the need for consideration of gender and youth issues in R & I in AU-EU FNSSA initiatives and beyond (e.g. Manyire and Apekey 2013; Forsyth et al. 2016; Yami 2021). However, there is considerable variation in the way gender and youth integration is perceived and understood, what drives the interest to do it, and how to do it (Danielsen et al. 2018). For instance, integration of gender and youth in R & I is considered as the donor's interest and as a way of fulfilling the funding requirements in proposal development, and an interest of the leadership body, thereby undermining the follow-up and ownership of the research agenda by the institutions (Najjingo-Mangheni et al. 2017). Such cases point out that efforts towards gender and youth integration could succeed by shifting from a mere indication of interest into adopting the right way of doing it. Increased success in integrating gender and youth was observed in projects

which adopted integration approaches in a continuous process from their design to their rigorous evaluation (Boender et al. 2004).

The approach used for gender and youth integration revealed variation. For instance, gender mainstreaming has been a dominantly used approach by a good number of research and development organizations (e.g. UN 2002; Gurung et al. 2011; Njenga et al. 2011). The approach has been widely adopted and it has led to positive changes in integrating gender and youth issues from planning to evaluation stages. However, the success of gender mainstreaming approach in transforming food systems depends on the extent to which agency, gender relations, and the structural causes of gender equality have been addressed in the interventions (Manyire and Apekey 2013; Kristjanson et al. 2017).

The past decade witnessed increased interest in applying an intersectionality lens such as taking into consideration and understanding how the multiple and compounding effects of factors such as age, religion, educational status, poverty status, and disability conditions in R & I (Tavener and Crane 2019; Cavicchioli et al. 2023). For instance, women with low educational status and live in remote areas are likely to face challenges specific to their context and have different access to opportunities and benefits compared to women with better access to education, services and rural infrastructures (Yami 2021; Yami et al. 2023). Besides, there is increased interest in employing gender transformative approaches which change the livelihoods of men, women, and youth, in a sustainable manner and for impactful projects in food systems (FAO 2019; Rietveld et al. 2022). For instance, inviting husbands and wives to trainings, awareness creation meetings, and other related events has positive impact in ownership of R & I processes and products compared to inviting men alone (Bullock et al. 2022; FAO 2023). Obviously, achieving gender transformation may not be the primary target of all projects in food and nutrition security due to their prioritization in investing time and resources in technical solutions to transforming agriculture and food systems. However, progress can be made when projects make a conscious effort in improving their level of gender and youth integration.

In this study, we used the gender integration continuum conceptual framework (PRB 2017). The framework was spearheaded by the Interagency Gender Working Group (IGWG) to critically examine the different approaches across the continuum with the aim of increased understanding of how gender integration or the lack of determines the impact of the health projects on women and youth (Knowledge SUCCESS project 2020). The framework was adopted by different public,

private and non-profit organizations in other sectors to assess the extent of gender integration across projects and programs (PRB 2017).

The framework has relevance for planning the level of integration to be achieved in a project. It is also commonly used to illustrate the extent to which projects have achieved their targets in gender and their goals towards gender equality (FHI 360 2012; Danielsen et al. 2018). The framework has been helpful in increasing the understanding on the different concepts of gender and shows the gender goals projects can achieve at different levels across the continuum. The framework helps identify how the different projects integrated gender and youth issues across five categories, namely gender blind, genderaware, gender exploitative, gender accommodative, and gender transformative (Fig. 1).

The framework starts by checking whether a project is ‘gender blind’ and makes project staff see where they are in gender integration. This way, the framework helps them to explore possibilities to move to the next levels and increase the impact of their work. In fact, where a project falls across a gender integration continuum could vary depending on the nature of the project, the availability of funding, and whether the staff have the required skills and are equipped to support gender and youth integration. The framework classifies the projects into five

different categories based on how the projects respond to gender and youth issues. Projects will be identified whether they are gender blind (i.e. ignores gender consideration), genderaware, seek to exploit, accommodate, or transform constraining gender norms and structures (FHI 360 2012). Once more, the relevance of the framework in enabling gender and youth in R & I activities has been recognized in the CGIAR, among others (Rietveld et al. 2020; Pyburn & van Eerdewijk 2021).

Methods

The study involves literature review and key informant interviews to gather data on the extent of gender and youth integration in R & I systems of projects aiming at increasing food and nutrition security in Africa. The review is based on published literature on integration in R & I for increased impact of the initiatives in enhancing food security, nutrition security and entrepreneurship. The review also applied a gender lens on the LEAP-4FNSSA projects documents, reports, publications, and communication materials with the goal of determining the extent of gender and youth consideration in R & I. In addition, repositories of key organizations working on women and youth in agriculture such as the International Fund for Agricultural Development (IFAD), the World Bank, The International Centre for Research on Women

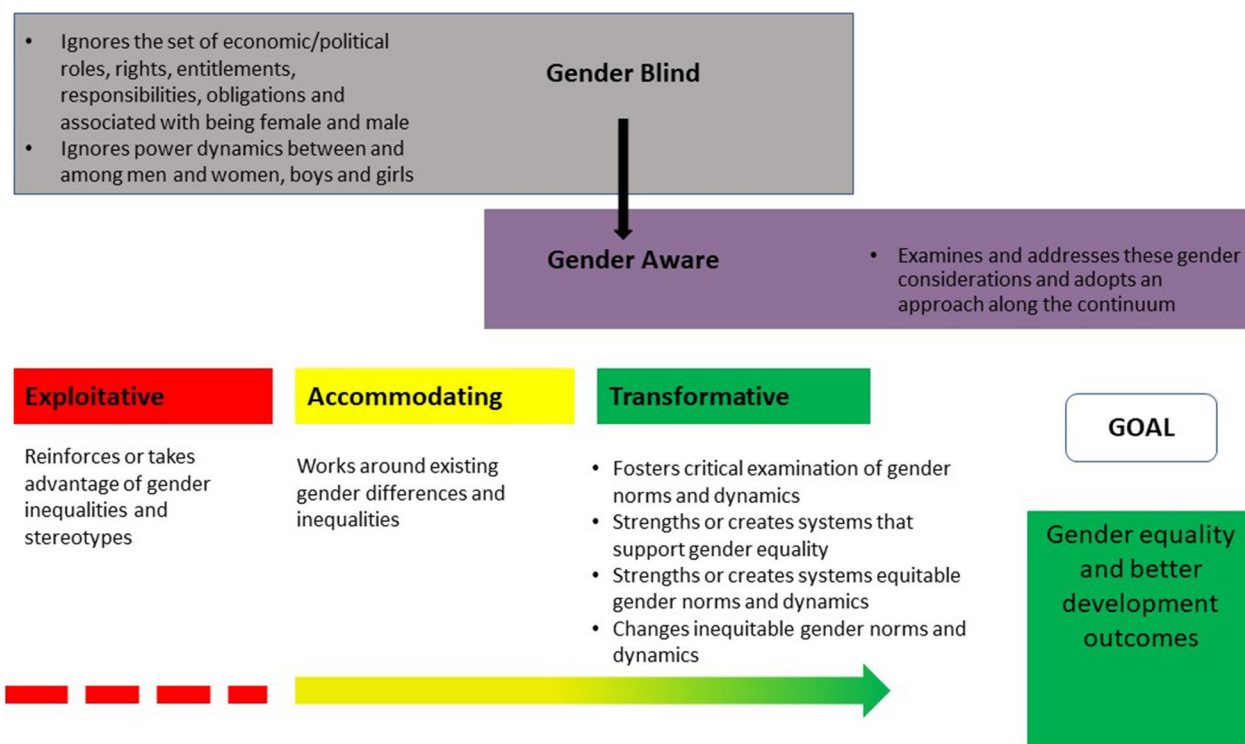


Fig. 1 Illustration of the gender equality continuum framework (Source: PRB, 2017)

(ICRW) were also consulted to gather statistical data and information on gender differences in food security, nutrition security, and entrepreneurship.

The key achievements, challenges, opportunities, and lessons learned from past initiatives on integrating gender and youth issues were documented. The desk review also included scientific databases such as science direct and google scholar to synthesize the recent scientific evidence on gender and youth integration in initiatives towards sustainable agriculture. Keywords including 'gender', 'innovations', 'research', 'food security', 'nutrition security', 'Africa', 'youth', 'young men', 'young women', 'youth-led businesses', 'youth innovations', 'self-employment', 'entrepreneurship', 'scaling up', 'dissemination', 'profitable value chains', 'agribusiness', 'agricultural enterprises', 'access to resources', 'innovative platforms', 'youth platforms', 'agricultural market information', 'gender equality', 'gender norms', 'agency', 'women empowerment', 'inclusiveness', 'social norms', 'exclusion', 'gender-based discrimination', 'decision-making processes', 'youth inclusive policy', and 'gender responsive policy' were used to search for literature. The initial search resulted in more than 300 documents. Screening was done to exclude documents that do not target R & I issues in FNSSA and documents that have no relevance to address the study objectives. Then, more than 60 documents from the FNSSA project database (https://library.wur.nl/WebQuery/leap4fnssa-projects?record-status=complete&wq_srt_desc=leap4fnssa/@isn) and other scientific databases were included in the review.

The desk review was supplemented with key informant interviews. Purposive sampling technique was employed to identify participants with first-hand experience on the LEAP4FNSSA projects and beyond. Semi-structured questionnaires with open and close-ended questions were used to interview 30 key informants engaged in FNSSA projects across Africa including Benin, Democratic Republic of the Congo, Cameroon, Ghana, Madagascar, Nigeria, Kenya, Senegal, Sudan, Togo, and Uganda using virtual platforms. The key informant interviews focused on opportunities and challenges for gender responsive and youth friendly R & I for supporting food security, nutrition improvement, and entrepreneurship. The data from literature review and key informant interviews were analyzed using deductive coding approach based on key themes such as innovation, research, gender equality, women's empowerment, youth inclusion and entrepreneurship. Instruments for gender and youth integration were also recommended based on the literature and key informant interviews. and A stakeholder workshop was held to gather feedback on the key findings on 13th September, 2022 in Accra, Ghana with more than 36 participants from government representatives,

academia, NGOs, civil society organizations, private sector, national, regional, and international agricultural research institutions.

Results and discussion

Continuum of gender and youth integration policies and practice in LEAP4FNSSA projects

Results revealed that the LEAP4FNSSA projects attempted to integrate gender and youth in the R & I process with different levels of emphasis. The most common practice has been identifying their target population and characterizing the target population based on basic demographic data. For instance, Africa-Milk project integrated gender by identifying gender issues in a baseline assessment (Key informant interview 2, July 2022; Table 1). Similar efforts were made by the project on Enhancing nutritional quality of plantain food products through improved access to endophyte primed and high pro-vitamin A plantain cultivars under integrated soil fertility management practices in Nigeria, Cameroon, and Gabon project. The project considered sociodemographic data including sex, age, number of women and children under 5 years old, details on income and expenses, energy sources and water supply. By doing so, the projects had the opportunity to recognize the status of women and youth in comparison to the wider population. The baseline data could also help monitor how the R & I process contributed to addressing the different needs and priorities of men, women, and youth. Besides, a good number of projects have gender inclusion criteria and targets. The above-mentioned activities showed gender aware and gender accommodative levels of gender and youth integration (Fig. 1).

Promising efforts were made by some projects in developing a gender action plan which outlines how men, women, and youth engage in the R & I from the beginning. The action plan helps in ensuring the consideration of gender and youth with adequate allocation of time and budget for the activities. For instance, the Innovations in Technology, Institutional and Extension Approaches towards Sustainable Agriculture and enhanced Food and Nutrition Security in Africa INNOVAFRICA (<http://innovafrica.eu/>) project had a gender action plan that aimed at identifying the gendered access and constraints in the agricultural systems in the target countries. For instance, the project employed the Harvard Analytical Framework for analyzing the gendered roles in a community with the aim of tailoring the project activities to the specific interests of men and women across different production systems (Ludgate 2016). Besides, the project mainstreamed gender and youth as a cross cutting issue across the different thematic areas. Such efforts have pertinent contribution in developing messages and

Table 1 A summary of factors influencing gender and youth integration in R & I activities

Mechanisms	Extent of use	Results from using the mechanisms
Sex- and age disaggregated data and gender analysis in baseline surveys, and in monitoring and evaluation	****	Identification of the status of women and youth in comparison to the wider population; Enabling monitoring of progress on gender and youth integration in R & I
Setting clear gender inclusion criteria and targets	***	Target groups engaged in activities and processes
Developing a gender action plan	**	Continuous integration of gender and youth issues in a project cycle, Increased accountability in implementation of gender and youth activities in the R & I
Analysis of gendered roles in a community	***	Tailoring of project activities to the specific interests of men and women
Mainstreaming gender and youth in thematic areas	**	Proper targeting communication and packaging of R & I to the needs of specific groups
Developing specific working packages focusing on gender integration	**	Consideration of different influences of structures, social norms, and mobility issues on participation of women and men in R & I
Using inputs of men and women in prioritization of R & I products	**	Socially acceptable R & I products; Gendered preferences considered
Applying intersectional lens to capture heterogeneity of social groups (e.g. Involving FHH, and husband and wife in married households)	*	Increased ownership of R & I activities; socially acceptable R & I products; Increased participation, and consideration of priorities and preferences of marginalized groups
Improving access to resources by women and youth	*	Reduced inequalities among men, women, and youth; Increased opportunities for livelihoods
Building on social networks	**	Improved access to information and knowledge sharing; Easy mobilization of collective action; Increased adoption of R & I process and products;

* Indicates the extent of use of the mechanisms in the projects. Assessment is based on emphasis given to the factors in the interviews

packaging R & I in a way that is suitable and accessible to the needs of men, women and youth. The gender and youth integration revealed accommodative and transformative steps.

The other approach was development of specific working packages focusing on gender integration. For instance, the Cassava Growth Markets (CassavaGMarket) project devoted a separate work package on gender issues and assigned the relevant expertise and resources to realize gender outcomes in improving the livelihoods of smallholder cassava farmers through better access to growth markets (CassavaGMarket 2017). This approach helped in understanding the roles and responsibilities of men and women in the production and marketing of cassava. The approach played an important role in showing how the market improvements affect men and women differently. The working package on gender also reflected on how the improved cassava value chains may influence the gender norms, women's agency, workload, degree of control over income, and joint decision-making. It also integrates differences in men and women's participation and mobilities within the community to enabling gender transformative approaches in R & I.

Projects also considered inputs of men and women in determining the priorities for technology development such as in crop variety improvements. In this regard, efforts were also made in the consideration of

the socio-cultural constraints affecting women's choice of technologies and innovations and the ways men and women interact with and benefit from the R & I process. For instance, gender norms and household relations determined whether women benefit from commercialization of cassava in Nigeria and Malawi (Forsythe et al. 2016). For that reason, R & I interventions in cassava commercialization in Nigeria and Malawi focused on understanding the gender norms and power relations in the target areas with the aim of benefiting women and reducing the risk of conflicts at household level and among members of small and medium enterprises. In the same vein, the projects on cassava and plantain improvements have also put emphasis on the potential impact of the R & I on the gendered division of labor. Such efforts enable women and youth involvement continuously from setting priorities up to impact assessment (Meinzen-Dick et al. 2014). The gender and youth integration exhibited accommodative level with some tendency towards transformative approaches.

By and large, LEAP4FNSSA projects adopted evaluation criteria beyond productivity. The common criteria in R & I process included taste, labor, and time demand for processing the improved varieties, shelf life, and nutrition value. The consideration has great relevance to gender equality. For instance, the project on Improved Orange Fleshed Sweet Potato value chains for food and

nutrition security in Benin, Niger and Nigeria contributed to the efforts in improving the nutrition deficiency in women and young children (Sohindji et al. 2022). Similarly, the evaluation criteria employed by the Enhancing nutritional quality of plantain food products through improved access to endophyte primed and high pro vitamin A plantain cultivars under integrated soil fertility management practices in Nigeria, Cameroon and Gabon project comprise nutritional values in addition to other criteria. The R & I activities fall under gender accommodative categories.

Yet again, the efforts had limitations in enabling representation and active involvement of the heterogeneous groups of stakeholders compared to their shares in the population especially the youth. For instance, the Africa-Milk project attempted to have a gender balance in the dairy innovation platforms by including women and youth representatives in the platform. However, the criteria for having three out of the six platform committees to be women was not implemented as planned due to gender bias toward men in a leadership role among members of the platforms (Key informant interview 2, July 2022). This point aligns with the gender gap identified by the Agricultural Science and Technology Indicators (ASTI) data based on 19 countries in Sub Saharan Africa. The assessment showed a substantial gender gap in agricultural research leadership positions in Africa, and the gender gap in senior science positions as women represented only 24% of all senior level agricultural scientists in 2014 (Beintema 2017). In the same vein, the use of Multi Actor Platforms (MAPs) and other institutional innovations in INNOVAFRICA project helped to involve youth in R & I to a certain extent. For instance, youth challenges in agriculture were identified and discussed in the MAPs. However, the effort was insufficient compared to the multifaceted constraints youth face in participating in the value chains, accessing extension and advisory services, and exploiting employment and entrepreneurship opportunities.

Once more, the extent of gender integration lacked consistency as it may be treated at a project policy level, as cross-cutting issues, in work packages, or may not be mentioned explicitly as a primary focus of R & I. This indicates some variation in the integration. Besides, the imbalance in gender integration vis-à-vis youth integration indicates inadequate rigor and pragmatism in the policies and practices accompanying R & I work supporting food and nutrition security in Africa. It was observed that LEAP4FNSSA projects paid low attention to youth integration compared to gender integration. This situation persists regardless of the growing interest in understanding how rural youth in Africa engage in employment and entrepreneurship in agriculture. Some projects, such

as the Africa-Milk project, however, attempted to integrate youth by involving young men and young women graduate students in the project for capacity development in R & I and to create the space for youth to bring in their concerns to the design and research activities (Key informant interviews 1, 2, 3 & 6, July 2022).

In sum, assessment of the FNSSA projects across the gender equality continuum showed that none of the project activities fall under gender blind and exploitative categories. Very few project activities fall under gender aware because they were limited to gender and youth integration in baseline surveys. Most of the gender and youth integration activities referred to accommodative levels because gender gaps were identified, and mechanisms were put in place to incorporate the preferences of men, women and youth in the products, services, and processes of R & I (Table 1). Some projects activities have led to achieving some transformative levels. For instance, projects that developed a gender action plan and working package and employed continuous gender mainstreaming to evaluate gendered outcomes have contributed to addressing existing inequalities. Projects that engage women and youth in leading scaling up of R & I also addressed the constraining gender norms. The fact that many project activities are in the accommodative category is encouraging and signals positive progress in gender integration in LEAP4FNSSA projects. Even then, the limited number of activities in the gender transformative approaches is concerning, and the evolution of gender integration in R & I across the continuum has been of critical significance for inclusiveness of the R & I interventions. Findings imply the need for investing in gender transformative approaches that have evolved out of gender blind, gender exploitative, gender accommodative, and gender responsive approaches with the aim of tackling the undermining gender norms and structural constraints (Druzca et al. 2020).

Factors influencing gender and youth integration in research and innovation

A wide range of factors influenced the success of gender and youth integration in R & I across LEAP4FNSSA projects. The consideration of gender and youth analysis from the onset to the evaluation stages of the projects has been an enabling factor across projects (Table 1). For instance, crop variety improvements need a prior gender analysis to identify what is considered as men's, women's, or jointly done task in the community and the time and labor requirements of the improved variety (Key informant interviews 1 & 8, July 2022). Among others, Forsythe et al. (2016) found that interventions in cassava market improvements in Nigeria and Malawi may affect market participation of individual farmers differently due

to the gendered access to land, labor, and capital. Similarly, factors including access to productive resources, control over income, labor allocation, and leadership skills influenced whether and how the R & I work of the INNOVAFRICA project contributes to the livelihood's improvement of women (Haug et al. 2019).

The experience of the CassavaGMarket project also emphasized the importance of improving the efficiency and affordability of the flash dryers and drying technologies of cassava were identified as an enabling factor for increased inclusiveness. This factor is critical for the scaling up of R & I to other groups of stakeholders and across different locations. Therefore, making the technologies and innovations accessible and affordable has positive influence on increased adoption and livelihood improvement among men, women, and youth. It was also observed that integrated approaches composed of capacity development, business incubation, mentorship, funding sources and business opportunities enabled successful scaling up of outputs of R & I by youth and women (Key informant interviews 3 & 7, July 2022). In line with this, Blackmore et al. (2022) indicated that women might not have the ability to use the available technologies, information, and services due to the gender gaps in accessing finance and markets. Men, women, and youth have different access to opportunities in the information and services for entrepreneurship attributed to the structural constraints (i.e. formal and informal institutions) and the gender norms that define roles, access to resources and decision making, and mobilities within the community (Yami et al. 2021).

In addition, strengthening the capacity of project staff in coordinating and partner institutions has also played an important role in properly designing and implementing activities targeting women and youth. For instance, deliberate efforts in engaging women and youth as source of information and in scaling up of the technologies at commercial level led to positive outcomes (Key informant interviews 1 & 7, July 2022). Some deliberate efforts were made to engage women and youth in the research team as a way to strengthen the capacities of national agricultural institutions (Key informant interviews 4 & 5, July 2022). Besides, capacity strengthening could be important in enabling active participation of women and youth groups in the downstream value chain activities such as postharvest handling and processing activities (Key informant interviews 5, 7 & 8, July 2022). In this regard, capacity strengthening in skills development and timely access to affordable credits would help women and youth benefit from employment and entrepreneurship opportunities. Capacity strengthening tailored to

the interests and capabilities of women and youth enable scaling up of technologies and innovations at lower costs (Key informant interviews 1 & 8, July 2022). For instance, a key informant explains that:

“Youth and women come in groups or cooperatives, and engage in scaling up. We [the R & I team] provides them the platform to engage. For instance, they learn how to do proper book keeping, and this helps them to be in a good position to access finance from the banks. We made infrastructure for processing available for them. We provide them equipment for high quality cassava processing. We also provide input such as planting materials, chemicals, and even provision of land in some cases for startup business, and supported scaling up of the already established business.” (Interview, key informant, Ibadan, Nigeria, July 2022).

Partnerships that involve multidisciplinary teams, including gender and youth expertise, have relevance for increased integration of youth and women issues (Key informant interviews 2 & 6, July 2022). Multidisciplinary teams could enable an in-depth analysis of employment and entrepreneurship opportunities. The teams also shape how the opportunities may support or discourage gender equality, women's empowerment, and youth participation in agribusiness and entrepreneurship for designing an inclusive R & I process (Key informant interview 5, July 2022). Once more, youth's preference in R & I was associated with the value added to that new technology in terms of reduction of operation costs, reduction of labor, and involving the use of digital tools, among others (Key informant interviews 3 & 4, July 2022). Such partnerships could ensure the inclusiveness of R & I processes by considering the impacts of agricultural technology on men's and women's time use, roles in on-farm and off-farm work, and household and community responsibilities (Meinzen-Dick et al. 2011).

In sum, factors related to the timing and approaches employed in gender and youth integration, the level of interest, competence, and adequacy of the R & I team and partnerships determined the extent of gender and youth integration in FNSSA projects. The presence of expertise, action plan, and specific-working packages contributed to positive results. An integrated approach combining capacity development, business incubation, mentorship, funding and business opportunities has led to positive outcomes compared to isolated interventions. Projects that integrated gender and youth from onset to evaluation stages were more successful compared to others. Success was also determined by whether deliberate efforts were made to integrate gender and youth or not. Moreover, accessibility, affordability, and commerciality

of the R & I products, services, and processes played an important role in enabling scaling up and entrepreneurship by women and youth. Furthermore, consideration of R & I relevance in terms of reduction of operation costs, reduction of labor, and involving the use of digital tools has significance in enhancing the effect of R & I on entrepreneurship.

Conclusions

The paper presents the findings of a literature review and key informant interviews on gender and youth integration in projects aiming at improving food and nutrition security. Findings show that projects attempted to integrate gender and youth in the research and innovation process with different levels of emphasis. The most common practice has been identifying their target population and characterizing the target population based on basic demographic data. A good number of projects also had gender inclusion criteria and targets. Promising efforts were made by some projects in developing specific work packages focusing on gender integration and also a gender action plan which outlines how men, women, and youth engage in research and innovation from the beginning. However, gender integration lacked consistency and there was imbalance in gender integration vis-à-vis youth integration as youth got little consideration in research and innovation policies and practices. Influencing factors include inadequate expertise and competence on gender and youth integration in R & I projects, and limited access of women and youth to leadership in research and innovation. In conclusion, scaling up of the good practices on gender and youth integration across projects, and promoting a separate focus on youth (men and women) entrepreneurship, and on transforming innovations to entrepreneurship, could be entry points for increasing the impact of FNSSA R & I projects on livelihoods, gender equality, women and youth empowerment, and entrepreneurship. Findings imply the need for strategies for communication, capacity development and learning on gender and youth engagement in R & I. Intersectional lens is also needed for meaningful involvement of different community groups in the R&I interventions, and for reducing the different causes of inequalities and marginalization hampering transformation of Africa's food system. This could be an entry point for increasing the positive impact of R & I projects on livelihoods, gender equality, women's empowerment, and entrepreneurship. For the sake of inclusiveness, R & I should address the specific needs of underprivileged and marginalized groups such as women and youth during generation, access, adoption and scaling of technologies and innovations. Consequently, there is a need for increased investment in translating the products and processes of R&I

interventions into opportunities for entrepreneurship and employment. Inclusive R & I also requires institutional gender capacity building in R & I teams for mainstreaming gender and youth dimensions in projects and programs, in procedures, and in the overall governance system, with an accountability framework. Such measures would help in increasing the adoption of products, services, and processes of R & I which are central for enhancing food productivity to meet the food demand of the growing population in Africa and to foster agribusiness development along the value chain, and for empowering women and youth in agriculture.

Acknowledgements

We would like to thank participants of the study for their time, insights, and kind collaboration, and the LEAP4FNSSA project staff across countries for providing literature and other useful information.

Author contributions

MY contributed to conceptualization, data collection and analysis, and development of the draft report. OA contributed to data collection and data entry, write up and review of the report. SZS, AM, and TA contributed to the coordination and facilitation of the study, development of the data collection instruments, and the review of the report.

Data availability

Not applicable.

Declarations

Competing interests

We would like to confirm that there is no competing interests regarding this manuscript.

Author details

¹Independent Researcher, P. O. Box 5689, Addis Ababa, Ethiopia. ²International Institute of Tropical Agriculture (IITA), PMB 5320, Oyo Road, Ibadan 200001, Oyo State, Nigeria. ³International Institute of Tropical Agriculture (IITA), P.O. Box 320, Bamako, Mali.

Received: 21 November 2023 Accepted: 12 January 2024

Published online: 01 February 2024

References

- Abdoulaye T, Wossen T, Awotide B. Impacts of improved maize varieties in Nigeria: ex-post assessment of productivity and welfare outcomes. *Food Security*. 2018;10(2):369–79.
- Aline & SDDirect. Assessing and supporting gender integration in Agriculture and Food Security (AFS) Projects. 2017. <https://idl-bnc-idrc.dspacedirect.org/handle/10625/56992>. Accessed 22 July 2022.
- Alliance for a Green Revolution in Africa AGRA. Africa Agriculture Status Report: Youth in Agriculture in Sub-Saharan Africa. Nairobi, Kenya. Issue No. 3. 2015.
- Alliance for a Green Revolution in Africa (AGRA). Africa Agriculture Status Report. A Decade of Action: Building Sustainable and Resilient Food Systems in Africa (Issue 9). Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA). 2021.
- Anunobi F. Women and development in Africa: from marginalization to gender inequality. *Afr Soc Sci Rev*. 2002;2(2):3.
- Anyanwu JC. Analysis of gender equality in youth employment in Africa. *Afr Dev Rev*. 2016;28(4):397–415.
- Anyidoho NA, Kayuni H, Ndungu J, Leavy J, Sall M, Tadele G, Sumberg J. Young people and policy narratives in sub-Saharan Africa. 2012.

- Beintema NM. An assessment of the gender gap in African agricultural research capacities. *Agri-Gender*. 2017;2(1):1–13. <https://doi.org/10.19268/JGAFS.212017.1>.
- Blackmore I, Ringler C, Meinzen-Dick RS. Gender gaps in agricultural growth and development: Opportunities for improving gender-responsive programming. Washington, DC: International Food Policy Research Institute; 2022.
- Boender C, Santana D, Santillán D, Hardee K, Greene ME, Schuler S. The So What Report: A Look at Whether Integrating a Gender Focus into Programs Makes a Difference to Outcomes. Interagency Gender Working Group Task Force Report (IGWG), Washington. 2004.
- Bullock RM, Yami M, Miriti P. Social dynamics and sustainable intensification in Ethiopia. Nairobi, Kenya: ILRI; 2022.
- Carr S, Roulin A. An exploration of agripreneurship, scope, actors and prospects. *Agenda*. 2016;2063:16.
- CassavaGMarket. Final narrative report (2012–2017). 2017.
- Cavicchioli M, Cole S, Teeken B, Ashby J, Polar V, Kramer B, Yami M, Abdoulaye T. Contextualizing women's and men's trait preferences and choice options in the uptake of breeding products: a framework. Brief. Ibadan, Nigeria: IITA; 2023.
- Croppenstedt A, Goldstein M, Rosas N. Gender and agriculture: inefficiencies, segregation, and low productivity traps. *World Bank Res Obs*. 2013;28(1):79–109.
- Danielsen K, Wong F, McLachlin D, Sarapura S. Typologies of change: gender integration in agriculture & food security research. Amsterdam: KIT Royal Tropical Institute; 2018.
- Druzca K, Tsegaye M, Azage L. Doing research and 'doing gender' in Ethiopia's agricultural research system. *Gend Technol Dev*. 2019;23(1):55–75.
- Edwards-Schachter M. The nature and variety of innovation. *Int J Innov Stud*. 2018;2(2):65–79.
- FAO. The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome: FAO; 2019.
- FAO. The status of women in agrifood systems. Rome: FAO; 2023.
- Farnworth CR, Badstue L, Williams GJ, Tegbaru A, Gaya HIM. Unequal partners: associations between power, agency and benefits among women and men maize farmers in Nigeria. *Gend Technol Dev*. 2020;24(3):271–96.
- FHI 360. Gender Intergration Framework: How to integrate gender in every aspect of our work. 2012.
- Forsythe L, Posthumus H, Martin A. A crop of one's own? Women's experiences of cassava commercialization in Nigeria and Malawi. *J Gend Agric Food Secur*. 2016;1(2):110–28.
- Fox L, Thomas A. Africa's got work to do: a diagnostic of youth employment challenges in Sub-Saharan Africa. *J Afr Econ*. 2016;25:i16–36.
- Fox L, Mader P, Sumberg J, Flynn J, Oosterom M. Africa's youth employment "crisis is actually a missing jobs" crisis. BROOKE SHEARER SERIES Number 9, 2020. https://africaportal.org/wpcontent/uploads/2023/05/Africas_youth_employment-1.pdf.
- Giller KE. The food security conundrum of sub-Saharan Africa. *Glob Food Sec*. 2020;26:100431.
- Gurung B, Ssendiwalwa E, Waithaka M. Influencing change: mainstreaming gender perspectives in agricultural research and development in Eastern and Central Africa. Cali: CIAT Publication; 2011.
- Haug R, Dechassa N, Bloem E. Report on strategies for mainstreaming gender. [INNOVAFRICA]. 2019; 64.
- IITA. (2015). Empowering Novel AgriBusiness-Led Employment for Youth in African Agriculture (ENABLE Youth). An investment program under development with the African Development Bank. Ibadan, Nigeria and Abidjan, Cote d'Ivoire.
- IITA. 50 years of research and development: Serving the African farmers and communities. IITA 2017 Annual Report. Ibadan, Nigeria. IITA. 2017. www.iita.org/annual-reports. Accessed on 27 Jul 2022.
- IITA. Scaling up innovations. IITA 2019 Annual Report. Ibadan, Nigeria. International Institute of Tropical Agriculture (IITA). 2019. www.iita.org/annual-reports. Accessed on 27 Jul 2022.
- Kabeer N. Reversed realities. London: Verso; 1994.
- Kabeer N. Targeting women or transforming institutions? Policy lessons from NGOs' anti-poverty efforts in development in practice 5:2. Oxford: Oxfam GB; 1995.
- Kanji N. "Strategies for mainstreaming gender: Achievements and challenges." Mind the gap: mainstreaming gender and participation in development. London: International Institute for Environment and Development; 2003.
- Kingiri AN. A review of innovation systems framework as a tool for gendering agricultural innovations: exploring gender learning and system empowerment. *J Agric Educ Ext*. 2013;19(5):521–41.
- Knowledge SUCCESS Project. Gender strategy for the knowledge SUCCESS project. Baltimore, MD: Johns Hopkins Center for Communication Programs; 2020.
- Kristjanson P, Bryan E, Bernier Q, Twyman J, Meinzen-Dick R, Kieran C, Doss C. Addressing gender in agricultural research for development in the face of a changing climate: where are we and where should we be going? *Int J Agric Sustain*. 2017;15(5):482–500.
- Levy C. The Process of Institutionalising Gender in Policy and Planning: The "Web" of Institutionalisation, Working Paper No. 74, Development Planning Unit, University College London. 1996.
- Ludgate N. Harvard Analytical Framework. Integrating Gender and Nutrition within Agricultural Extension Services. Info Sheet: Common Gender Analysis Tools (2). 2016.
- Madgavkar A, Manyika J, Krishnan M, Ellingrud K, Yee L, Woetzel J, Balakrishnan S. The future of women at work: transitions in the age of automation. New York: Mckinsey & company; 2019.
- Manyire H, Apekey AD. Mainstreaming gender equality in African agricultural research and development: a study of constraints and opportunities. Accra: Forum for Agricultural Research in Africa (FARA); 2013.
- Meinzen-Dick R, Quisumbing A, Behrman J, Biermayr-Jenzano P, Wilde V, Noordeloos M, Beintema N. Engendering agricultural research, development and extension (Vol. 176). Washington D.C: International Food Policy Research Institute; 2011.
- Meinzen-Dick R, Quisumbing AR, Behrman JA. A system that delivers: integrating gender into agricultural research, development, and extension. In: Quisumbing AR, Meinzen-Dick R, Raney TL, Croppenstedt A, Behrman JA, Peterman A, editors. *Gender in Agriculture*. Dordrecht: Springer; 2014. p. 373–91.
- Mmbando F, Mbeyagala E, Binagwa P, Karimi R, Opie H, Ochieng J, Nair RM. Adoption of improved mungbean production technologies in selected East African countries. *Agriculture*. 2021;11(6):528.
- Mullinax M, Hart J, Garcia AV. Using research for gender-transformative change: principles and practice. Ottawa: International Development Research Center (IDRC) and American Jewish World Service (AJWS); 2018.
- Najjingo-Mangheni M, Miiro R, Boonabaana B, Musiimenta P Towards gender responsive agricultural research: needs, gaps, and opportunities for gender training and institutional transformation in East Africa. 2017.
- Njenga M, Karanja N, Prain G, Lee-Smith D, Pigeon M. Gender mainstreaming in organisational culture and agricultural research processes. *Dev Pract*. 2011;21(3):379–91.
- Njuki J. Practical Notes: Critical elements for integrating gender in agricultural research and development projects and programs. *J Gend Agric Food Secur*. 2016;1(3):104–8.
- Nyabam VS, Tarawali G, Ijie BA. Empirical Analysis of IITA Youth in Agribusiness Model as a Panacea for Solving Youth Unemployment Problem in Nigeria. *Int J Gov Dev*. 2018;5(1 & 2):117–21.
- OECD. The measurement of scientific and technological activities: guidelines for collecting and interpreting innovation data: Oslo manual. 3rd ed. Paris: OECD; 2005.
- Pamuk H, Van Rijn F. The impact of innovation platform diversity in agricultural network formation and technology adoption: evidence from sub-Saharan Africa. *J Dev Stud*. 2019;55(6):1240–52.
- Petesich P, Badstue L, Prain G, Elias M, Tegbaru A. Entry points for enabling gender equality in agricultural and environmental innovation. GENNOVATE resources for scientists and research teams. CDMX, Mexico: CIMMYT; 2017.
- Population Reference Bureau (PRB). World population datasheet. 2019. <https://www.prb.org/wp-content/uploads/2019/09/2019-world-population-data-sheet.pdf>. Accessed 7 July 2022.
- Pyburn R, van Eerdewijk A. CGIAR research through an equality and empowerment lens. Advancing gender equality through agricultural and environmental research: past, present, and future. Washington D.C: International food policy research institute; 2021.
- Rafaelli T, Hutchinson G. The secondary impacts of COVID-19 on women and girls in Sub-Saharan Africa. Brighton, UK: Institute of Development Studies; 2020.

- Rietveld AM, van der Burg M, Groot JC. Bridging youth and gender studies to analyse rural young women and men's livelihood pathways in Central Uganda. *J Rural Stud.* 2020;75:152–63.
- Rietveld A, Gartaula H, Farnworth CR, Lopez DE, Bailey A, Hellin J, Fisher E, Kramer B, Teeken B, Mujawamariya G, Choudhury A. A Community of Practice for Gender-Transformative Research Methodologies. CGIAR GENDER Impact Platform Working Paper #007. Nairobi, Kenya: CGIAR GENDER Impact Platform. 2022.
- Rocca C, Schultes I. Africa's youth: action needed now to support the continent's Greatest Asset. London: Mo Ibrahim Foundation; 2020.
- Sakho-Jimbira S, Hathie I. The future of agriculture in Sub-Saharan Africa. *Policy Brief.* 2020;2(3):18.
- Sanginga N. Youth in agribusiness within an African agricultural transformation agenda. *Youth in agribusiness within an African agricultural transformation agenda.* 2015.
- Schillo RS, Robinson RM. Inclusive innovation in developed countries: The who, what, why, and how. *Technol Innov Manag Rev.* 2017;7(7):34.
- Schwebel D, Estruch E, Wobst P, Grandelis I. Policies for youth employment in Sub-Saharan Africa. *Youth and jobs in rural Africa: beyond stylized facts.* Oxford: Oxford University Press; 2019. p. 47–74.
- Singh S, Aggarwal Y. In search of a consensus definition of innovation: a qualitative synthesis of 208 definitions using grounded theory. *Innov Eur J Soc Sci Res Approach.* 2021. <https://doi.org/10.1080/13511610.2021.1925526>.
- Sohindji FS, Adje OAC, Hotegni VNF, Fogni NF, Akponikpe T, Quenum F, Achigan-Dako EG. Orange-fleshed sweetpotato production: progress and perspectives for value chain development in West Africa. *JSAF Rep.* 2022;2(5):198–207.
- Srinivas H. Towards a gender analysis framework to assist the application, adoption and use of environmentally sound technologies. 2015
- Sumberg J, Okali C. Young people, agriculture, and transformation in rural Africa: an "opportunity space" approach. *Innov Technol Gov Glob.* 2013;8(1):259–69.
- Sumberg J, Anyidoho NA, Leavy J, te Lintelo DJ, Wellard K. Introduction: the young people and agriculture 'problem' in Africa. *IDS Bull.* 2012;43(6):1–8.
- Sumberg J, Anyidoho NA, Chasukwa M. Young people, agriculture, and employment in rural Africa. In: Resnick D, Thurlow J, editors. *African youth and the persistence of marginalization.* Oxfordshire: Routledge; 2015. p. 129–50.
- Tavener K, Crane TA. Beyond "women and youth": applying intersectionality in agricultural research for development. *Outlook Agric.* 2019;48(4):316–25.
- Tavener K, Crane TA. Hitting the target and missing the point? On the risks of measuring women's empowerment in agricultural development. *Agric Human Values.* 2022. <https://doi.org/10.1007/s10460-021-10290-2>.
- Totin E, van Mierlo B, Klerkx L. Scaling practices within agricultural innovation platforms: between pushing and pulling. *Agric Syst.* 2020;179:102764.
- Twyman J, Ambler K. Tools and methods for gender research and integration in agricultural value chain, market and entrepreneurship projects. CGIAR GENDER Platform Working Paper #004. Nairobi, Kenya: CGIAR GENDER Platform. 2021. <https://hdl.handle.net/10568/116888> Accessed on 27 Jul 2022.
- African Union-European Union (AU-EU). The AU-EU innovation agenda. Working document. 2022. https://ec.europa.eu/info/sites/default/files/research_and_innovation/events/documents/final_au-eu_ia_14_february.pdf. Accessed 18 July 2022.
- United Nations (UN). Gender mainstreaming: An overview. Office of the Special Adviser on Gender Issues and Advancement of Women. 2002.
- Von Schomberg R. A vision of responsible innovation. Hoboken: Wiley; 2013.
- Wairimu E, Mburu J, Gachui CK, Ndambi A. Characterization of dairy innovations in selected milksheds in Kenya using a categorical principal component analysis. *Trop Anim Health Prod.* 2021;53(2):1–12.
- White B. Agriculture and the generation problem: rural youth, employment and the future of farming. *IDS Bull.* 2012;43(6):9–19.
- Witinok-Huber R, Radil S, Sarathchandra D, Nyaplue-Daywhea C. Gender, place, and agricultural extension: a mixed-methods approach to understand farmer needs in Liberia. *J Agric Educ Ext.* 2021;27(4):553–72.
- Woodhill J, Kishore A, Njuki J, Jones K, Hasnain S. Food systems and rural wellbeing: challenges and opportunities. *Food Secur.* 2022. <https://doi.org/10.1007/s12571-021-01217-0>.
- Yami M. Opportunities for Youth in Rural Business and Entrepreneurship in Agriculture. Report. 54pp. UN Women. 2021.
- Yami M, Feleke S, Abdoulaye T, Alene AD, Bamba Z, Manyong V. African rural youth engagement in agribusiness: achievements, limitations, and lessons. *Sustainability.* 2019;11(1):185.
- Yami M, Barletti JP, Larson AM. Can multi-stakeholder forums influence good governance in communal forest management? Lessons from two case studies in Ethiopia. *Int for Rev.* 2021;23(1):24–42.
- Yami M, Sagoe AA, Guebama MH, Seisay M, Mokenye J, Nadioppe E. Unlocking the potential for strengthening the role of women in conservation of aquatic biodiversity and environmental management in Africa. *Policy Note.* AU-IBAR. 2023.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.