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in partnership with

Sasakawa Africa Association (SAA)

and

African Forum for Agricultural Advisory Services (AFAAS)

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Editor's Note

Let us talk about Agricultural Extension

I have always been interested in agricultural extension from the time I used to see extension workers visit my mum, then a peasant farmer in the village, working hard to make sure her family was always food secure. Even though her husband (my father) was out on a government job, she understood that she had to do her bit. His salary would be reserved for paying school fees for the children, putting up good housing, and providing some material goods that could put them at a certain level in society. Cash was highly valued, as it still is today. My mother was not farming to sell. Whatever excess she had would be shared with needy relatives and neighbors. With the support of extension workers who used to provide free seeds, teach how to make compost manure, and then guide farmers all the way to harvest and storage, we never lacked food except when there was a very serious famine. I remember feeling hunger pangs, at a time when we had porridge only for breakfast, no lunch, and then had a full meal at dinner. The memory of those hunger pangs is the reason why I am not happy when I hear of children going hungry for whatever reason.

Agricultural extension means extending knowledge to farmers, knowledge that has been generated by scientists in the laboratory or the field. But as I ventured into the field, where farmers are, I realized what a minefield of information it is, and how so critical it is to ensure that extending knowledge cannot be one way. I used to enjoy lab work in high school chemistry, biology, and zoology. I continued in university and into doing my PhD work. But all this changed when I undertook my fieldwork for my PhD dissertation. It was like I had been let out of a bubble. I could not believe the level of poverty I saw, the types of malnutrition, and the degree of ignorance in parents when it came to child-rearing. I could not believe that I was seeing this in my own country of Kenya, which at the time was proudly proclaiming food self-sufficiency.

As always, I became very curious. What do we mean by food self-sufficient? A family can be hungry and food insecure and even have members who are emaciated as their nation proclaims to be food self-sufficient. As I witnessed all this, it always brought me back to the extension worker in khaki uniform who used to guide my mother on her farm, as my mother diligently worked the farm knowing she would get a good harvest. It reminded me of how much I used to enjoy harvesting the maize together with the women who were helping my mother to do this.

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After this initial harvesting, only taking the good cobs, we children would still go back to scout for leftovers. This would fetch us a few coins to buy snacks. I was not aware of hunger during those days except when we had outright season failure, or when at one time locusts came and wiped out all the green there was, but then we survived by eating the locusts. We could eat the locusts because they were fresh, not sprayed with dangerous chemicals.

As time went on, the extension service system changed. More and more farmers got less and less attention, yet as a country, we continued to proclaim: *"Agriculture is the mainstay of our economy"*, and yet; we do not fund agricultural research, we eat and yet do not care about those who produce the food, we cease to value our food and our palates are confused by foreign foods that are not as nutritious as our own? And now, the climate change impacts are ravaging our food systems in ways we do not understand. And then we act helpless. Who will come to the aid of subsistence farmers upon whom we still depend? That is why this special issue on extension is important. It has been a while since we put out the call.

I am not sure why good papers did not come quickly. Finally, we have very good papers and a great Editorial from seasoned scientists doing great work on the continent's farming sector. Our readers are free to comment and to engage with authors online.

My personal view is that extension professionals are needed as much today as they were in the fifties when my mother was a subsistence farmer. In Africa, that one-on-one interaction with the farmer will not become irrelevant soon. One international NGO that I became closely associated with more than a decade ago is Sasakawa Africa Association, whose clarion call has become: Walking with the farmer, and it means exactly that. Farmers need motivation to grow beyond what the family needs; we still need these millions of smallholder farmers to be able to feed a fast-growing world population. We need them to maintain a robust food economy and the rest of the local economy. That ensures happy people ready to contribute to the national economy and to the fulfillment of their own families.

However, the farmers need knowledge as well as being appreciated as they share their own innovations and knowledge. Farmers are perpetual scientists, but where can they share or publish what they know? A recurring question to ponder.

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EDITORIAL

ADVANCING AGRICULTURE EXTENSION MODELS IN AFRICA: BRIDGING THE GAP FOR EFFECTIVE DELIVERY OF TECHNOLOGIES AND INNOVATIONS

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ABSTRACT

Agriculture in Africa is undergoing transformative shifts, driven by the need for sustainable food production, increased productivity, and resilience to challenges such as climate change. This paper explores the current state of agriculture extension models in Africa and their role in delivering technologies and innovations to target beneficiaries and other stakeholders in agricultural innovation systems. We delve into key challenges, promising approaches, and recommendations for enhancing the effectiveness of extension services in the dynamic agricultural landscapes of Africa. The paper showcases innovative extension models by Sasakawa Africa Association that have made a significant impact. These include Farmer Learning Platforms (FLPs) model, Private and Extension Service Provision (PESP), The Agro-Processing Enterprise Center (APEC) Model, Community-Based Seed Multiplication (CBSM) model, private and extension service provision Model (PESP), and the community savings for investment in Agribusiness (CSIA) model. The Sasakawa Africa Fund for Education (SAFE) Demand Driven Curriculum (SDDC) model is also highlighted. These examples highlight the importance of context-specific approaches and the role of extension in empowering farmers to embrace sustainable and resilient agricultural practices. By addressing key challenges and leveraging opportunities, this paper aims to contribute to the sustainable development of agriculture in Africa.

Key words: Agriculture extension models, Technology Adoption, participatory approaches, Innovation, Sustainable Development

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INTRODUCTION

Africa's agricultural sector is crucial for economic development and food security, but it faces many obstacles, including limited access to modern technologies and information. Additionally, agriculture extension faces numerous challenges in Africa, including limited resources, inadequate infrastructure, and a diverse agro-ecological conditions. Agriculture plays a crucial role in the socio-economic development of Africa, but the continent faces challenges in effectively delivering agricultural technologies and innovations to farmers.

The low ratio of extension workers to farmers in Africa, which ranges from 1: 5,000 to 1: 10,000 in Nigeria [1] and 1:1800 in Uganda [2] (the average ratio in Africa is 1:3000), is a problem that affects the provision of agricultural extension services. Effective agriculture extension models play a critical role in addressing these challenges by facilitating the delivery of innovations to farmers and other stakeholders. An efficient agricultural extension and advisory service (AEAS) is required to provide farmers with pertinent and helpful information and technologies that can increase their production and productivity. Governments have traditionally assisted smallholder farmers with extension services for a long time, but because of shifting priorities, financing for these initiatives has decreased in many nations. Several developing nations are also changing their governance structures in response to the multilateral and bilateral donors recommendations to privatize and decentralize extension services and farm-level initiatives that are more in-touch with the public. The degree of grass-roots AEAS involvement encourages farmer-oriented approaches that enable more interactive reciprocal learning between unified, multidisciplinary formal and informal knowledge frameworks. By having good conversations with extension workers and with other farmers, farmers and other rural residents learn how to solve difficulties. It is thus crucial to highlight the importance of aligning extension strategies with the diverse needs of African farmers and fostering collaboration among key actors in agricultural innovation systems. In order to better meet the needs of farmers and support agricultural transformation, this article suggests ways to close these gaps and enhance agriculture extension services.

Strategies for Enhancing Agriculture Extension

Resilient agriculture extension models that can effectively reach and engage farmers are necessary to promote the effective distribution of agricultural technology and innovations in Africa. Some of the key models and approaches that can enhance agriculture extension in Africa may include: a) ICT-Based Extension Services, b) Radio and Television Programs, c) Farmers' learning platforms, d) Community-Based Extension Services, e) Public-Private Partnerships, f) Extension through NGOs and Development Organizations, g) participatory demonstrations, h)

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Extension through Cooperatives, l) Market-Oriented Extension, and k) Continuous Training and Capacity Building. Given the variety of agricultural practices and difficulties found throughout the continent, we must align our extension systems and modify these models/approaches to the unique socio-economic and cultural settings of various regions within Africa. Furthermore, to guarantee the validity and efficacy of these extension models/approaches in raising agricultural productivity and livelihoods, continuous monitoring and assessment are necessary. Drawing on successful case studies, research, and best practices, the paper identifies promising extension approaches in Africa, as well as systems-oriented extension services along the agriculture value chain. The paper also explores how these approaches contribute to increased technology adoption, knowledge dissemination, and improved agricultural practices. Drawing on best practices and lessons learned, these strategies include strengthening farmer engagement, leveraging digital technologies, promoting knowledge-sharing platforms, and fostering multi-stakeholder partnerships.

Validated agriculture extension models

A vital part of guaranteeing the efficient transfer of agricultural innovations and technologies is the use of validated and tested agriculture extension models and techniques. These models, which are usually supported by data, have been shown to increase farmer knowledge, encourage the adoption of modern practices, and increase overall agricultural productivity. They also contribute to building a foundation of efficiency, sustainability, and confidence in the delivery of agricultural technologies and innovations. Enhanced sustainability, inclusion and equity, learning from success and failure, scaling up and replication, continuous improvement, partnerships and collaboration, resilience building, scientific rigor and credibility, and efficient resource allocation are all reasons why validated and proven approaches are important. To have a significant and long-lasting impact on farmers' livelihoods and the agricultural sector's overall development, these models are needed. Incorporating a pluralistic perspective into the system is necessary for the verified models to be adopted and scaled up.

Pluralistic agriculture extension models

Various actors, such as public institutions, private sector, non-governmental organizations (NGOs), and local communities, collaborate in pluralistic agriculture extension models. This method encourages a more inclusive and holistic change of the agri-food system while acknowledging farmers' various demands and contexts. This collaborative paradigm acknowledges that change necessitates the joint efforts of all stakeholders striving for shared objectives. Using pluralistic extension methods can help promote more efficient and sustainable development in the African environment, where agriculture is frequently diverse and

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complicated. The main ideas and elements of pluralistic agriculture extension models in Africa include: a) public-private partnerships, b) multi-stakeholder platforms, c) community-based organizations, d) value chain approaches, e) customization and localization, f) inclusive gender approaches, g) digital technologies for extension, h) capacity building for extension agents, I) market-driven extension, j) policy support and coordination, and k) monitoring and evaluation. African nations may leverage the diverse strengths of many players in the agriculture sector by embracing a pluralistic approach, resulting in agri-food systems that are more inclusive, resilient, and sustainable [3, 4, 5].

Research and extension model linkage

Nonetheless, a crucial component of agricultural development in Africa is the linkage that exists between extension models and the uptake of agricultural technologies at the farm level. Academic, research, and extension endeavors are interrelated in comprehending, formulating, and implementing effective strategies to promote technology adoption. Creating and putting into practice efficient extension models that promote the adoption of agricultural innovations at the farm level in Africa requires close collaboration between research, academia, and extension personnel. By working together, collaborators can make sure that interventions are grounded in evidence, tailored to the particular context, and adaptable to the changing agricultural landscape in the area [5, 8].

Policy and agriculture extension

Developing efficient decision-making processes in Africa depends on the relationship between policy and agriculture extension. Agriculture extension acts as a link between policymakers and the grassroots level, facilitating the implementation of policies and providing guidance for agricultural Development. Building an environment that fosters equitable and sustainable agricultural development in Africa requires efficient coordination between the development of policies and agriculture extension initiatives. Policies ought to be flexible, adaptable to changing conditions, and actively established with the participation of all pertinent parties. By working together, we can make sure that laws are implemented in a way that benefits farmers and advances the agricultural industry as a whole [6, 7, 9].

Experience of Sasakawa Africa Association

The Sasakawa Africa Association (SAA) has developed innovative strategies to improve the effectiveness and efficiency of extension service delivery. It began collaborating with the private sector alongside government extension agents to create new tools, approaches, and models of extension, including the Agro-Processing Enterprise Centre (APEC) Model, the Private and Extension Service Provision (PESP) model, and Farmer Learning Platforms (FLPs). The community-

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based seed multiplication (CBSM) model, the community savings for investment in agribusiness (CSIA) model, and the Sasakawa Africa Fund for Education (SAFE) Demand Driven Curriculum (SDDC) model. Digital transformation strategies powered by information and communication technology (ICT) are also offering chances to improve the provision of extension services to smallholder farmers. All these models are applied in an integrated approach along the entire Agriculture value chain since they are interdependent of each other (Fig 1).

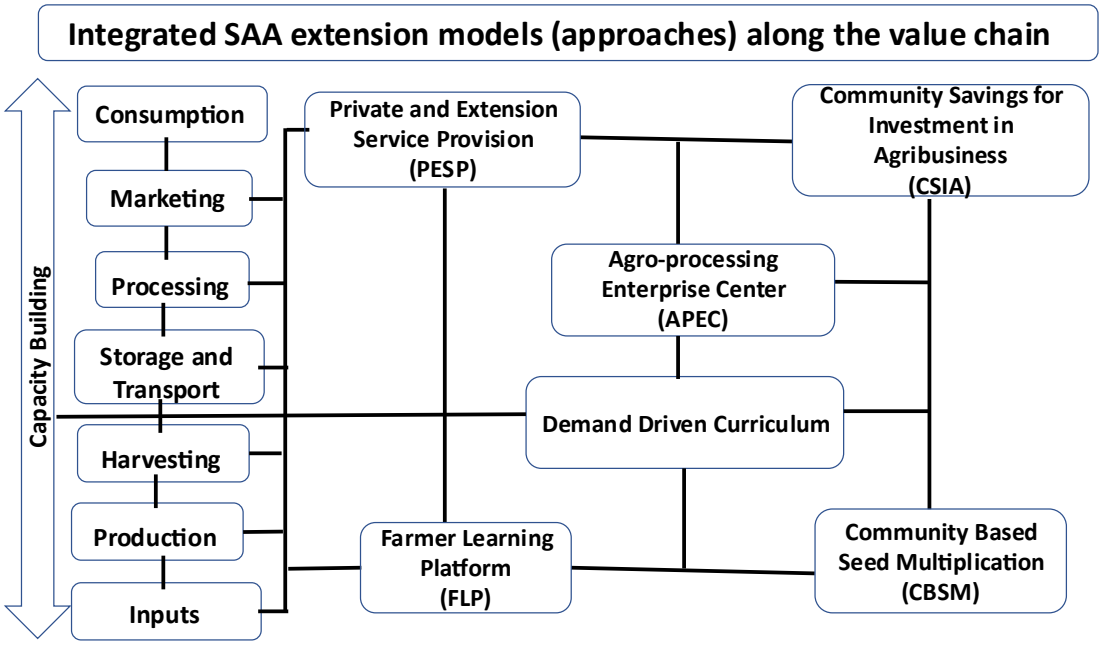

Figure 1. The SAA Integrated extension models implemented along the entire agriculture value chain

a) The Agro-Processing Enterprise Center (APEC) Model

The SAA promotes the Agro-processing and Enterprise Centre (APEC) model which showcases improved technology choices that can be applied to add value, resulting in positive effects on the economy and society. By increasing the nutritional worth of food, people and organizations can use this centre to raise awareness, enhance food quality, and create revenue. For extension workers, students, producers, and marketers, the centre provides additional information on utilization potentials and constraints that are used to create and implement technology diffusion strategies. It also provides practical guidance on starting and operating an agro-processing enterprise in actual environments.

The main objective of APEC is to provide a platform for the development of small and medium-sized agro-processing enterprises by providing training and technical support. It focuses on converting local produce into value-added agricultural goods and transferring technologies for agribusiness expansion in order to boost revenue

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creation and food and nutrition security. The APEC model is specifically used to: a) increase the quantity and quality of processed products by using value-adding technologies and techniques; b) improve the business acumen and skills of extension workers, students, producers, and marketers; c) create a platform for the growth of agro-processing businesses that generate income and job opportunities, especially for women and youth; d) connect producers to profitable markets; and e) promote nutrition messaging, cooking, and consumption of adequate, balanced, and varied diets obtained locally.

b) Farmer learning platforms (FLPs) model

Through better farming and extension practices, the Farmer Learning Platforms (FLPs) aim to increase crop productivity and production in Africa. They also create opportunities for interactive learning and active participation among farmers, program staff, and partner extension agents in the process of delivering extension services for technology innovation, adaptation, and dissemination. The purpose of FLPs is also to look into the efficacy and efficiency of the technology packages that smallholder farmers are receiving. They consist of four types of plots: community demonstration plots showcasing climate-smart and productivity-boosting Sasakawa Africa Association technology; technology adoption plots managed by early adopters; model adoption plots that serve as models; and commercial technology adoption plots that are selected based on stringent requirements like complete adoption of the demonstrated technological package and community practices managed by non-participating farmers [10].

c) Community-Based Seed Multiplication (CBSM) Model

The multidisciplinary approach used by the CBSM Model that SAA promotes encompasses a range of stakeholders along the value chain for seeds, such as financial institutions, community-based value chain agents, professional seed companies and retailers, and providers of seed research and extension services. To promote social learning, provide high-quality seeds for farmers to utilize themselves, and offer seeds to other farmers, the CBSM Model divides individual farmers and their support groups into small seed production units [11]. Through social learning, the effective CBSM model improves farmers' knowledge and gives them access to better seed for both CBSM membership and non-membership farmers. According to reports, the model increases access to bean seed in Ethiopia [12], and improves seed access in Nepal [13]. Through the CBSM, SAA hopes to increase farmers' use and access to enhanced seed while also encouraging a greater uptake of its productivity-boosting technology.

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d) Private and Extension Service Provision Model (PESP)

The paucity of government extension agents to spread knowledge and technologies generated by the research system, the scarcity of information about better technologies, and the high cost of investing in these technologies pose ongoing challenges for the Sasakawa Africa Association (SAA) in its intervention programs among rural communities in Africa. In order to improve production and productivity, food and nutrition security, and the quality of life for smallholder farmers (SHFs), the Private and Extension Service Provision (PESP) extension model seeks to offer a scale-out strategy for agricultural extension and advisory services with the active participation of the private sector.

The PESP model supports the engagement of private individuals and/or groups to give producers, smallholder farmers, and other value chain actors access to necessary technologies and extension services, promotes enterprise development in the agricultural value chain, and allows them to make a living from those enterprises. It also helps to improve the delivery of agricultural extension and advisory services. The approach calls for identifying and educating a subset of community members who belong to commodities associations as well as enterprising people who are willing to invest in and embrace the technologies of their choosing.

The Production, Postharvest and Trade Centre [PHTC] model [14], which is known as Promoting Sustainable Agricultural Mechanization for smallholder farmers (SHFs), Private Service Providers (PSP); Commodity Association Traders/Trainers (CA/CAT); and Community-based Facilitators (CBF) are the component models of PESPs. PESPs receive technical and entrepreneurial skill development training, are linked to financial institutions, suppliers of machinery and inputs, and providers of machine repair and maintenance services. Since extension agents are actively involved in the implementation, they gain from a constant stream of new information and expertise on the management and operation of various technologies as well as the financial benefits of doing so.

e) Community Savings for Investment in Agribusiness (CSIA)

SAA have made strides to enrich its agricultural value chain approach through promotion of inclusive and mutually reinforcing interventions varying from staff and extension advisory service capacity enhancement to providing and supporting innovative ways of disseminating improved agricultural technologies to sustainably stimulate commercial farming that can effectively generate more income and ensure food security for smallholder farmers while creating rural employment opportunities for the youth, women and People with Disabilities (PwDs).

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Africa's rural areas are underserved in financial services, requiring investment and subsistence needs. Traditional formal financial institutions, such as commercial or agricultural banks haven't provided customized services, hindering rural SHFs' potential. Financial inclusion can increase household income, improve livelihoods, and create jobs, benefiting the impoverished. The SAA has developed strategies for farmers, groups, and extension agents to create sustainable farming groups that practice farming as a business enterprise using the community savings for investment in agribusiness (CSIA) model, focusing on reinvesting and saving.

The CSIA model is a resource mobilization practice used by farmer groups in African SAA communities. It allows self-selected groups to build savings and access finance for their needs. The model is simple, accessible, and encourages SHFs to consider agriculture as a business and build market systems. It creates bonding among members and ensures access to finance. SAA enhances CSIA methodology by linking CSIA groups to other value chain actors, providing sustained access to savings and services for the poor, enhancing investment, and supporting microenterprises development.

f) The Sasakawa Africa Fund for Education (SAFE) Demand Driven Curriculum (SDDC) model

All scheduled educational opportunities offered by affiliated agricultural colleges and universities comprise the SDDC model. The SDDC curriculum that is promoted by SAA outlines the knowledge and abilities that students should learn. These consist of: a) learning and development objectives; b) teacher-taught units and lessons; c) student assignments and projects; d) training materials and modules; and e) evaluation (factual field-level action research assessments and classroom assessments). The course content (modules), teaching approaches (pedagogy and andragogy), learning techniques (experiential learning), evaluation of students' knowledge, and feedback are the main components of the SDDC. In addition to field level-training, mid-career extension agents (EAs) are provided opportunity to upgrade their extension capacity through SAA's collaborating agricultural universities and colleges particularly in conducting their supervised enterprise projects (SEPs)

Demand-driven curriculum (DDC) focuses on stakeholders' interests in agricultural extension advisory services, involving academics and professionals from public and private sectors. It ensures high-quality service, delivery, and content, resulting in desired outcomes for learners [15]. DDC adapts to employer and student needs, community actors, and the rapidly evolving global economy, ensuring skills for both recent graduates and lifelong learners [16].

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The SDDC was developed by SAA as a demand driven process to meet the needs of stakeholders, including students, farmers, Agricultural Colleges, Universities, Private Businesses, Non-Governmental Organizations (NGOs), Community Based Organizations, Public and International Organizations, Ministries, and Farmers, in light of the significance and relevance of agriculture in both national and global development. The majority of those involved in agricultural development are small-holder farmers. As a result, the curriculum for the agricultural sector must prioritize needs and adapt to the changing demands of small-holder farmers.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

To enhance the effectiveness of agriculture extension models in Africa, there is a need for strengthening public-private partnerships, fostering a pluralistic approach that engages diverse stakeholders, investing in capacity building for extension agents, and leveraging digital technologies for more widespread dissemination of agricultural information. It is also important to examine the challenges and underscore the importance of tailoring extension approaches to local contexts, ensuring inclusivity, and addressing gender disparities in technology adoption.

There is an urgent need for advancing agriculture extension models in Africa to effectively deliver technologies and innovations. By addressing challenges, embracing promising approaches, and implementing recommendations, stakeholders in agricultural innovation systems can collectively contribute to the sustainable development of the continent's agriculture. Efficient extension should encourage ongoing collaboration, learning, and adaptation to ensure that extension services remain dynamic and responsive to the evolving needs of African farmers and the agricultural sector as a whole. It should also include investing in extension infrastructure, supporting capacity-building initiatives, and creating enabling environments for innovation and entrepreneurship in agriculture. In conclusion, this paper underscores the importance of advancing agriculture extension models in Africa to bridge the gap between technology innovation and adoption. By addressing key challenges and implementing effective strategies, stakeholders can work towards sustainable agricultural development and improved livelihoods for farmers across the continent.

REFERENCES

1. **Tafida, Ibrahim, Bulus, Timdir Vondun, Nazifi, Buhari** Strengths, Weaknesses, Opportunities and Threats to Extension Service Delivery in Kaduna State, Nigeria. *Journal of Agricultural Extension*. 2024; **Vol. 28(1)**. https://dx.doi.org/10.4314/jae.v28i1.4

2. **Ladu IM** Agricultural extension must evolve. Daily Monitor, Tuesday, June 20, 2023. https://www.monitor.co.ug/uganda/business/prosper/agricultural-extension-must-evolve--4276868 *Accessed June 2023.*

3. **Gêmo HR, Stevens JB and P Chilonda** The role of a pluralistic extension system in enhancing agriculture productivity in Mozambique. *S Afr. Jnl. Agric. Ext.* **vol.41 n.1** Pretoria Jan. 2013.

4. **Jawoko HO, Opio A, Mwesigye A and R Bariyo** Understanding pluralistic agriculture extension services through a social governance lens in Northern Uganda. *Journal of Agricultural Extension and Rural Development*. **Vol.15(1),** pp. 36-45 January-March 2023. https://doi.org/10.5897/JAERD2022.1360

5. **Meena M, Singh KM and S Burton** Pluralistic Agricultural Extension System in India: Innovations and Constraints (July 15, 2013). http://dx.doi.org/10.2139/ssrn.2293788

6. **African Development Bank.** African Economic Outlook. Developing Africa's Workforce for the Future. 2020. https://www.afdb.org/sites/default/files/documents/publications/african_economic_outlook_2020-en.pdf *Accessed November 2023.*

7. **FAO.** The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome. Licence: CC BY-NC-SA 3.0 IGO.

8. **Robert BZ, Läderach P and BM Campbell** Transforming Food Systems in Africa under Climate Change Pressure: Role of Climate-Smart Agriculture. *Sustainability*. 2021, **13(8),** 4305. https://doi.org/10.3390/su13084305

9. **Muyanga M, Tschirley D, Reardon T, Jayne TS, Meyer F, Liverpool-Tasie S and T Davids** Synthesis Report III. Rural and Agrifood Systems in Transforming Economies in Africa and Asia October. Feed the Future, Innovation Lab for Food Security Policy, 2019

10. **Sasakawa Africa Association.** Farmer Learning Platform Concepts and Implementation. Guideline, 2017.

11. **Omega PA and P Rossiter** Improving Emergency seed relief in Kenya: A cooperative analysis of direct seed distribution and seed vouchers and fairs. 2011. Nairobi, Kenya. 43pp.

12. **Katungi E and S Gebeyehu** Enhanced seed accessibility and adoption of improved common bean varieties in Ethiopia: Monitoring early adoption of improved varieties. *Survey report.* 2011. http://www.harvestplus.org/file/1678/download?token=ID8NJ2RR *Accessed January 2024.*

13. **Koirala KB, Gurung GB, Porkrel B, Acharya G, Prassai HK, Poudel R and M Bhattarai** Community based seed production: Experience from Western and Mid-Western hills of Nepal. Paper presented at the National Summer Crops Research on Maize Research and Production in Nepal, Rampur, Nepal. **105(1):** 1-13. 2004.

14. **Sasakawa Africa Association.** Utilization of Models in Agricultural Extension: the case of Production, Postharvest and Trade Center [PHTC] model in Mali. 2020. Technical brief.

15. **MacDonald CJ, Stodel E, Laura GF and M Gabriel** The demand-driven learning model: A framework for Web-based learning. March 2001. *The Internet and Higher Education* **4(1):** 9-30. https://doi.org/10.1016/S1096-7516(01)00045-8

16. **Deegan J and N Martin** Demand Driven Education Merging work & learning to develop the human skills that matter. 2016. Pearson.Com

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AGRICULTURAL EXTENSION DEBATABLE ISSUES

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ABSTRACT

Extension, and extension workers in particular, drive the agricultural modernization process and the rest of those in associated professions and positions are 'support staff.' Whether you are a lecturer, a professor, a dean, a researcher, an extension director or a head of a non-government organization, if your mission is to develop smallholder agriculture at farmer level, you are supporting the field extension worker to achieve your/farmers' goals. To this extent, it is no surprise that, when no perceptible improvement takes place at the farmer level, the blame lies squarely on the shoulders of extension. Despite its importance, agricultural extension is the most misunderstood of all agricultural disciplines, and the lack of understanding reveals itself in several ways. This paper discusses some of the misconceptions and debatable issues that affect the way extension is supported, the way it is structured, the way it is staffed and the way extension workers are trained and capacitated. The misconceptions also affect the kinds and levels of expectations people have of extension. The misconceptions include: *unending definitions of extension, expanding extension concepts, blaming extension for perceived failures in agriculture, undermining the extension discipline, inadequacies in extension teaching and training, markets and the role of extension and structural changes in extension.* The origins of some of these debatable issues can be traced to development partners who come with their conceptions of what is needed while others come from development theorists who have not done any extension work in the field. Unfortunately, there are no strong extension professional associations in many African countries that could: raise the profile of extension as a discipline, interrogate some of the agricultural development interventions before implementation and help clear some of the misconceptions. In the absence of extension platforms, extensionists operate as individuals, each struggling the best way they know how to make a difference at the farmer level. There is no way of harnessing the experiences the individuals are going through for purposes of learning, sharing and developing common positions. The purpose of this paper is to promote debate on, and scrutiny of these extension issues which are often presented as facts and absolute truths.

Key words: Extension issues, debatable, agricultural discipline, misconceptions, professionals, smallholder farmers

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INTRODUCTION

The paper is based largely on the author's experiences during the implementation of an in-service degree program for mid-career agricultural extension professionals at 12 universities in four countries: Ethiopia (Arba Minch, Awassa, Bahir Dar, Haramaya, Jigjiga, Jima, Mekelle, Samara, Wollo), Malawi (Lilongwe), Tanzania (Sokoine) and Uganda (Makerere) between 1996 and 2017. The program was supported by Sasakawa Africa Fund for Extension Education (SAFE) in partnership with Winrock International (WI). Winrock International and SAFE provided leadership in catalyzing linkages between employers and selected agricultural education institutions in Africa and encouraging them to develop responsive BSc. degree programs for mid-career agricultural extension professionals [1]. Employers, mostly ministries of agriculture, and universities formed partnerships wherein employers identified and sent their staff to universities on full salary and also paid their fees, while the universities provided staff to teach program courses. Although WI/SAFE have since ended their support, many of the programs are still running, supported by their own institutions.

As part of their training, the students together with their employers, farmers and researchers, develop 'supervised enterprise projects', or 'supervised extension projects' (SEPs) proposals relevant to their jobs as extensionists, that they go back and implement in their respective workplaces for 6-8 months. The SEPs' aim is to solve real-life problems at farmer level. The students implement the projects under direct supervision of their employers, while academic supervisors visit the projects to provide on-the-spot instruction. The SEPs provide an opportunity for co-learning amongst the farmers, the students, their employers and university lecturers in a real-life situation. They provide unique and rare opportunities for academic staff to assess the relevance and effectiveness of their teaching and to identify other opportunities for learning. Supervised enterprise projects differ substantially from the regular research projects in that SEPs involve both *'action'* and *'research'* – *'action'* to improve farmers' welfare and *'research'* to increase knowledge. Due to the intensive nature of the supervision required for these projects, annual intakes at each university do not usually exceed 30 students.

1. Unending definitions of extension

The problem with extension starts with its definition. Extension definition is a moving target – there are so many definitions, and more are still coming [2]. There is confusion about what agricultural extension is and what it is supposed to achieve – with some definitions tending to broaden its mandate [3, 4]. Apart from changing definitions of extension, there is even debate about the use of the term 'extension'

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because it is believed to have top-down connotations. Some argue for the abolition of the term altogether – but have not yet found a suitable and enduring substitute.

When a pan-African extension platform was formed about 20 years ago, there were challenges in coming up with an appropriate name because the founders did not want the word 'extension' in it. Eventually, they called it African Forum for Agricultural Advisory Services (AFAAS). However, over the years, AFAAS's flagship event has been the biennial Africa-Wide Agricultural Extension Week (AWAEW) – an international event that brings together agricultural extension and advisory services (AEAS) stakeholders and other value chain actors across Africa and globally, to deliberate on selected strategic and topical themes for sustainable development. The founders could not run away from the word 'extension' on this one.

At about the same time that AFAAS was formed, a global platform was formed and was called Global Forum for Rural Advisory Services (GFRAS) – again the founders made effort to avoid the word 'extension.' However, since its formation, one of GFRAS's main achievements has been the publication of a booklet entitled 'The New Extensionist.' Again, they could not run away from the word 'extension' – because that is what it is.

Makerere University in Uganda changed their Bachelor of Agricultural Extension and Education (BAEE) program to Bachelor of Agricultural and Rural Innovation (BARI), a change which was spearheaded by a colleague who had just returned with a PhD from Wageningen University, having been influenced to avoid using the term 'extension.'

Haramaya University in Ethiopia changed its Department of Agricultural Extension to Department of Rural Development and Agricultural Extension, a change which was spearheaded by a colleague who had just returned with a PhD from the University of Pretoria – also, where he was influenced to de-emphasize the term 'extension.' Several universities in Ethiopia have since adopted the Haramaya naming of their extension departments.

2. The extension concepts (or slogans?)

There is a proliferation of extension concepts and approaches which leave no traceable evidence of success. Concepts like: *demand-driven extension, farmer first, client-oriented extension, farmer-led extension, decentralized extension, accountability, farmer field schools, training and visit, participatory rural appraisal, agricultural knowledge systems, agricultural innovation systems, farmers plant wise clinics, farmer to farmer extension, market-oriented extension, value chain-oriented extension, climate-smart agricultural extension,* will not, in themselves,

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bring food to the table. Their power to transform rural people's lives tends to be exaggerated at times. Debates on these can be endless without ever seeing whether they are achieving anything on the ground or not. It would be difficult to arrive at a point where people can say 'extension is doing it right' based on these concepts as the goals can keep changing depending on who is articulating the concepts. Discussions of the concepts can be quite academic – and even sound more like slogans. There is need to avoid labouring and romanticizing these concepts and focus on seeking practical ways of enabling farmers to prosper in agriculture.

3. Using extension as a punch bag for perceived failures in agriculture

When no perceptible improvement takes place at the farmer level, the blame lies squarely on the shoulders of extension. Criticisms abound of the failures and ineffectiveness of extension in sub-Saharan Africa. Literature is replete with reasons for extension failures, ranging from inappropriate training, top-down approaches (and there seems to be an obsession against public extension services on this point), to marginalization of women, youth and limited resourced farmers [5]. In fact, when one goes through literature, one hardly finds anywhere where extension has “done it right”. If it happens that a country produces more than its food needs, credit goes to some government initiative, or the weather – and rarely attributed to extension.

4. Extension is usually not recognized as an agricultural discipline

Most universities do not teach extension and, if they do, it is in the form of an elective or introductory service course given to students pursuing degrees in other agricultural disciplines. Because of this lack of understanding, these universities do not even have departments of extension – and the people who teach the odd extension course are usually placed in departments of agricultural economics. The rationale behind this structuring is not clear. What is the relationship between agricultural extension and agricultural economics?

Considerable education is needed across the board for all to know that: getting agricultural science right is one thing, and delivering the products of agricultural science to farmers is quite another. That is why there are a lot of technologies on the shelf that could make a difference at farmer level but are still lying there unused.

5. Inadequacies in extension teaching and training

The fact that extension is usually not recognized as a distinct agricultural discipline leads to poor preparation of extension practitioners as reflected in the level and type of training provided by agricultural educational/training institutions.

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5.1 Few extension practitioners have received extension training

There seems to be a general belief that anybody can do extension. That is why there is no extension training at most universities; that is why people with no extension training are employed to do extension; that is why extension is being decentralized to district local governments in some countries; that is why, in some ministries of agriculture, there are no directorates of extension; that is why, in some countries, people with neither extension nor agricultural training are appointed to manage extension. Part of the reason is the failure of employers to articulate their needs to universities and training colleges.

For many employers, especially government ministries, things are usually alright as they are, and they do not see any need for changing them. They take whatever they are given by universities in the belief that universities know what is good for all. So, they believe that any agricultural graduate can do extension. Thus, universities see no need for extension training. This status quo is, therefore, self-reinforcing as shown in Figure 1 below.

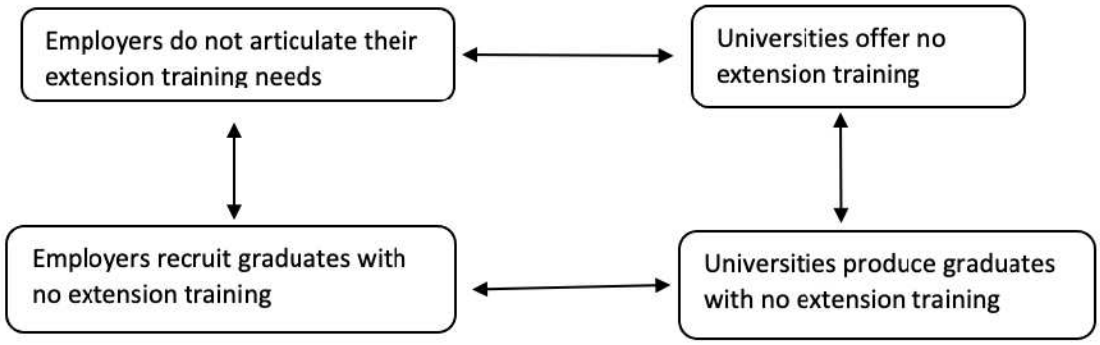

Figure1: Self-reinforcing *status quo* for no extension training

Universities churn out graduates without extension training – extension services carry the blame for poor performance. It is like sending a poorly-trained army to battle – one cannot expect to win. To break this cycle, employers need to articulate their needs to universities.

In the countries where the mid-career program was implemented, WI/SAFE demystified the 'ivory tower' phenomenon which has traditionally characterized institutions of higher learning by demonstrating that universities can actually respond to well-articulated needs. Through this program, employers demanded extension training and universities responded with need-based BSc. programs in agricultural extension.

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5.2 Value chain-oriented curriculum

The initial curriculum used for the mid-career program was production-oriented. Extension focused on improving production and productivity. As a result, farmers were actually reducing the value of their produce through poor practices. For example, when farmers thresh their crops by using cattle to trample over the crop (Fig 2), they are reducing the value through soil, urine and dung contamination, and some seeds will be lost thereby reducing yield recovery. When they harvest their fruits prematurely and take them to the market (Fig 3), they are reducing the value of the fruits as most of them rot and are discarded.

Figure 2: Threshing wheat

Figure 3: Fruits harvested before they were fully mature

Based on this realization, value chain-oriented and practical curricula were developed [6]. The process involved needs assessment surveys, developing responsive curricula and writing instructional materials. At the same time, this process led to the realization that the original curriculum was weak on pastoral issues. So, a pastoral-oriented value chain needs survey was conducted, followed by a pastoral-oriented curriculum for Ethiopia. But, as they say, 'the devil is in the detail.' There were several challenges in implementing the value chain-oriented curricula.

5.2.1 Retooling teaching staff

The first challenge was that university teaching staff generally lack the experience necessary to teach practical-oriented programs. They are products of theory-based production-oriented programs and most of them are recruited immediately after graduating. They, therefore, can only teach what they know from what they were taught. During a discussion with the Dean of the Faculty of Agriculture at Makerere University about the practical-oriented curriculum, he wondered how the practical aspects of the program were going to be achieved, giving examples of lecturers who "have never milked a cow, but are teaching Animal Science within the program."

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Finding teachers to teach the teachers became a challenge. There was very little literature of practical relevance. So, WI/SAFE decided to facilitate self-teaching and learning through workshops and individual explorations for information. Instructors were facilitated to write, or adapt their own instructional materials. That way, more appropriate teaching and learning materials were generated locally rather than buying books written in far-away countries with little local relevance. In addition, 'technology villages or centers' were set up with a range of appropriate technologies at several universities. However, only a few centers were used for teaching students. Most teaching staff had no experience in using the 'demonstration method' of teaching using hardware technologies.

The program benefited from the field experiences of Sasakawa Africa Association (SAA) staff who were working on post-harvest management. A series of value-enhancing seminars were organized at the different universities for SAA staff to share their experiences with teaching staff.

5.2.2 Teaching of the value chain concept

The second challenge, which was related to the first one, had to do with how the value chain concept was taught. There were professionals who made a living out of articulating the value chain concept – it was an 'industry' to them. They made it sound like 'rocket science' with maps and arrows facing all over, giving examples from the motor and clothing industry – with no relevance to smallholder farmers – when, in actual fact, what the farmer needed was much simpler. The smallholder farmer needs to know what the market options are, the quality wanted, and how they can produce the product and get it to the market in a state that the market wants it. Unfortunately, these are missed out in the training of extension workers who are left to figure out how to assist farmers benefit from available market opportunities.

5.2.3 Challenges with the SEPs

The SEPs, also known as *'supervised experiential learning projects (SELPs)'*, provided a unique opportunity for actualizing the value chain concept. There was a great opportunity for ensuring that the students embraced the value chain orientation through their SEPs but, challenges were observed here as well.

a) SEPs remained largely production-focused

Firstly, there seemed to be very little of practical value that was taught, beyond what smallholder farmers were already doing, that could enhance the value of their crops and crop products – especially from harvesting to marketing. Research has produced largely production-oriented technologies.

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b) Crops dominated student projects

Secondly, there seemed to be very little of practical value that was taught, beyond what farmers were already doing, that could enhance the value of livestock and livestock products at smallholder farmer level. As a result, mid-career students avoided livestock when choosing topics for their SEPs – even students following the pastoral-oriented curriculum preferred crops. It seems more work has been done on crop technologies than on livestock. Extensionists, therefore, have more to say on crops than on livestock. Farmers must, therefore, be missing opportunities for enhancing their incomes through livestock production.

A workshop was organized where:

- teaching staff were requested to list specific farmer-level value-enhancing technologies and practices that they were teaching students using one value chain as an example per lecturer.
- employers were requested to list specific farmer level value-enhancing technologies and practices for crops and livestock that they recommended to smallholder farmers.

The workshop generated lists of specific smallholder farmer technologies and practices that students could recommend with confidence, but, once again, most of the technologies were production-oriented. There is need, therefore, for research to do more work on value-enhancing technologies and practices for both crops and livestock.

5.3 Standard research methods

A standard 'research methods' course taught at universities emphasizes scientific ways of conducting research. Students are taught scientific methods of collecting and analyzing data and report writing. They collect data and analyze it in ways that enable them to describe situations as they exist, and they come up with long 'wish lists' in the form of recommendations for others to implement. They become experts in analyzing and developing models to describe situations – but they cannot change the situations. In other words, they are taught how to describe problems, but not how to solve them. They produce reports that are of no use to anybody, not even to themselves, apart from other students doing similar academic studies. It is just as well that they do not claim to be anything else other than research projects done and *"…. submitted to the …university in partial fulfilment of the degree of…."* They are not done in partial fulfilment of a solution to farmers' problems. So, why would anybody be interested in the reports unless they were also students pursuing similar degrees?

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In his book on writing and publishing scientific papers, Day [7] observed that the dustiest corner of a university library is where the PhD theses are kept. They are written in ways that only the advisor and other students of the same topic will understand. The methods are not suitable for action-oriented extension research of which the SEPs are a typical example. The inadequacies of the standard research methods course were so serious that three teaching staff were inspired to write a book entitled "A Step-by-Step Guide to Agricultural Extension Research", which was published in 2019 and is now being used at some of the universities running the mid-career program.

6. Markets for agricultural produce and the role of extension

Perhaps one of the major challenges in extension has to do with the nature of markets available to smallholder farmers. Markets outlets for most of the smallholder farmers are largely informal and dominated by middle-people, who do not pay premium prices based on quality (examples Fig4. Fig 5, Fig 6). There is, therefore, little incentive for smallholder farmers to invest in quality-oriented management levels.

Figure 4: Roadside food market

Figure 5: Crop market

Figure 6: Cattle market

Functioning markets are a key and indispensable pre-condition to, and drive agricultural development. They trigger innovativeness, creativity and adoption of improved practices among farmers. They trigger entrepreneurship among farmers and all the value chain actors (Fig7).

Markets enhance efficiency of extension. Where markets are available and functioning properly, extension's role is to ensure that:

- Farmers have all the information on market needs.
- Farmers have knowledge and skills to maximize production.
- Farmers produce the best quality of each commodity.
- Farmers work together to maximize benefits.

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Markets are a key determinant of agricultural development. Where there is a functioning marketing system, markets express their needs, make production inputs available and pay for agricultural commodities that meet their needs.

Market needs trigger entrepreneurship. Farmers respond to market needs by investing in their agricultural education to get the knowledge and skills that enable them to capitalize on the market needs. They invest in improved technologies and production inputs that give them the best yields and quality products. They invest in improved management practices that enhance their incomes.

Market needs trigger the emergence of service entrepreneurs like input distributors (for example veterinary products and feeds), veterinary paraprofessionals, combine harvester and thresher operators, transport operators, labour providers, middle people or persons (middlemen), money lenders, and so on.

Markets trigger the emergence of farmer institutions to lower transaction costs in sharing knowledge and skills, encouraging each other, buying inputs, selling farm products and lobbying for services and for fair prices.

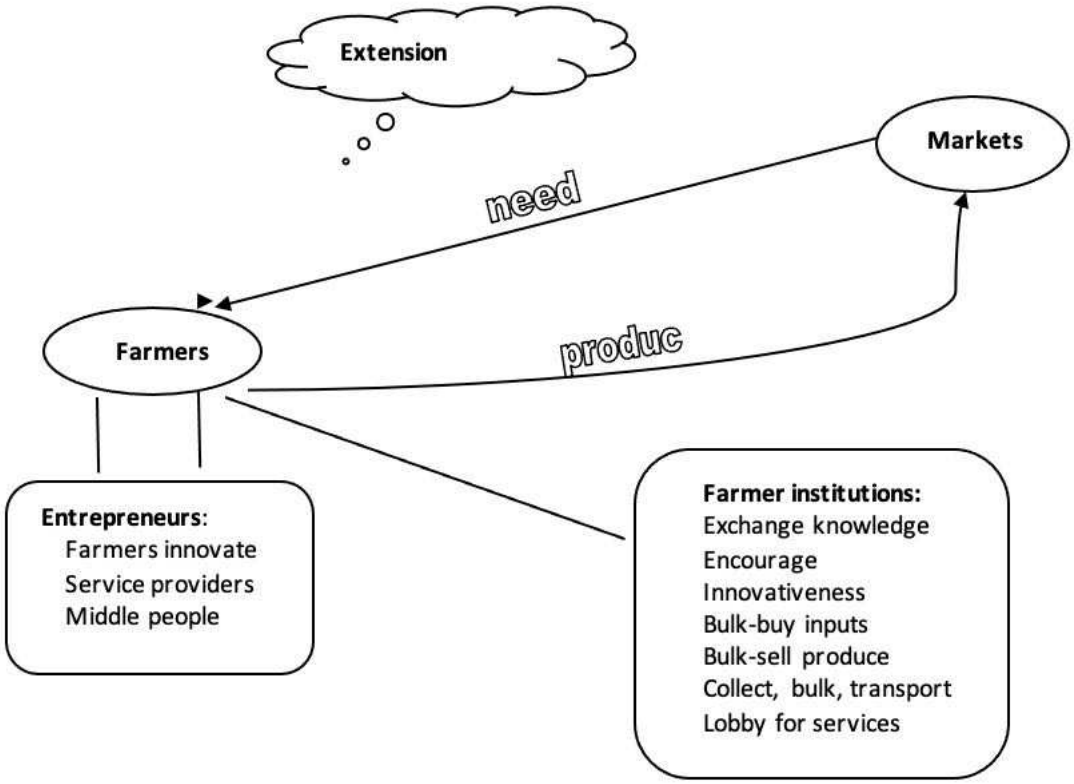

Figure 7: Linkages between markets, entrepreneurs and farmer institutions

Where markets are dysfunctional: extension cannot link farmers to markets because there are no markets, and extension cannot create markets and farmers produce for home consumption or produce based on 'hope' that someone will be

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willing to pay for their produce. There is, therefore, no real incentive for farmers to invest in production beyond home consumption needs. There is no incentive for service entrepreneurs and there is no incentive for farmers to work together as the benefits for doing so are not clear.

7. Structural changes in extension

According to a study report by Oladele [8], international agencies and scholars have been urging developing countries to decentralize, and, indeed, several countries have been decentralizing in response to pressure from donor agencies. Under this arrangement, extension is decentralized to, and managed by, rural councils or district local governments whose pre-occupation is in 'governing.' They may not have full appreciation of extension, in which case they may not prioritize extension in the allocation of resources; they may give extension personnel non-extension duties; and they may not consider capacity development of extension staff as important. This posed a problem for the mid-career program in the countries with decentralized extension like Tanzania and Uganda, where neither the ministries of agriculture nor the ministries of local government would sponsor extension staff for the program. The ministries of agriculture were no longer the employers, and ministries of local government did not consider staff development as important. This led to low morale among the extension staff as they felt like 'orphans' with neither ministry paying attention to their professional development needs.

This also created problems for WI/SAFE in terms of negotiations. In countries where extension staff were under the respective ministries of agriculture, WI/SAFE had only one employer to negotiate with regarding the mid-career program. Where countries had decentralized extension, WI/SAFE had to engage with dozens of new 'employers' as decision-making powers were decentralized to local councils.

It is not clear what informs the call for decentralization. More worrying is the fact that countries do not seem to learn from each other's experiences as they move to 'experiment' with decentralization. Uganda ran the experiment for 10 years and realized that it was not producing the desired results. Production statistics showed a decline and only 10% of the farmers received extension services [9]. The Government of Uganda had to reconstitute its ministry of agriculture and modified the decentralized system. As Uganda was having second thoughts about its experiment, Kenya, right next door, was also decentralizing, the same way Uganda had done and was abandoning. During a friendly discussion, a Kenyan lady was asked why Kenya was not learning from its neighbor, and her response was "…we are a sovereign nation." This short and sharp answer might have been a joke, but it looks like this is how governments do their business.

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Theorists argue that 'decentralization' of extension services leads to strong farmer participation. They say that decentralization leads to *improved efficiency, effectiveness and relevance of extension through: increased participation of farmers, improved extension accountability to farmers, improved extension responsiveness to farmers' demands and, timely access to advice by farmers.*

However, the theorists make these arguments without showing how moving the extension function from a technical ministry (agriculture) to an administration ministry (local government) will enhance farmer participation. In fact, it is not clear how extension can be closer to farmers via the ministry of local government – a ministry whose main preoccupation is 'governing' with no special orientation to agricultural extension. How does handing over the extension function to local government lead to increased farmer participation in extension programs? How does this bring field extension workers (who are already in the field by the way) closer to farmers? The fact that the extension departments in many countries are already more decentralized than other departments with an extension worker at village or community level is ignored. In fact, in many cases, frontline agricultural extension staff end up providing services on behalf of other departments who have no staff at local level.

If extension reports to district councils, these are not farmer representatives, they are political representatives. If the aim is to strengthen farmer participation, then decentralization should be preceded by farmer institutional development and strengthening. Not only will this provide a network of farmer organizations that extension can engage with, but the farmers will have capacity to demand services.

For decentralized extension systems to be effective, there will be need for strong, viable and self-sustaining farmer organizations (FOs) that are able to, among other things:

- identify their own problems and seek ways and means to solve them
- seek ways and means of developing their technical and management knowledge and skills to better plan, implement and evaluate their programs
- take collective actions for the common good of their members
- take collective action in lobbying for better services from extension and other services providers and,
- monitor and evaluate performance of delivery services.

Strengthening farmer organizations is a more realistic and practical strategy for achieving the objective of *improved efficiency, effectiveness and relevance,* as strong FOs will demand services, accountability, responsiveness and they will participate in developing and implementing programs.

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CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

Agricultural extension is the most misunderstood of all agricultural disciplines. The misunderstanding starts with its definition which is continually evolving; its roles are not well understood leading to varied expectations, some of which border on the rejection of its importance. The confusion affects the way extension is supported, structured and staffed. It affects how extension workers are trained and capacitated. Generally, the confusion is the major source of the lack of appreciation of extension prevailing in many African countries today. At the center of all this is the failure to recognize extension as a distinct agricultural discipline.

Employers, universities and development partners need to recognize extension as a full-fledged agricultural disciple with its own knowledge and skills set. The recognition will change the whole perspective on extension including the definition and expectations. It will lead to a more focused understanding of extension capacity needs. Employers, in particular, need to articulate their extension capacity development needs in ways that will enable universities and other training institutions to come up with appropriate curricula.

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REFERENCES

1. **Naibakelao D, Mutimba J, Akeredolu M, Kante A and T Worku** *Creating Demand Driven Agriculture Curricula in African Universities: Experience of SAFE/Winrock.* Paper presented at a side event on Extension Training in Africa, RUFORUM Conference, Maputo, July, 2014.

2. **Mutimba J** Reflections on agricultural extension and extension policy in Africa. *S Afr. Jnl. Agric. Ext.* **vol.42 n.1** Pretoria, 2014.

3. **Sulaiman RV and K Davis** The "New Extensionist": Roles, Strategies, and Capacities to strengthen Extension and Advisory Services. *Global Forum for Rural Advisory Services*, 2012.

4. **Worth SH** An assessment of the appropriateness of agricultural extension education in South Africa. *Ph.D. Thesis*, University of Kwazulu-Natal, Pietermartzburg, 2008.

5. **Christoplos I, Sandison P and S Chipeta** Guide to Evaluating Rural Extension. Global Forum for Rural Advisory Services (GFRAS), Lindau, Switzerland 2012.

6. **Mutimba J** Agricultural value chain-oriented training needs assessment for field extension professionals in Ethiopia. IN**:** Proceedings of the International Conference on Innovations in Extension and Advisory Services: Linking Knowledge to Policy and Action for Food and Livelihoods. CTA 2013. http://knowledge.cta.int/Media/Multimedia/Innovation-in-Extension-CTA-Intl-Conference-2011 *Accessed 22nd April 2015.*

7. **Day RA** How to Write and Publish a Scientific Paper. Phoenix, New York: Oryx Press, 1988.

8. **Oladele OI** 'Report on Effect of Centralisation and Decentralisation of Agricultural Extension and Advisory Services in Africa' prepared for the African Forum for Agricultural Advisory Services. Kampala, Uganda, 2015.

9. **Rwamigisa PB and R Birner** A key challenge of reforming national agricultural extension systems in Africa: The case of Uganda's extension reform process 1996-2011, 2011. http://extensionconference2011.cta.int/programme/session4/policy/1 *Accessed 22nd April 2015.*

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INTEGRATING NUTRITION IN THE SASAKAWA AFRICA ASSOCIATION EXTENSION SERVICES: KNOWLEDGE, ATTITUDE AND PRACTICES AMONG SMALLHOLDER FARMERS

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ABSTRACT

This survey aimed to establish nutrition-related knowledge, attitudes and practices, and to observe how gender influences household food-related decision-making processes in the Sasakawa Africa Association (SAA) intervention areas in the Oromia and Southern Nation Nationalities and People regions of Ethiopia. The findings would inform implementation of communication for nutrition social and behaviour change among small-holder farmers as part of the SAA corporate strategy on nutrition-sensitive agriculture. The study population was smallholder farmers supported by SAA from which 311 respondents were selected through multistage sampling. Data were collected via a mixed methods approach consisting of a household survey, focus group discussions (FGDs) and key informant interviews (KIIs). Quantitative data were analysed using descriptive statistics while qualitative data was analysed using a narrative and content approach. The study focused on knowledge, attitudes and practices related to production and consumption of micronutrient-rich foods. Majority (59.5%) of the respondents were male. Men were the main decision makers on staple or commercial food crop production and proportion of produced crops to be consumed at home or sold in the market. Women mainly made decisions regarding production and consumption of fruits and vegetables, intra-household food distribution, preservation and storage. There was a lack of knowledge on iron and vitamin A fortified or biofortified sources of food. Nearly three quarters (72%) of women did not meet the minimum dietary diversity for women, a proxy indicator of adequacy of micronutrient intake and diet quality. The mean dietary diversity score was 3.8 with animal source foods being the least consumed. Not having sufficient money to buy food, unavailability of different food groups and poor intra-household food distribution were among the key reasons for lack of diverse diets. Majority of the respondents were aware of the importance of production and consumption of micronutrient-rich foods. However, there was a gap in practice and awareness about biofortified and fortified foods. While most of the respondents had produced fruits and vegetables in home gardens in the three months prior to this survey, more than half (54%) of the respondents thought it was not likely that they would produce fruits and vegetables for home consumption. More targeted nutrition campaigns are required to increase the ability of small-holder farmers to adopt best practices while reducing the barriers associated with access and consumption. Promotion of fruit and vegetable production in home gardens could be considered as option for improving household dietary quality as well as empowering women to make more decisions.

Key words: Sasakawa Africa Association, Small-holder farmers, Nutrition, Knowledge, Practices

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INTRODUCTION

Malnutrition in all its forms is a global burden that leads to serious public health risks and incurs high economic costs. Improvements in nutrition contributes significantly to stimulating economic growth, reducing poverty and achieving health, education and employment goals [1].

While Ethiopia has made progress in the reduction of child stunting with prevalence decreasing from 58% in 2000 to 37% in 2019 [2], the country continues to experience a high prevalence of micronutrient deficiencies [3]. According to the 2016 National Micronutrient Survey [3], the national prevalence of anaemia among preschool children, school-aged children and non-pregnant women of reproductive age was 34%, 26% and 18%, respectively. The prevalence of tissue iron deficiency was estimated at 30%, 20% and 16%, among preschool children, school-aged children and women of reproductive age, respectively. In addition, the prevalence of subclinical vitamin A deficiency and iodine deficiency was 11% and 48%, respectively among school-aged children. Eliminating undernutrition in Ethiopia would prevent losses of up to 11% per year from the gross national product [1].

Although women are the main food producers, they are disproportionately affected by hunger and malnutrition. Evidence shows that when women make more decisions on how to feed their children and on how much time to spend on this, and when they have better access to health care, prevalence of undernutrition reduces [4]. The nutritional status of women before, during and after pregnancy is also intimately linked to the nutritional status of their children [5]. Food insecurity disproportionately affects women and people living in rural areas. Globally, moderate or severe food insecurity affected 33.3% of adults living in rural areas compared with 28.8 % in peri-urban areas and 26 % in urban areas in 2022 [6]. In Ethiopia, even when food is available, women tend to be malnourished as economic and social disparities tend to be greater [7] and they continue to shoulder the “triple roles,” including their biological role of bearing/rearing children (reproductive), their productive (farm work) and social (community) responsibilities [8]. Understanding the socio-cultural structures and gender dynamics would strengthen the impact of nutrition programs in Ethiopia.

The Ethiopian government has put in place a National Nutrition Program that allows for integrated and coordinated nutrition actions and mainstreaming with the various national development sectors [9]. A positive government policy framework has provided an enabling environment for development partners to support the fight against malnutrition. It is in this context that Sasakawa Africa Association (SAA) has recently adopted Nutrition-Sensitive Agriculture as one of its key pillars in the 2021-2025 corporate strategy [10]. Tanager, an international nonprofit

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through the Impacting Gender and Nutrition through Innovative Technical Exchange (IGNITE) in Agriculture project has established a partnership with SAA to strengthen its capacity to deliver impactful nutrition in agriculture programs (https://tanagerintl.org/portfolio/ignite/). This is envisioned to positively impact behaviour change for improved nutrition outcomes by leveraging on SAA's existing extension delivery mechanisms to small-holder farming households. The objective of this survey was to establish nutrition-related knowledge, attitudes, and practices and observe how gender influences household food-related decision-making processes in the SAA intervention areas of Oromia and Southern Nations, Nationalities and Peoples (SNNP) regions in Ethiopia.

MATERIALS AND METHODS

Study design, population and sampling

The descriptive cross-sectional study was done in Anna Sora and Negele Arsi woredas in Oromia region and Angacha woreda in SNNP region in late 2021. The study population was smallholder farmers supported by SAA. Six kebeles were chosen using a non-probability sampling approach based on SAA intervention areas. One respondent per household was randomly selected based on their household membership in the SAA project beneficiary list until the sample size of 311 was attained of which 185 were males and 126 females.

Data collection and analysis

The study applied a mixed methods approach consisting of a household survey, key informant interviews (KIIs) and focus group discussions (FGDs). A Likert scale was used to establish the respondents' attitudes towards malnutrition, micronutrient deficiencies and consumption of micronutrient-rich foods. Key informant interviews were conducted among woreda agricultural extension coordinators, agricultural development agents and health extension service providers working at the kebele level. The FGDs were conducted among 126 respondents organized into 21 groups. The enumerators were trained, and pre-testing of the questionnaire done in the Kofele woreda prior to data collection.

Descriptive statistics, such as mean and proportion for quantitative data were analysed using Statistical Package for the Social Sciences (SPSS®) version 25. Qualitative data were transcribed and analysed using a narrative and content approach. Minimum Dietary Diversity for Women (MDD-W) was calculated as described by FAO (n=126) [11].

Ethical considerations

This study was done in the context of an existing project by SAA. The participation of all research subjects was voluntary and written consent was obtained. Participants were informed before an interview or discussion took place about the

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purpose of the study and given the opportunity to refuse upon understanding the purpose. No exercise of undue inducement or any other form of constraint or coercion to participate in the study was permitted or accepted.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents

Among the 311 surveyed respondents, majority (59.5%) were male with an average age of 38 years and 40.5% were female. More than half of the respondents (54%) had only primary level education. The importance of the level of education in gender equality is also underscored by the World Bank which notes that low levels of education, especially among women, represent a serious constraint on development in most of the sub-Saharan countries, including Ethiopia. At the individual level, education is perceived to be the ultimate liberator, which empowers a person to make personal and social choices [12]. The World Bank argues that education is also perceived to be the ultimate equalizer, particularly in promoting greater gender equity for women. Nearly all (92%) respondents were married, and the average household size was seven, which is higher than the national average of five. The average number of years the respondents had been in the SAA program was 1.4 years (Table 1).

Decision-making process in the household

The FGD participants observed that women are engaged in more activities compared to their spouses/partners as they also participate in roles performed by men but their roles were subsidiary and feminine rather than major work. This observation is similar to the results which observe that women are rarely considered to be farmers [13]. In Ethiopia, a farmer is seen as someone who can independently plough, sow and harvest, all of which are core farming activities. Ploughing is argued to be a “man’s activity” that is too difficult for women as the very concept of a woman farmer can be transgressive of the social order [13, 14, 15].

The survey found that decisions related to food could either be made by men, women, or both. Decisions related to household food crop production were mainly made by men while decisions around food handling, food storage, household distribution and consumption were made by women (Figure 1).

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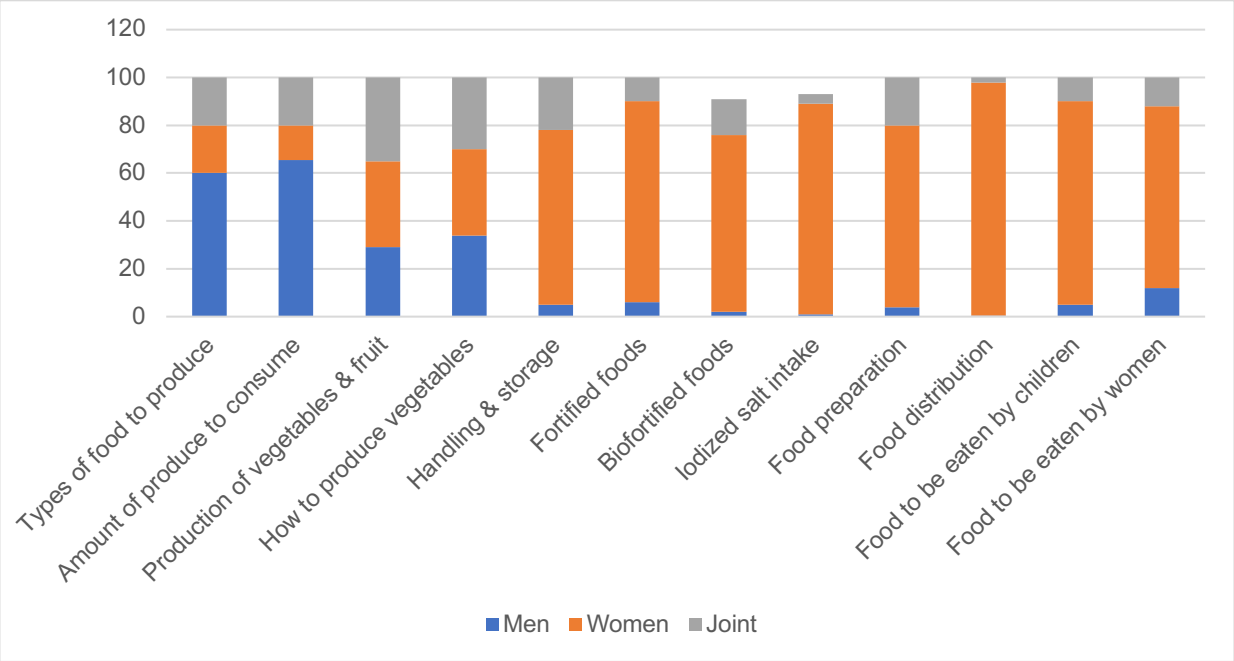

Figure 1: Household decision-making process on food production and consumption

The results also show increased status of women's independent or joint decision-making on vegetable and fruit production and allocation for home consumption in the study area compared to their status in decision-making on other food crops production. These observations are similar to another study done in regions with similar socio-cultural characteristics [16]. This study also found that women take control of agricultural produce when it moves from farm to dish and their status in decision-making processes tends to rise as food moves from production to home consumption, while men's status tends to decline. This observation is similar to those reported in other reports [17, 18].

Women's dietary diversity

Minimum dietary diversity for women (MDD-W), is an indicator of dietary quality and adequacy of micronutrient intake validated for women aged 15 to 49 years old based on ten food groups [19]. The mean dietary diversity score for the women in this survey was 3.8±1.4 (Table 2). Nearly half of the women (44%) consumed less than or equal to three food groups the day preceding the study. There was a significant variation of MDD-W across the two regions. The proportion of women who achieved their minimum dietary diversity in the Oromia region (36%) was three times more than women who achieved their minimum dietary diversity in the SNNP region (12%). Only 15% of women reported having eaten any eggs, meat/poultry, and fish the previous day. Low dietary diversity among women has been found in different regions in Ethiopia [20, 21, 22] and therefore continued

targeting of women in nutrition interventions will go a long way to improving the nutrition status not only of the women but also the children in their households.

Awareness of malnutrition, micronutrient deficiencies and consumption of micronutrient-rich foods

Majority of the respondents (>95%) could recognize if someone in their household was malnourished which is characterized by fatigue and general weakness. Malnutrition was reported to be a major problem in the area by the FGD participants. Lack of enough money to buy food (87%) and unavailability of different food groups locally (71%) were the main reasons for lack of a diverse diet in the study area. Many respondents (72%) were aware that eating foods enriched with micronutrients, such as iron and vitamin A would prevent malnutrition in their household.

Red meat was reported as a major source of iron-rich foods by most of the respondents (78%) while carrots were reported to be a major source of Vitamin A (Table 3). Body weakness, paleness and headache were the most common symptoms of inadequate intake of iron-rich foods reported by the respondents. Majority of the respondents (88%) reported that they knew about iron-deficiency anaemia, vitamin A deficiency (83%) and problems related to iodine deficiency, such as goitre (69%). Majority of respondents knew about the benefits of eating iron rich foods (93%) and vitamin A-rich foods (90%). There was a lack of knowledge on iron and vitamin A fortified or biofortified sources of food. In the study, all FGD participants stated that they were unable to distinguish between the fortified and non-fortified foods in the market, and, therefore, could not make an informed choice when it came to buying products fortified with micronutrients.

Attitudes related to malnutrition, micronutrient deficiencies and consumption of micronutrient-rich foods

Nearly three-quarters (74%) of the respondents were not likely to think that their household may have undernourished members and only a tenth (11%) thought malnutrition is a very serious issue (Table 4). When asked about the likelihood of having a household member that has a micronutrient deficiency, about 4 of every 10 respondents thought that it was not likely that they had an iron (40%) or vitamin A (38%)-deficient household member. More than half of the respondents (60%) thought that it was a serious problem when their household members did not eat iron-rich foods while 42% reported that lack of iodized salt is a serious issue. Slightly more than half (52%) reported that it was a serious issue to have vitamin A deficiency. This study showed that there was a positive attitude towards the presence and/or absence of malnutrition, micronutrient deficiencies and consumption of micronutrient rich foods. Attitude is known to be a good predictor of behaviour [23]. From the findings, it is then possible that the participants would act

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towards reducing the prevalence of malnutrition specifically micronutrient deficiencies by consuming micro-nutrient rich foods.

Practice related to consumption of micronutrient-rich foods in the household

Nearly all respondents had consumed starchy staples the previous day (98%). Participants in the FGDs and KIIs also noted that community members in the study area mostly consumed starchy foods, with some opting to sell some nutritious foods in exchange for other foods, such as coffee and sugar. This finding is similar to other findings which showed almost all women consumed grains, roots and tubers in Ethiopia [24]. More than half of the respondents consumed iron-rich (53%) and vitamin A-rich (83%) foods in the last 24 hours prior to the survey (Table 5). The most consumed micronutrient-rich foods were legumes (mixed beans, baked beans, lentils, chickpeas) and dark leafy green vegetables. While all surveyed participants responded that they used salt to cook meals, only 39% reported using iodized salt. The FGD and KII participants stated that the local community usually consumes non-iodized salt, and in very rare occasions did they consume packed and iodized salt. Some of the reasons given were a lack of awareness about the existence of iodized salt and affordability. The results show that there is a knowledge and practice gap in the consumption of iodized salt in the study area.

Awareness, attitude and practices related to production and preservation of vegetables and fruits in the household

All survey respondents knew about the benefits of producing (91%) and preserving (84%) fruits and vegetables (Table 6). Some FGD participants stated that they did not know about the health benefits of eating fruits and vegetables before the start of the SAA project, but they now have increased awareness.

Slightly more than half of the respondents thought it was unlikely that they would produce (54%) fruits and vegetables for home consumption. Nearly half (47%) of the respondents thought it was a very serious problem if a household is not producing fruits and vegetables in a home garden for home consumption. More than half (60%) reported that their households were likely to preserve fresh fruits and vegetables for home consumption.

Most of the respondents had produced fruits and vegetables in home gardens within the last three months prior to this survey. Cultural rules or taboos were not strong against production and consumption of fruits and vegetables. It is possible to promote the production of fruits and vegetables and have a large uptake in the community. Over two-thirds of the respondents (69%) preserved fresh fruits and vegetables at home. Home gardens play a highly significant role in food security in both urban and rural settings. Fruit and vegetable production in the small farming

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systems have been found to mainly take place in home gardens in Ethiopia [25] and women tend to be in control of these gardens especially when used for home consumption [26, 27, 28].

Self-efficacy to produce and prepare micronutrient rich foods

About a third (34%) of the respondents said it was very difficult for their households to prepare meals with iron-rich foods (Table 7). Almost three-quarters (73%) of the respondents were not confident in preparing meals with iron-rich foods, indicating the perceived inability to prepare iron-rich foods as a major barrier to consumption. Most respondents (71%) were confident that they could prepare meals with vitamin A-rich foods and majority of the respondents (95%) liked the taste of vitamin A-rich foods. These results indicate that while respondents had a positive attitude towards eating micronutrient-rich foods, feeling of inadequacy to prepare the right foods might have hindered consumption of micronutrient-rich foods. A slight majority (57%) of the respondents stated that it was easy for their household to buy and use iodized salt. This finding on perceived ability to buy and use iodized foods could be leveraged to increase awareness on fortified foods and their potential of being micronutrient-rich without necessarily being more expensive than non-fortified foods. Fortification of staple foods has been shown to be an effective way to ensure that many consumers, including women and children who are at risk of vitamin and mineral deficiencies, receive the micronutrients they require [29].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

This study showed both men and women participate in agricultural production activities but due to existing gender norms, there is variation in the patterns of men's and women's engagement and decision making along the food chain. The study also showed the existence of low dietary diversity among women of reproductive age. Benefits of biofortified and fortified foods are still largely unknown among community members in the study area which then hinders their use. While majority of the respondents were aware of and had a positive attitude towards the importance of consuming vitamin A and iron-rich foods including fruits and vegetables, and using iodized salt there is still a gap between knowledge and practice in the consumption of these micronutrient rich foods. Activities that would positively change nutritional behaviours such as consumption of fortified foods, biofortified foods, eggs, milk and milk products would be encouraged to improve women's dietary quality.

Intentional design of a context- and gender-specific implementation plan to empower women in household decision-making processes and strengthen the link between gender and nutrition from production to consumption is recommended. In addition, since women were shown to be more involved in decision-making around

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the production and consumption of fruits and vegetables, it may therefore be "low-hanging fruit" for SAA to support fruit and vegetable production in home gardens to improve both household diet quality and ability of women to make more decisions.

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Authors' Contributions

CM-M was responsible for the overall study including design, tools development, data collection, data analysis, report development and client management process. GGG, HT and AT led all the field-related activities in Ethiopia including tool development, sampling, data collection, data analysis and drafting of the report. AO and GM provided the technical background of the project and were involved in study design and reporting.

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Table 1: Respondents' sociodemographic characteristics

Characteristics of the respondents	Male (n=185, %)	Female (n=126, %)	Total (n=311, %)
Average age of the respondent in years	39	35	38
With no education	8	22	13
With primary education	50	59	54
With secondary education	35	19	29
With higher education	7	0	4
Proportion of married respondents	96	88	92
Average number of household members	7	7	7
Number of years respondent has been farming	23	19	21
Number of years respondent has worked with SAA	1.5	1.4	1.4

Table 2: Women's dietary diversity and consumption patterns

Characteristic	Oromia (%)	SNNP (%)	Total (%)
Average dietary diversity score*	4.3±1.3	3±1.3	3.8±1.4
Low dietary diversity (≤3 groups)	29	74	44
Medium dietary diversity (4–5 groups)	57	23	46
High dietary diversity (≥6 groups)	14	3	10
Women meeting minimum dietary diversity	36	12	27
Consumed staples	98	97	98
Consumed pulses	76	72	75
Consumed nuts or seeds	65	50	60
Consumed milk or milk products	83	23	62
Consumed meat, poultry, or fish	15	3	7
Consumed eggs	12	3	9
Consumed dark green leafy vegetables	50	90	85
Consumed other vitamin A-rich fruits or vegetables	88	34	69
Consumed other vegetables	54	80	63
Consumed other fruits	16	4	12

*Characteristic is a mean ± SD not proportion. ≤3 represents women ate less than or equal to three food groups, 4-5 represents women ate four to five food groups, & ≥ 6 represent women ate equal to or greater than six food groups in the last 24 hours prior to the survey

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Table 3: Knowledge about micronutrient deficiencies and consumption of micronutrient-rich foods

Knowledge of the respondent	Male (%)	Female (%)	Total
Aware of iron-deficiency anaemia	87	88	87
Know benefits of eating iron-rich foods	93	92	93
Aware of vitamin A deficiency-related symptoms	89	88	89
Aware of vitamin A deficiency	86	78	83
Aware of benefits of vitamin A-rich foods consumption	93	86	90
Aware of benefits of OFSP consumption	39	41	40
Aware of iodine deficiency	72	66	69
Aware of how iodine deficiency can be prevented	57	59	58

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Table 4: Attitudes related to malnutrition, micronutrient deficiencies and consumption of micronutrient-rich foods

Attitude		Male (%)	Female (%)	Total (%)
Perceived likelihood that a household may have undernourished members	Not likely	75	73	74
	Not sure	4	3	3
	Likely	21	24	21.6
How serious is malnutrition for your household members' health?	Not serious	57	57	57
	Serious	25	24	24
	Very Serious	11	10	11
Likelihood of a household member being iron-deficient	Not likely	44	35	40
	Likely	40	44	41
	More likely	9	9	9
The seriousness of not consuming foods rich in iron	Not serious	12	13	12
	Serious	56	64	59
	Very serious	28	17	23
How likely do you think it is that any of your household members lack vitamin A in their body?	Not likely	37	40	38
	Not sure	9	15	12
	Likely	51	40	46
	More likely	3	6	4
Perceived seriousness for lack of vitamin A.	Not serious	22	24	23
	Not sure	6	8	7
	Serious	51	52	52
	Very serious	21	16	19
Perceived likelihood that household lacks iodized salt	Not likely	30	33	31
	Not sure	17	14	16
	Likely	30	35	32
	More likely	23	18	21
How serious do you think not using iodized salt in the body is?	Not serious	16	19	17
	Not sure	33	33	33
	Serious	42	43	42
	Very serious	9	6	8

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Table 5: Practice related to consumption of micronutrient-rich foods

Practice		Male (%)	Female (%)	Total (%)
Consumed iron-rich foods yesterday		49	60	53
Iron-rich foods consumed yesterday by the household	Legumes	68	66	67
	Dark leafy vegetables	58	63	60
Buy fortified edible oil or wheat flour		79	77	78
Type of salt used	Iodized	38	41	39
	Not iodized	47	40	45
	Don't know	15	18	16

Table 6: Knowledge, attitudes and practices related to the production and preservation of vegetables and fruits

Characteristic		Male (%)	Female (%)	Total (%)
Knowledge on vegetables and fruits preservation				
Household know how preserve fresh fruits and vegetables	Yes	82	86	84
Attitudes towards producing and preservation of vegetables and fruits				
Likelihood of household producing fruits and vegetables in a home garden	Not likely	57	50	54
	Not sure	1	2	2
	Likely	38	44	40
	More likely	4	4	4
How serious do you think it is to not produce fruits and vegetables in a home garden?	Not serious	15	10	9
	Not sure	0	0.8	0.3
	Serious	38	52	44
	Very serious	54	37	47
Likelihood of household not preserving fresh fruits and vegetables for consumption	Not likely	63	56	60
	Not sure	1	2	1
	Likely	35	40	37
	More likely	2	3	2
Practices on household vegetable and fruit production and preservation				
Produce fruits and vegetables in a home garden within the last three months	Yes	92	87	90
Preserve fresh fruits and vegetables at home	Yes	66	70	69

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Table 7: Self-efficacy towards preparation and consumption of micronutrient-rich foods and production of fruits and vegetables

Action		Male (%)	Female (%)	Total (%)
Perceived difficulty for the household to prepare iron-rich foods	Not difficult	16	22	18
	Somewhat difficult	52	42	48
	Very difficult	32	36	34
Perceived confidence in preparing iron-rich foods	Not confident	15	17	16
	Less confident	61	52	57
	Confident	22	28	24
	More confident	3	3	3
Perceived difficulty for household to prepare vitamin A-rich foods?	Not difficult	17	28	22
	Somewhat difficult	56	40	50
	Very difficult	27	32	29
Perceived confidence in preparing vitamin A-rich foods?	Not confident	12	17	14
	Less confident	52	50	54
	Confident	28	31	29
	More confident	3	2	2
Perceived difficulty for household to buy and use iodized salt	Not difficult	55	60	57
	Somewhat difficult	29	29	29
	Very difficult	16	10	14
Perceived difficulty for household to produce fruits and vegetables in a home garden	Not difficult	66	66	66
	Somewhat difficult	25	26	26
	Very difficult	9	8	8
Perceived confidence to produce fruits and vegetables in a home garden	Not confident	6	7	6
	Less confident	24	29	26
	Confident	57	54	56
	More confident	12	10	11

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REFERENCES

1. **International Food Policy Research Institute.** Global Nutrition Report 2015: Actions and accountability to advance nutrition and sustainable development. Washington, DC. 2015 http://dx.doi.org/10.2499/9780896298835

2. **Ethiopian Public Health Institute (EPHI) and ICF.** Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF 2021. https://dhsprogram.com/pubs/pdf/FR363/FR363.pdf *Accessed September 2023.*

3. **Ethiopian Public Health Institute.** Ethiopian National Micronutrient Survey Report 2016. Addis Ababa, Ethiopia 2016 http://repository.iifphc.org/handle/123456789/1075 *Accessed September 2023.*

4. **Verhart N, Wijngaart van den A, Dhamankar M and K Danielsen** Bringing agriculture and nutrition together using a gender lens. Royal Tropical Institute (KIT) and Netherlands Development Organisation (SNV), KIT Working Papers 2015-6.

5. **Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C and J Rivera** Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008; **371(9608):** 243-60. https://doi.org/10.1016/s0140-6736(07)61690-0

6. **FAO, IFAD, UNICEF, WFP and WHO.** In Brief to The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. FAO, Rome, 2023. https://doi.org/10.4060/cc6550en

7. **Ersino G, Zello GA, Henry CJ and N Regassa** Gender and household structure factors associated with maternal and child undernutrition in rural communities in Ethiopia. *PloS One.* 2018;13(10): e0203914. https://doi.org/10.1371/journal.pone.0203914

8. **Moser C** Gender planning in the third world: Meeting practical and strategic gender needs. *World Development.* 1989; **17(11):**1799–825.

9. **Government of the Federal Democratic Republic of Ethiopia**. National Nutrition Program I, 2008-2015. Addis Ababa, Ethiopia 2008.

10. **Sasakawa Africa Association.** Strategic plan 2021-2025, Addis Ababa Ethiopia, 2021 https://www.saa-safe.org/elfiles/IJ0sUVij/SAA%20Strategic%20Plan%202021-25_En.pdf *Accessed September 2023.*

11. **FAO.** Minimum dietary diversity for women. FAO, Rome 2021. https://doi.org/10.4060/cb3434en

12. **World Bank.** The World Bank Annual Report 2016. Washington, DC 2016. http://hdl.handle.net/10986/24985

13. **Badstue L, Petesch P, Farnworth CR, Roeven L and M Hailemariam** Women Farmers and Agricultural Innovation: Marital Status and Normative Expectations in Rural Ethiopia. *Sustainability,* 2020; **12:** 9847. https://doi.org/10.3390/su12239847

14. **Gebre GG, Isoda H, Rahut BD, Amekawa Y and H Nomura** Gender differences in agricultural productivity: evidence from maize farm households in southern Ethiopia. *Geo Journal* 2021;86: 843–864. https://doi.org/10.1007/s10708-019-10098-y

15. **Gebre GG, Isoda H, Rahut BD, Amekawa Y, Nomura H and T Watanabe** What Explains Gender Gaps in Household Food Security? Evidence from Maize Farm Households in Southern Ethiopia. *Soc. Indic. Res.*, 2021;155: 281–314. https://doi.org/10.1007/s11205-020-02600-8

16. **Abebe T and D Mulu** The role of women in the management and utilization of home garden: The case of Dale District, in Southern Ethiopia. *Asian J. Plant Sci. and Res.,* 2017; **7(4):** 41–54.

17. **Njuki J, Parkins JR, Kaler A and S Ahmed** Gender, agriculture, and food security: Where are we? **In:** Njuki J, JR Parkins and Kaler A (Eds.), Transforming gender and food security in the global south. New York. Routledge. 2016:1-18.

18. **Gebre GG, Isoda H, Amekawa Y, Rahut B D, Nomura H and T Watanabe** Marketing Efficiency among Gender-Based Decision- Making Farm Households in Southern Ethiopia. *J. Int. Food & Agribusiness Marketing*, 2022; **347(45):** 538–563. https://doi.org/10.1080/08974438.2021.1911906

19. **INDDEX Project.** Data4Diets: Building Blocks for Diet-related Food Security Analysis. https://inddex.nutrition.tufts.edu/data4diets Tufts University, Boston, MA. 2018. *Accessed on 12 January 2022.*

20. **Tilahun AG and AM Kebede** Maternal minimum dietary diversity and associated factors among pregnant women, Southwest Ethiopia. *BMC Nutr* 2021: **7(66)**. https://doi.org/10.1186/s40795-021-00474-8

21. **Hirvonen K and A Wolle** Consumption, production, market access and affordability of nutritious foods in the SNNP Region of Ethiopia. Alive & Thrive and International Food Policy Research Institute. Addis Ababa, Ethiopia: 2019. http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/13348 *Accessed March 2022.*

22. **Mesfin BA, Argaw AT, Getahun NF, Emiru DA, Aserese AD and GY Matebe** Minimum Dietary Diversity and Associated Factors Among Pregnant Women Living in Arba Minch Health and Demographic Surveillance Sites, Southern Ethiopia, 2022. *Health Serv Res Manag Epidemiol.* 2023 Apr 25. https://doi.org/10.1177/23333928231166671

23. **Norman P** Applying the health belief model to the prediction of attendance at health checks in general practice. *Br J Clin Psych.* 1995; **34:** 461-470.

24. **Merga G, Mideksa S, Dida N and G Kennedy** Dietary diversity and associated factors among women of reproductive age in Jeldu District, West Shoa Zone, Oromia Ethiopia. *PLOS One* 2022: **17(12).** https://doi.org/10.1371/journal.pone.0279223

25. **Hengsdijk H, Sertse Y, Tesfaye S and E Likoko** Scoping Study on Fruits and Vegetables: Results from Ethiopia Report. Wageningen Economic Research 2021: 2021-2108.

26. **Gebre GG, Legesse T and AA Fikadu** Food safety knowledge, attitude, and practice among male and female food handlers: Evidence from fruit and vegetable producers in Ethiopia. *Heliyon*, 2023; **9(6):** e17301. https://doi.org/10.1016/j.heliyon.2023.e17301

27. **Aregu L, Bishop-Sambrook C and R Puskur** Opportunities for Promoting Gender Equality in Rural Ethiopia through the Commercialization of Agriculture. Improving Productivity and Market Success of Ethiopian Farmers Project (IPMS) Addis Ababa, Ethiopia 2010: *Working Paper No. 18* pp. 1-68 https://hdl.handle.net/10568/1788 *Accessed August 2022.*

28. **Gebre GG, Isoda H, Rahut DB, Amekawa Y and H Nomura** Gender differences in the adoption of agricultural technology: the case of improved maize varieties in southern Ethiopia. *Women's Stud. Int. Forum.* 2019; **76**. https://doi.org/10.1016/j.wsif.2019.102264

29. **Ara G, Khanam M, Rahman AS, Islam Z, Farhad S, Sanin KI, Khan SS, Rahman MM, Majoor H and T Ahmed** Effectiveness of micronutrient-fortified rice consumption on anaemia and zinc status among vulnerable women in Bangladesh. *PLoS One.* 2019 Jan 10; **14(1):** e0210501. https://doi.org/10.1371%2Fjournal.pone.0210501

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INTRA-HOUSEHOLD GENDER DYNAMICS AND THE ADOPTION OF BEST PRACTICES AMONG TEFF FARMERS IN ETHIOPIA

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ABSTRACT

Teff farming in Ethiopia is commonly seen as being dominated by men, with women playing supporting roles on some aspects of the growing process. This study is rooted in existing literature on drivers of Best Practices (BP) adoption and decision-making theory and is unique in that it focuses primarily on understanding how gender-specific factors influence decision-making on the adoption of BPs. To this end, the study assessed the intra-household gender dynamics at play within farming households in Amhara, Ethiopia, and their influence on deciding whether or not to adopt agricultural best practices for teff farming. These gender dynamics include the division of labor between women and men, intra-household decision-making processes, social and cultural norms and access factors (such as access to information, training, credit and control over income). Using data from a three-round quantitative survey with one woman and one man in 555 households, as well as focus group discussions and in-depth interviews, this study is uniquely placed to assess the impact of these gender-specific and intra-household factors on the adoption of best practices. The findings show that households where women are more involved in teff farming, have less input into decision-making, less control over income, and more access to information and adopt on average more best practices. However, there is significant heterogeneity when looking at individual best practices, with women's decision-making power or access to resources particularly important for specific practices such as sowing in rows. This study implies that designing more gender-sensitive agricultural programs and extension services in Ethiopia – specifically on practices relevant to women and men – can increase best practice adoption, with the ultimate aim of increasing productivity and income for teff farming households, and empowering women. Since male and female farmers are involved in different practices, access to resources and decision-making power have different impacts depending on the gender of the respondent and the practice analyzed, and there is no "one size fits all" solution to improve teff farming productivity.

Key words: intra-household dynamics, decision-making, gender roles, best practice adoption, teff

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INTRODUCTION

Teff is one of the most important cereal crops in Ethiopia, accounting for twelve percent of Ethiopians' food expenditures [1]. Teff farmers, therefore, play a critical role in feeding the country, and understanding what drives teff farmers to adopt agricultural best practices (BPs) is a priority. Across sub-Saharan Africa, socio-economic characteristics (such as higher education, larger household size) and resource endowments (such as more assets, higher income, larger farm size) are commonly found to be associated with more adoption of farming BPs [2]. However, the importance of gender dynamics as a driver of best practice adoption is often ignored or simplified to a binary variable of the gender of the household head. This masks the complexity of intra-household dynamics which could be playing a role in farmer decisions to adopt or not adopt a BP. The research question, therefore, asks:

> *How do intra-household gender dynamics and gender-specific factors drive the adoption of BPs in teff farming households in Ethiopia?*

This mixed-methods study investigated the intra-household gender dynamics of teff farming in Amhara, Ethiopia, and tested whether these gender dynamics are driving the adoption of BPs for teff farming. The study focused on teff farming households living in Gonji Kollela and Yielmana Densa woredas in the West Gojjam zone of Amhara in the 2021-2022 teff growing season.

Conceptual Framework

This study is rooted in existing literature on drivers of BP adoption and decision-making theory, and is unique in that it focuses primarily on understanding how gender dynamics influence decision-making on the adoption of BPs by speaking to both women and men in each household. Figure 1 illustrates a conceptual framework for the study, in line with the approach proposed by Badstue *et al.* [3]. Each adult in teff farming households in Ethiopia is impacted by the factors differently, which influences the individual's participation in the decision to adopt or not adopt the BP.

The gender-specific factors explored were:
Gendered division of labor, includes how male and female household members engage with farming at the different stages of the teff growing cycle.
Intra-household decision-making, includes power relations within the household and how much input participants have into decisions concerning teff farming.
Access factors, include sources of support, such as access to credit, memberships in social groups, access to sources of information such as agricultural extension training, and control over the use of income.

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Social and cultural norms, includes perceptions of self-efficacy[1], such as beliefs that one is improving as a farmer, perceptions of self-confidence, and the recognition one feels they receive from their community (being respected as a teff farmer).

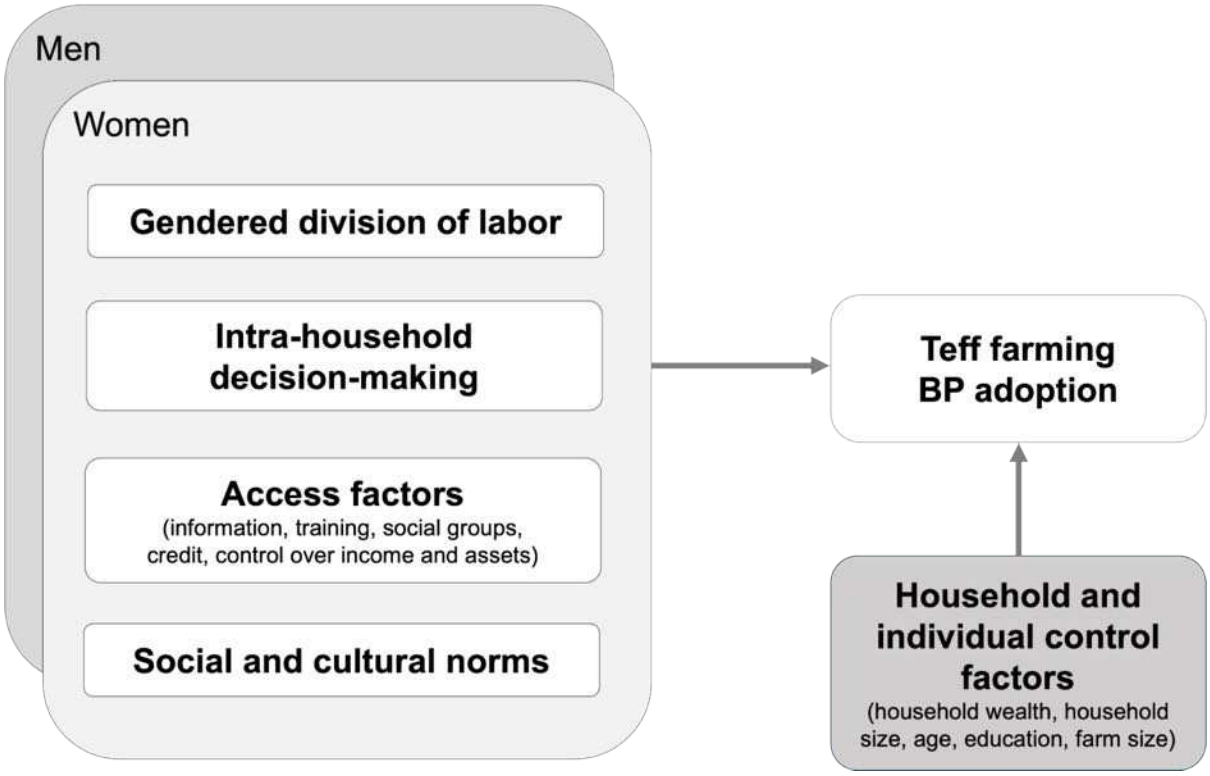

Figure 1: Conceptual framework for the study (adapted from Badstue *et al.* [2])

The key hypotheses were as follows:

H1: Increased involvement in teff farming from both men and women has a positive impact on best practice adoption [4].
H2: Women's involvement in decision-making has a positive impact on the adoption of best practices where women are heavily involved in.
H3: Social norms that downplay women's contributions to teff farming and focus on men leading as teff farmers have a negative impact on the overall adoption of BPs.
H4: Women's increased control over income has a negative impact on household best practice adoption [5, 6].

[1] According to Albert Bandura, who first defined the term, self-efficacy is "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations"

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MATERIALS AND METHODS

The sampling frame for this study included all dual-adult (at least one man and one woman) teff-growing households registered with a development agent (DA) in communities where Sasakawa Africa Association (SAA) provides training to government DAs[2]. The focus was on dual-adult households to better analyze the intra-household power dynamics between men and women [6].

Quantitative data collection consisted of a three-round household survey with 555 households in South Gonder and West Gojjam regions of Amhara state. One adult man and one adult woman from each household were interviewed in each round, for a total of 3,330 individual quantitative surveys. An observation of one teff farming plot was also conducted at each household at each time to evaluate the adoption of BPs. Data were collected during land preparation and sowing in August 2021, during weeding and fertilizer application in October 2021, and during harvesting in February 2022.

Qualitative data collection consisted of focus group discussions (FGDs) with farmers, both as mixed-gender and women-only groups; in-depth interviews (IDIs) with farmers (women, men and couples), and key informant interviews (KIIs) with development agents (DAs). In total, 9 FGDs, 12 IDIs, and 4 KIIs were conducted.

RESULTS AND DISCUSSION

The section begins with descriptive statistics and qualitative insights on the four gender- specific factors, followed by an econometric analysis of the gender-specific drivers of best practice adoption[3].

Gendered Division of Labor and Social Norms

Women and men were asked about their personal level of participation in each phase of the teff farming growing season. Activities that were seen as male-dominated were land preparation, harvesting and threshing, fertilizer application and sowing. Women were heavily involved in weeding the teff, and in storage, as they managed the teff for household consumption. Women also supported men with sowing, applying fertilizer, clearing the land for ploughing or preparing food for hired laborers during harvesting. This is in line with findings from Tekalign *et al.* [7], which found that men dominated land preparation and marketing, while women

[2] The sample was stratified by kebele, and then a three-stage cluster random sampling method was employed. The primary sampling unit being the development agent (DA), the secondary sampling unit being the community demonstration plot (CDP), and the tertiary sampling unit being households. Within the household, two people were interviewed: one adult man and one adult woman

[3] A detailed overview of best practices included in analysis and overall adoption rates is included in Appendix 1. Appendix 4 provides summary statistics on the socioeconomic status and demographic characteristics of the sample

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dominated weeding and harvesting activities. Weeding is the most labor-intensive activity, followed by threshing [8].

Plough agriculture has been associated with more traditional, persistent gender norms across cultures, and a stronger gender division of labor [9]. Teff farming is no exception, as certain activities are coded as male-dominated, while others are associated with women, although in practice, women and men often work side by side. Farming is labor-intensive and a large portion of family income, so most women cannot afford to not get involved in farming. In some cases, this results in a double workload for women, as they are also responsible for household chores. One woman farmer noted, *"We help with land preparation; we help with planting…we do everything together. I would say the women's workload is heavier."* Particularly during harvest time, women's workload tends to be particularly heavy, as noted by a woman farmer, *"those days are very challenging for the woman. She suffers. There is too much work to do."*

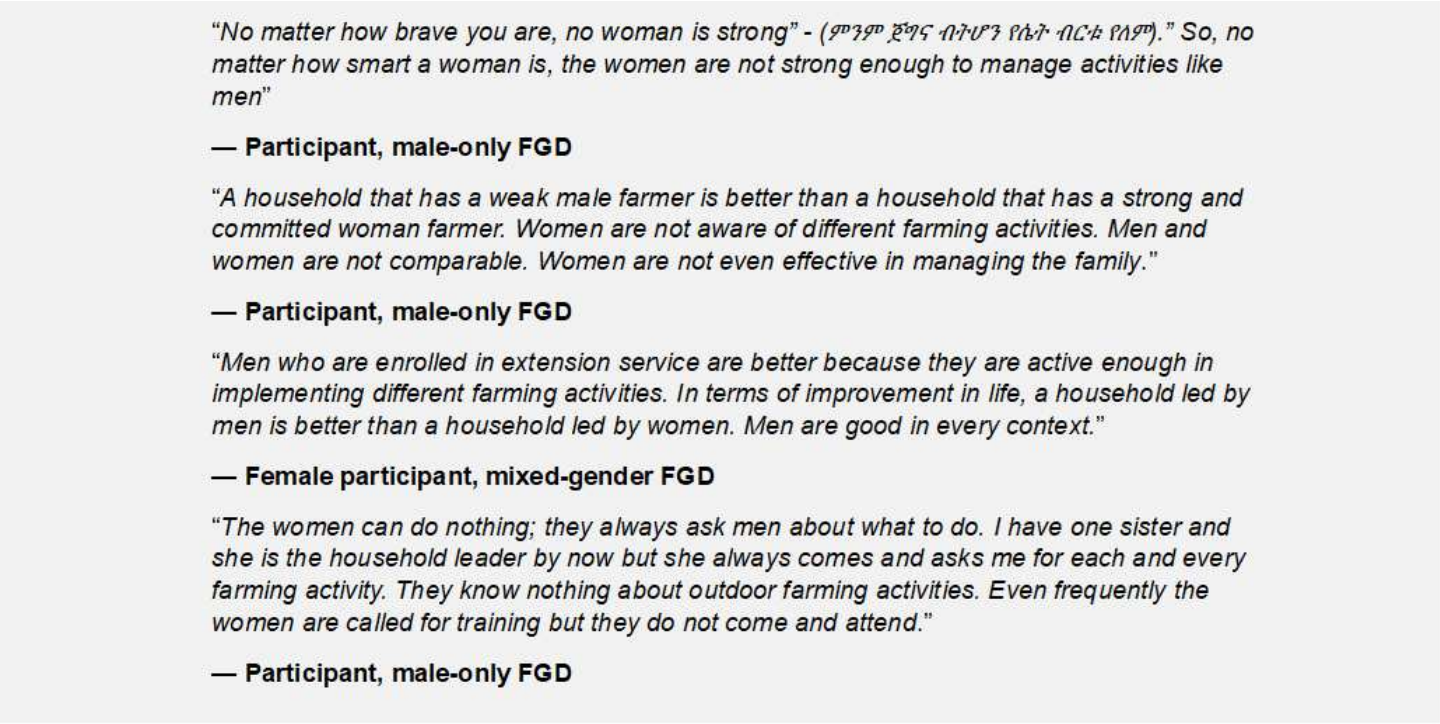

Figure 2: Farmer quotes on gendered division of labor and social norms

Men in the sample assumed the plot manager role in 97% of plots analyzed, meaning that women-managed plots are rare. Women are often perceived to be incapable of independently managing plots, requiring the support of men to manage more labor-intensive activities. Insights from focus group discussions show that women were perceived to be less effective teff farmers, particularly by men.

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Farmers volunteered multiple opinions on why men farmers are superior (some are shown below).

Intra-household Decision-making

Using modules from the Pro-WEAI [10], both women and men in the same household were asked to indicate their input into decision-making on various teff practices, and which member of their household was primarily responsible for a variety of teff farming decisions.

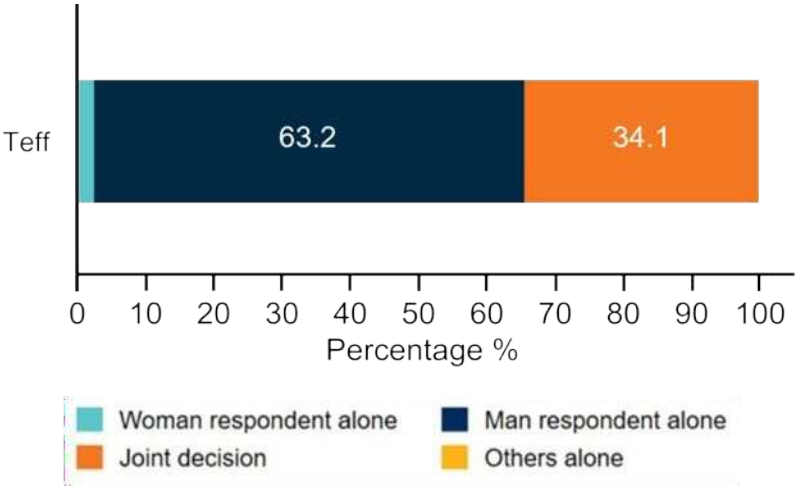

Figure 3: Person Responsible for Decision Making on Farming Teff and Other Grains

As shown in Figure 3, men alone were responsible for most productive decisions when farming teff. This aligns with gender roles where despite women's involvement in various stages of teff farming, it is seen as the man's responsibility to lead the process. Decision-making often takes the form of a discussion between spouses, who may also involve other household members or friends, neighbors or DAs.

Depending on the farming activity, women and men are differently involved in decision- making. Practices where both women and men agreed that men play a leading role included land preparation, sowing, fertilizer application, and pest management, although women often still report some input into the decision. Practices where decisions are made jointly included post-harvest management, storage, and selling. As a male farmer stated, "storing and selling are the two activities that need serious attention of both the women and men. Both discuss and decide in this case." For three practices – weeding, harvesting and threshing – men reported being the primary decision makers, while women report joint decision-making. For instance, 62% of men reported deciding alone how frequently the teff was weeded, while 71% of women reported this decision was made jointly

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between the man and the woman. A similar situation occurs for harvesting, where 75% of men claimed sole decision-making power, while 53% of women reported joint decision-making. This disagreement is possibly due to women's high involvement in these activities, rather than direct input into how the activity per se should be carried out.

Access and Control Factors

Access to Information

Access to information on teff BPs can occur through multiple channels: intra-household communication, membership in social groups, or extension training attendance. Overall, 78% of the men attended at least one teff training in their lives, while only 30% of the women attended any training. Women and men were also asked individually to assess their extent of access to information to make decisions on teff farming – on a four-point scale from "not at all" to "a high extent". Men reported significantly higher access to information on teff farming than women.

Access to Social Groups

Almost all (96%) of men belonged to a social group, compared to 76% of women. The most common groups for both men and women were mutual help and insurance groups registering 82% membership. About half (53%) of men and women in the study population also belonged to religious groups. Agricultural groups registered very low membership rates for both men and women.

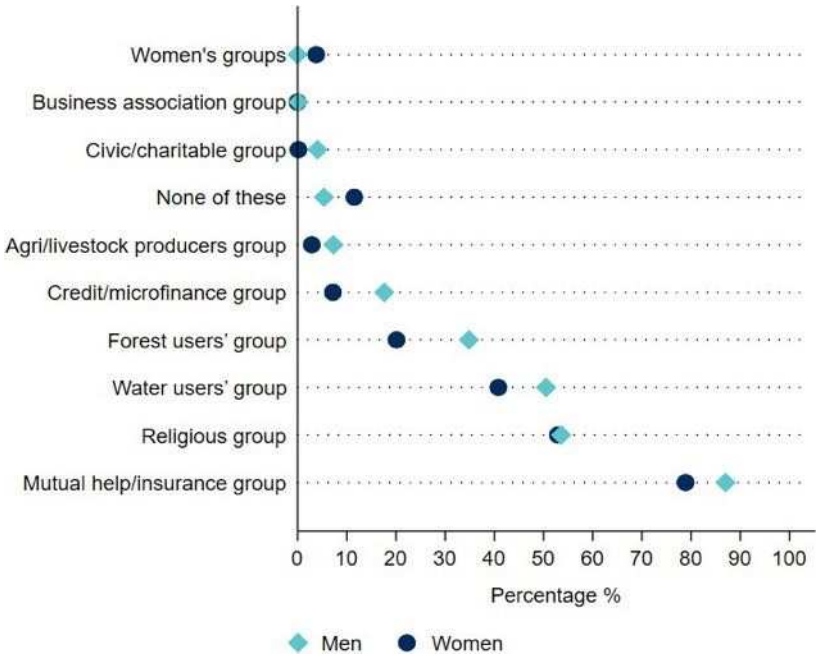

Figure 4: Group Membership, Disaggregated by Gender

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Control over Income and Assets

Men and women reported similar levels of control over income from teff. Qualitative data revealed that income from large quantities of teff farming was primarily controlled by men, while women controlled income from small quantities of teff. Respondents reported an understanding that this income would be used for inputs for the next year, or other household purchases, and that a husband should not use the income just for himself, as stated by a male farmer: "This is because we trust each other and know that the other will not do things that are harmful." This is in line with dynamics on control of income observed by Bjorvatn *et al.* [11] which found that husbands and wives reported having equal say in how to share and spend income, and that relatively few thought that the spouse was hiding money from them or disapproved of the spending decisions of the spouse.

Interviewer: "What if the husband insists he will sell the teff?"

Female: "But, the teff is ours (women's) once it is stored."

Male: "There is a story about a farmer where he sings and is playful when plowing planting and harvesting. Later, when he is threshing, his tone is low (as if he was sad). When people ask him 'Why do you plow and plant with such great excitement but sing sad songs when you are threshing?' and he said 'Well, we (men) are about to hand over the teff to women.'"

Female: "Yes. Once the teff is home, it is our (decision)."

— Participants, mixed-gender FGD

Figure 5: Farmer quotes on teff sales

Access to Savings and Credit

More than half (55%) of men and 25% of women had an account with a bank or microfinance institution. Of these accounts, 19% of both men and women reported having a joint account, while 80% (81% of men and 78% of women) had an individual account. Almost all (93%) of the sampled population reported being able to access a credit from at least one source. Women were significantly more likely to have no access to any credit, from either formal or informal sources (10% of women; 5% of men).

Best Practice Adoption Rates

Adoption rates were gathered through plot observations[4] and were reported at the household level. The 20 BPs[5] align with the Ethiopian extension system's training guidance for the study location, as provided by SAA. Some BPs were readily

[4] These visits were conducted with one household member (the manager of the plot, usually a man) on the household's primary teff plot

[5] Appendix 1 provides the list of 20 practices and their adoption criteria. Appendix 2 provides details on the adoption of individual best practices, and how households are – or are not – applying them

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adopted by all households, while some BPs were rarely adopted. The average household adopted 9.2 out of the 20 BPs observed in the study.

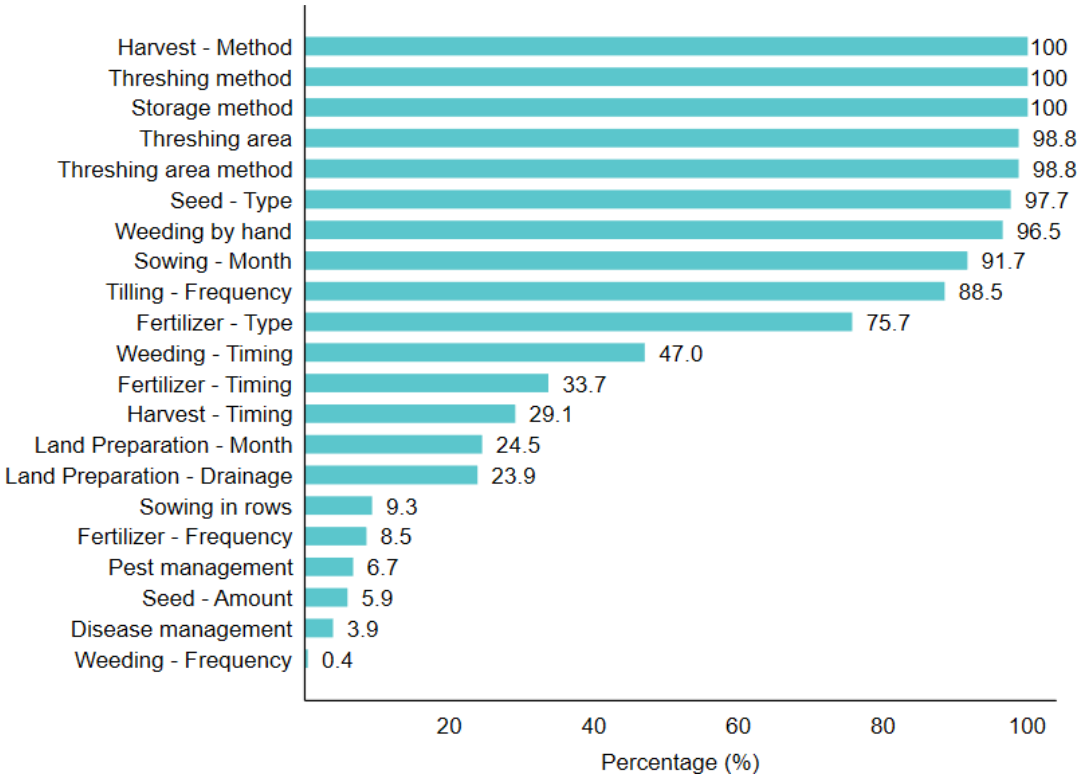

Figure 6: Percentage of households adopting individual BPs (n=555)

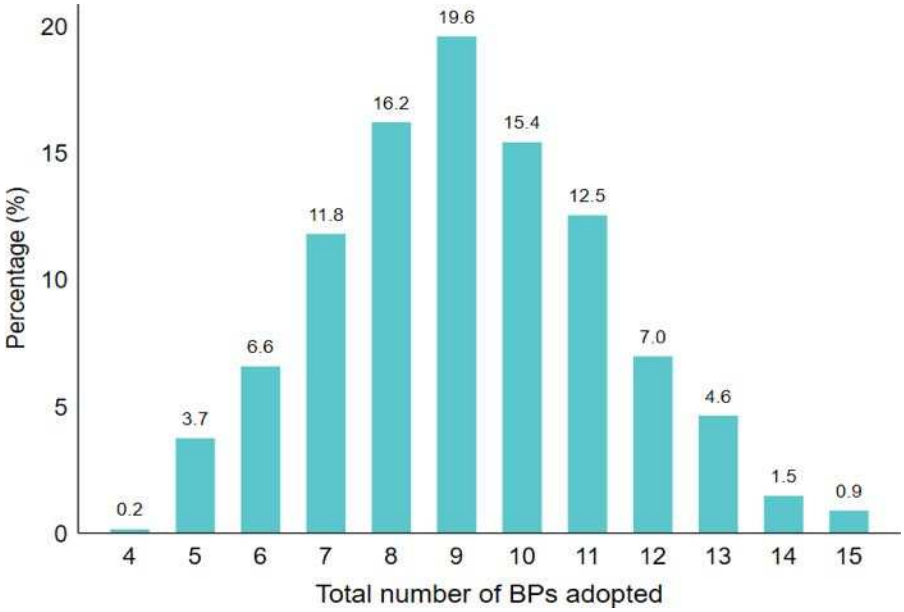

Figure 7: Distribution of total number of BPs adopted by households (out of 20) (n=555)

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Gender-specific drivers of BP adoption

In the literature, factors that are commonly positively associated with BP adoption include higher income [12], more education [13], larger farm size [13, 14], more household members [15], access to information [16], access to extension [13], access to credit [13], ownership of livestock [9,13], belonging to social groups [13], or BP-specific factors, like the trialability of the practice or technology, as well as positive farmer perceptions of the technology, and low cost required to adopt [11,15, 16]. For teff specifically, one study found that experience in teff farming, farm size, distance to the market, participation in the farmers' association, extension, and availability of credit are all correlated with the adoption of BPs on teff [17].

The drivers of best practice adoption were primarily explored through regressions to determine associations between gender-specific and control factors and adoption outcomes. Best practice adoption is first defined as a sum of the total number of BPs adopted at the household level. For the drivers of BP adoption, for *i* households consisting of *j* individuals, a linear regression model was used, of the form:

$$BP_i = Roles_j + DM_j + Access_j + Norms_j + HH_i + Indiv_j + \epsilon$$

The study additionally examined each individual BP and employed logistic regression where the dependent variable is a binary variable indicating whether a specific BP is adopted or not. The results are presented in Table 1 and Appendix 3.

Gendered division of labor

For each additional teff farming activity women are involved in, the household adopts 0.2 more BPs out of a total of twenty BPs. For men, a similar relationship exists, as the household adopts 0.4 more BPs on average for each additional teff farming activity men are involved in. Both findings are significant at the 1% level. This is in line with the largely complementarian teff farming model in Ethiopia, where women and men work together in different roles but side by side throughout each phase of the teff growing cycle [4]. When looking at individual BPs, this effect holds for fertilizer application, where households are twice as likely to apply fertilizer at the right time if the woman reports being involved in the activity, or for sowing in rows, where women's involvement translates into a threefold increase in the probability of adoption.

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Access factors

- ***Access to information:*** For both women and men, having higher access to information is associated with the household adopting more BPs. Households where women reported having higher access to information on teff farming adopted 0.15 more BPs, and households where men reported having higher access to information on teff farming adopted 0.25 more BPs. Looking at specific practices, households where men reported having high access to information on harvesting teff were five times more likely to adopt harvesting BPs, and 40% more likely to adopt the correct land preparation methods. This finding is consistent with the existing literature on best practice adoption. Lack of access to information has commonly been found as a major barrier to the adoption of BPs [1, 18], with limited access to information or low literacy rate to use the information as the number one constraint for women in adopting BPs [19].
- ***Training attendance:*** Women and men were asked if they had ever attended training for teff farming in their lives. Counterintuitively, households where men had ever attended training adopted 0.6 less BPs. This finding requires further investigation and should be interpreted with caution for a few reasons: 1) there is significant variation depending on the specific BP adopted; 2) the study is observational and is not measuring the impact of training through random assignment, so it could be that farmers with less experience and lower BP adoption self-select into attending extension training; 3) the variable used asked if the participant had ever attended training in their lives, and some of these indicated attending training several years ago, suggesting that the lessons of the training may have been forgotten, or that different BPs may have been taught; 4) training attendance is correlated with access to information among the sample, and access to information shows a positive significant association with BP adoption for both women and men; 5) all households in the sample were registered with a DA, thus were in some way connected to the extension system whether attending training or not. Robustness checks using different definitions of training attendance resulted in less statistical significance and smaller coefficients in some cases, but generally found a similar relationship.

  For women, when looking at some individual BPs, there is a positive association between women's training attendance and certain BPs. For weeding, households where women had ever attended training in their lives were 80% more likely to weed at the right time, or attempt sowing in rows. This suggests that training attendance is associated with more BP adoption for women when the training focuses on activities where women play a bigger role

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(for example, weeding, sowing in rows). One potential explanation is community normative gender roles, as both weeding and sowing in rows are practices where women are more likely to play a role.

- ***Control over teff income and access to credit:*** Having more control over teff income is associated with less BP adoption for women, and significantly more BP adoption for men, in line with findings from the literature that show women spend a higher share of their income on household consumption, and female control of resource allocation tends to lower efficiency, in contrast to male control [5, 6]. Households where men made decisions over the use of income resulting from teff adopted on average 0.4 more BPs. For each additional source of credit men had access to, households adopted 0.2 more BPs. Men's access to credit is also associated with a higher probability of using the right fertilizer type, and a higher probability of weeding at the right time. When women had control over income, households adopted on average 0.3 less BPs. This finding may be driven by men culturally having more involvement practices such as purchasing fertilizer or hiring and trading labor. Both these activities require a significant share of the household's income, and it is typically the man who completes the transaction.
- ***Membership to groups:*** Existing literature frequently shows a positive relationship between more group membership and BP adoption [13]. This is commonly explained through a pathway of information sharing, as people in social groups are more likely to converse with other farmers and DAs. On aggregate, the findings show that households where men reported not belonging to any social groups adopted on average 0.9 more BPs (for women, 0.5 more BPs). One hypothesis for this may be that farmers save time by not attending group meetings and social events, and may use this time for teff farming instead, which is labor-intensive. Furthermore, the groups farmers reported attending most were not agricultural in nature, which could further detract from teff farming.

  For women, being members of more groups is associated with more adoption of the harvest timing best practice. Harvesting often commences when women have prepared food for the laborers, so it could be that women in social group settings are influenced by other women in the groups to coordinate food preparation and begin harvesting at recommended times.

Decision-making dynamics

Households where women had more input into decision-making on teff farming adopted on average 0.4 less BPs. In terms of decision-making on individual BPs, the impact of women making more decisions is mixed. For instance, when women

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have more input into decisions, households are more likely to attempt to use the right fertilizer type or weed at the appropriate time. However, when women have more input into fertilizer application or harvesting decisions, households are significantly less likely to harvest teff at the right time.

There are several potential explanations for these mixed findings. In terms of harvest timing, as discussed in the gender roles and decision-making section, women commonly dictate when harvesting begins, as it is linked to food preparation. As one female farmer states, “harvesting begins once the women prepare food.” There is a possibility that women’s time constraints and roles are a bigger determinant of harvest timing than the recommended BPs. Meanwhile, as men are in charge of hiring or trading labor with neighbors for harvesting, increased participation in decision-making could translate into more influence on when the community harvests.

Social and cultural norms

Households where men believed they were respected by their communities as teff farmers adopted

0.6 less BPs, an association that is particularly pronounced for harvesting BPs. This finding should be interpreted with caution, as the sample size is small (n = 26). This perhaps might be owed to overconfidence bias. Indeed, DAs in the sample report farmers exhibiting reluctance to adopt certain practices, due to erroneous beliefs that they know better. For example, although sowing in rows is proven to increase teff productivity, some farmers believed that broadcasting is a better method, as explained by a male farmer, “I believe broadcasting is still the practice that has higher yield. If we apply enough fertilizer, broadcasting is better.”

For women, households where women reported feeling confident in their ability to implement BPs were 60% more likely to weed at the right time, and over twice as likely to apply fertilizer with the right frequency. Men who reported feeling confident were more likely to sow teff in the right month. These findings suggest a relationship between community norms, farmers’ sense of self-efficacy, and specific teff BPs.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The impetus for this study was to understand what drives a teff farming household to adopt BPs, and what role gender dynamics within the household might play in that process. The hypothesis was that certain gender-specific factors and intra-household dynamics might influence adoption decisions. The evidence provided in the previous section confirms this hypothesis in a limited way. The study does find

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numerous gender-specific drivers of adoption, both on specific BPs and at the aggregate sum of practices adopted.

However, while there is evidence of gender playing a role in adoption decisions, further investigation is required to explore in more detail whether the findings are generalizable to the broad teff farming population of Ethiopia. In particular, the study design presents some limitations which should be considered when interpreting the results. First, the design was not representative of all teff farming households, but only those registered with DAs, and also not representative of single-adult or female-headed households. Second, the findings may also not necessarily be generalizable as social and cultural norms differ significantly across regions, and the study was conducted in locations where the SAA intervention is ongoing, which may affect BP adoption. Finally, the associations identified through regression analysis do not imply causality, as the study is observational in nature. This study looked at the concept of gender dynamics in a robust way, interviewing women and men within the same households to get a rich understanding of the intra-household dynamics of teff farming. The study presented a novel dataset on a wide range of gender-specific variables, and focused on the intra-household gendered dynamics that influence teff best practice adoption. The findings have important implications for extension training service delivery: since male and female farmers are involved in different practices, access to resources and decision-making power have different impacts depending on the gender of the respondent and the practice analyzed, and there is no “one size fits all” solution to improve teff farming productivity.

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Table 1: Linear regression on the sum of BPs adopted (out of 20)

Sum of BPs adopted	Women	Men
Gendered division of labor		
Number of teff activities involved in	0.180***	0.395***
	(0.042)	(0.104)
Intra-household decision-making		
Level of input in decisions on teff farming	-0.409***	-0.338
	(0.082)	(0.046)
Access and control factors		
Access to information on teff farming	0.148* (0.086)	0.251**
	-0.277*	(0.120)
Control over teff income	(0.146)	0.411**
		(0.161)
Ever trained on teff farming	-0.302	-0.590***
	(0.253) 0.477*	(0.200) 0.908**
Not a member of a group	(0.227)	(0.378)
Number of credit sources respondent has access to	0.13	0.227***
	(0.234)	(0.409)
Social & cultural norms		
Is confident in applying new practices	-0.147	0.228
	(0.195)	(0.422)
Feels respected by community as a teff farmer	-0.325	-0.634**
	(0.240)	(0.269)
Household and individual controls		
Age	0.001	-0.003
	(0.008)	(0.006)
Education	0.095	0.058
	(0.127) 0.093*	(0.080) 0.133**
Number of household members	(0.054)	(0.058)
Household wealth	-0.037	-0.092
	(0.057)	(0.059)
Farm size (hectares)	0.276	0.359
	(0.255)	(0.255)
Constant	7.794*** (0.703)	4.312*** (1.189)
Observations	555	555
R-squared	0.095	0.124

Linear regression with standard errors clustered at the DA level Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

REFERENCES

1. **Minten BAS, Taffesse AS and P Brown** The economics of teff: Exploring Ethiopia's biggest cash crop. International Food Policy Research Institute (IFPRI). 2018.

2. **Arslan A, Floress K, Lamanna C, Lipper L, Asfaw S and T Rosenstock** The adoption of improved agricultural technologies: A meta-analysis for Africa. IFAD. 2020.

3. **Badstue L, van Eerdewijk A, Danielsen K, Hailemariam M and E Mukewa** How local gender norms and intra-household dynamics shape women's demand for labor saving technologies: insights from maize-based livelihoods in Ethiopia and Kenya. *Gender, Technology and Development.* 2020; **24(3):** 341-361.

4. **Seebens H and J Sauer** Bargaining power and efficiency—rural households in Ethiopia. Journal of International Development: *The Journal of the Development Studies Association.* 2007; **19(7):** 895-918.

5. **Pender J and B Gebremedhin** Land management, crop production and household income in the highlands of Tigray, northern Ethiopia: An econometric analysis. *International Food Policy Research Institute*. Washington, D.C. 2006; **chapter 5:** 107-140.

6. **Uphoff N and L Buck** Strengthening Rural Local Institutional Capacities for Sustainable Livelihoods and Equitable Development. Paper prepared for the Social Development Department, World Bank, 2006. Retrieved from https://openknowledge.worldbank.org/entities/publication/bf002bd6-1209-59d9-b26f-ec9a4f64c831 *Accessed on 03 September 2023.*

7. **Tekalign S, Eneyew A and F Mitiku** Gender roles in teff value chains in Borecha District of South Western Ethiopia: husband and wife comparisons. *J. Agribus. Rural Dev.* 2020. **1(55):** 93–105.

8. **Vandercasteelen J, Dereje M, Minten B and AS Tafesse** Labor, profitability and gender impacts of adopting row planting in Ethiopia. *European Review of Agricultural Economics*. 2018; **45(4):** 471–503.

9. **Alesina A, Giuliano P and N Nunn** On the Origins of Gender Roles: Women and the Plough. *Quarterly Journal of Economics.* 2013, **128(2):** 469-530.

10. IFPRI. Women's empowerment in agriculture index. 2012. Retrieved from on https://www.ifpri.org/publication/womens-empowerment-agriculture-index *Accessed on 16 September 2023.*

11. **Bjorvatn K, Getahun T D and S Halvorsen** Conflict or cooperation? Experimental evidence on intra-household allocations in Ethiopia. *Journal of Behavioral and Experimental Economics*. 2020; **85**.

12. **Diiro G** Impact of off-farm income on agricultural technology adoption intensity and productivity. *Journal of Developing Areas.* 2015, **49(2):** 145-162.

13. **Feyisa B** Determinants of agricultural technology adoption in Ethiopia: A meta-analysis. *Cogent Food & Agriculture*. 2020; **6(1).** https://doi.org/10.1080/23311932.2020.1855817

14. **Gabre-Madhin Z and S Haggblade** Success in African Agriculture: Results of an Expert Survey. *World Development*, Elsevier. 2004; **32(5):** 745-766.

15. **Mignouna B, Manyong M, Rusike J, Mutabazi S and M Senkondo** Determinants of Adopting Imazapyr-Resistant Maize Technology and its Impact on Household Income in Western Kenya. *AgBioforum*. 2011; **14(3)** 158-163.

16. **Kariuki S and M Mwangi** Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. *Journal of Economics and Sustainable Development*. 2015; **6(5)** 208-216.

17. **Milkias D** Factors Affecting High Yielding Teff Varieties Adoption Intensity by Small Holder Farmers in West Showa Zone, Ethiopia. *International Journal of Economy, Energy and Environment.* 2020; **5(1)** 6-13. 17.

18. **World Bank and IFPRI.** Gender and governance in rural services: Insights from India, Ghana, and Ethiopia. 2010; Retrieved from https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/557271468331168780 *Accessed on 08 September 2023.*

19. **Ragasa C** Gender and Institutional Dimensions of Agricultural Technology Adoption: A Review of Literature and Synthesis of 35 Case Studies. IAAE Conference. 2012. Retrieved from https://ageconsearch.umn.edu/record/126747/ *Accessed on 15 September 2023.*

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Appendix 1: Overview of Teff Best Practices and Adoption Criteria

The table below outlines the 20 best practices for teff farming that were assessed in the study, and the criteria required to be considered adopted. These best practices align with the Ethiopian extension system training for teff farming in the study locations, as provided by SAA.

Activity	Best Practice	Criteria for Adoption
Land preparation	BP1: Month started preparing land	Start plowing after harvest in January (Tir ጥር) or February (Yekatit የካቲት).
	BP2: Frequency of tilling	Conventional extension system: till 3–5 times. Regenerative agriculture system: till 2–3 times. Note: The same tillage must have been applied to the entire observed plot.
	BP3: drainage practices for waterlogged plots	Considered adopted if the household faces water management issues and used at least 1 or more strategies to cope (using broad bed maker or traditionally with "dirdaro" (ድርዳሮ) or "shurube" (ሹርቤ)). Note: This best practice was only assessed for households who have experienced waterlogging issues (usually those in Kotcha soils). These practices must have been applied to more than half of the plot.
Sowing	BP4: Month teff was sown	Sow in July (Hamle ሐምሌ) or August (Nehase ነሐሴ)

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	BP5: Use of improved seed varieties	The following improved seeds are suitable for the study area: Magna (ማኛ / DZ-01-196), Kuncho (ቁንሬጭ / DZ-Cross-387), Dukem (ዱከም / DZ-01-974), Kora (ኮራ / DZ-Cross-438), Dagm (ዳግም / DZ-Cross-438), Negus (ነጉስ / DZ-Cross-429). Other varieties of improved seeds for highland/colder areas (Tsedey, Boset, Smada, Dega, Enatit, Yielmana) can also be considered adopted. Note: Local traditional seeds were not considered improved seeds.
	BP6: Sowing in rows	Planting in rows is recommended. Broadcasting (casting seeds by hand) is not recommended. Note: To be considered adopted, a household must be planting in rows for the entire plot, and must be planting seeds at a depth of 1-3 cm.
	BP7: Amount of seeds used per hectare	Depending on the soil type, 10-15 kg of seed per hectare of land. Note: This amount is for farmers using the row planting method. Farmers using broadcasting (not considered best practice) use more seeds.
Fertilizer	BP8: Fertilizer type	NPS and urea should be applied, compost may be used for loamy soils DAP should not be used
	BP9: Frequency of fertilizer use	NPS application once per season. Urea application twice per season.
	BP10: Timing of fertilizer use	NPS application at the time of sowing Urea application first 15-18 days after sowing, and then again 35-40 days after sowing.

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	Fertilizer amount	Red soil: • NPS – 100 kg per hectare • Urea – 37.5 kg per hectare at both applications Black soil: • NPS – 150 kg per hectare • Urea – 62.5 kg per hectare at both applications Note: this practice was not included as an observed best practice due to recall bias and difficulty in obtaining accurate figures.
Weeding	BP11: Weeding Method	The best way to weed is by hand. An acceptable alternative is using herbicide.
	BP12: Weeding Frequency	The plot should be weeded at least three times per season.
	BP13: Weeding Timing	The plot should be weeded for the first time 18-25 days after sowing (15-18 days after teff has sprouted and the first weeds have emerged).
Pest & Disease Management	BP14: Disease management	Knowledge of common teff diseases: leaf rust, head smudge, damping off, and zonate eye spot. Note: respondents were scored as adopting if they knew at least 3 diseases. Knowledge of disease control measures: sowing early in the season, using early-maturing teff varieties, applying fungicide. Note: respondents were scored as adopting if they knew

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		at least 2 control measures.
	BP15: Pest management	Knowledge of common teff pests: Degeza (Wollo Bush Cricket), Shoot fly, Red teff worm, Black teff beetle, Grasshopper (Fenta). Note: respondents were scored as adopting if they knew at least 3 pests. Knowledge of pest control measures: i) Early tilling or tilling soon after harvest (including mention of exposure to sunlight), ii) Deep tilling, iii) Removal of nearby pest hosts (weeds, crop residues, other plants), iv) Practicing crop rotation, v) Use of insecticide, vi) Removing and killing insects by hand. Note: respondents were scored as adopting if they knew at least 4 control measures.
Harvesting	BP16: Harvest Method	Teff harvested by hand with a sickle or by harvester (if any)

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	BP17: Harvest Timing & Appearance	Teff harvested by hand with a sickle or by harvester (if any) Teff harvested about 12 weeks after planting. Note: The specific time depends on the type of seed. Teff harvested when it appears ready (when it turns yellow or is dry).
Threshing	BP18: Designated Threshing Area	Preparation of a designated area for threshing by one of the following methods: i) Use plastic sheeting, ii) Use manure/dung to plaster the area, iii) Clean the area, iv) Use a threshing area prepared by someone else.
	BP19: Threshing Method	Threshed by animals trampling, a threshing machine, or by beating with a stick.
Storage and post-harvest	BP20: Storage Method	After threshing, teff should be stored in polypropylene or hermetic bags (PICS, Zero fly, Agroz), barrels, hermetic metal silos, or traditional storage (dibignit, gota). Teff should be stored inside the home, as compared to outside.

Appendix 2: Details on the adoption of individual best practices

Land Preparation

BP1: Month started preparing land

One-fourth of observed plots started preparing land in January or February, as recommended. Eleven different months were chosen as starting months with March (Megabit መጋቢት) being the most common month to start land preparation.

BP2: Frequency of tilling

The vast majority of households (89%) followed the recommendation to till between three and five times, with fThe times being the most common. Under regenerative agriculture it is recommended to till just two to three times; 32% of observed plots

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did this.

BP3: Drainage practices for waterlogged plots

Waterlogging was not a common issue in all woredas — only 81 out of 555 observed plots reported experiencing waterlogging issues on their plot. Out of these, 24% adopted water drainage practices “dirdaro” or “shurube”. Waterlogging was most common in Gonji Kollela, and significantly less common in Yielmana Densa. Some farmers that were impacted by waterlogged soils noted in qualitative work that DAs did not account for their needs in recommendations, and they may not undertake recommendations due to this concern.

Sowing

BP4: Month teff was sown

Ninety-two % of observed plots followed the recommendation to sow in July (Hamle ሐምሌ) or August (Nehase ነሐሴ). After July, June (Sene ሰኔ) was the second most common choice (7%), although this is one month earlier than advised.

BP5: Use of improved teff seeds

Almost all observed plots in the sample used Kuncho improved seeds, which are advised for the area. Magna, Dukem, Kora, Dagm, and Negus are also suitable for the study area, although they were all very uncommon or never reported.

BP6: Sowing in rows

This practice was the least adopted practice in Round 1. Nine % of observed plots attempted row planting and only 1% fully adopted. Full adoption required planting teff in rows for the entire plot (34% of those who attempted did not plant the entire plot), and seeds must also be planted at a depth of 1-3 cm (82% of those who attempted did not). Lack of available labor is the primary reason farmers gave for not planting in rows (65%), followed by thinking the practice would not work (24%).

BP7: Amount of seeds used

Farmers used two to three times more seeds than advised, with the average farmer using 35 kilograms per hectare. Depending on the soil type, farmers should use 10-15 kilograms of seed per hectare of land when sowing in rows. Only 6% of observed plots used the advised amount of seeds.

Fertilizer Application

BP8: Type of fertilizer used

About three-fourths (74%) of observed plots applied the recommended NPS and Urea; no farm reported applying DAP.

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BP9: Frequency of fertilizer use

About half (45%) of households applied nitrogen, phosphorus and sulfur (NPS) fertilizer only once, as recommended, and 21% of households applied urea twice, as recommended. Only 8% of households applied both NPS and urea the advised number of times.

BP10: Timing of fertilizer use

33% of households applied both NPS and urea the advised number of days after sowing. 86% of households applied NPS immediately after sowing, as recommended, and 36% of households applied urea 15-18 days after sowing for the first time, as recommended.

Weeding

BP11: Weeding method used

Farmers are advised to weed by hand and to do so at least three times per season. Only 14 households (2%) report weeding exclusively by hand. The vast majority (92%) combined weeding by hand with the application of herbicides. 37 respondents weed only by applying herbicides, and only 25 households in the sample reported not using herbicide.

One female farmer in the focus group discussions from Yielmana Densa explained, “we know we get better yield when we weed by hand. If we think we have time, we do weeding by hand as much as we can. And that makes a difference. Other times, we can’t get to it all on time while weeding by hand and so the remaining will be covered with chemicals.”

BP12: Weeding frequency

Only two households reported weeding three times per season as recommended. Most weeded only once (80%) or twice (20%).

BP13: Weeding timing

Plots should be weeded for the first time 18-25 days after sowing (15-18 days after teff has sprouted and the first weeds have emerged). 46% of households weeded for the first time 18-25 days after sowing (by hand or with herbicides).

Pest and Disease Management

BP14: Disease management

47 out of 540 households reported having experienced disease problems on their observation plot this season. These include: head smudge (42), leaf rust (4), and

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zonate eye spot (1). 4% of households took measures against diseases this season. Farmers employ disease management measures both for prevention reasons, and to mitigate diseases. Overall, 21 households reported having acted against diseases on their plot this season. Sowing early in the season was the most common measure, employed by 96% (20/21) of households adopting measures.

BP15: Pest management

Overall, 27 out of 540 households reported having experienced insect pest problems on their teff observation plot this season. These include: red teff worm (23), shoot fly (2), black teff beetle (2), grasshopper/fenta (2), and degeza (1). 7% of households took action against insect pests this season. 72% chose to use early tilling, 65% chose to remove nearby pest hosts, and 53% used deep tilling. 35% of households practiceed crop rotation. Only 5% used insecticide, while 16% killed insects by hand.

Harvesting

BP16: Harvest method

100% of respondents indicated that they had harvested teff this season by hand with a sickle, as recommended.

BP17: Harvest timing

29% of farms reported to have harvested teff when it looked ready (when leaves start turning yellow), which is the recommended best practice, while the majority (71%) harvested in a specific month, particularly in November (89% of those who harvested in a particular month harvested in November (ጎዳር)). When asked for the reasons why they harvested when they did, 96% of households reported the teff was ready for harvest, 32% reported they feared unpredictable rain and 10% reported that they had enough labor available at the time (multiple answers were allowed). The use of trading labor ("wonfel") for harvesting was commonly reported in the focus group discussions. Under this system, farming households support their neighbors in harvesting when the time is right, in exchange for support on their own farm.

Threshing

At the time of data collection, 44% of observation plot managers reported having threshed their teff this season. Therefore, the rates of adoption are based on this subsample.

BP18: Designated threshing area

The vast majority (99%) of households prepared a designated threshing area, by using manure/dung (97%) and/or by cleaning the area (83%).

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BP19: Threshing method

100% of plot managers who had threshed teff this season reported to have done so by trampling the teff with oxen. Two respondents used humans to beat the teff with sticks in addition to animals. Both methods are accepted and therefore all applicable households passed this best practice. Similar to harvesting, it is common for farmers to trade labor ("wonfel") for threshing. One farmer reported that while trading labor has decreased for harvesting, for threshing it has continued, explaining, "In the past, we used to trade labor for weeding and harvesting. Nowadays the only activity we trade labor for is threshing. Farmers are using more hired labor and less trading labor. This is also only because they cannot handle threshing with hired labor as they will need to borrow cattle as well."

Storage

BP20: Storage method

81% of plot managers stored teff this season, and of those, 100% used one of the recommended storage methods: traditional storage facilities dibignit (53%) and gota (19%), and in bags (39%). Some farmers in Gonji Kollela indicated that they were simply not producing enough teff to store, opting instead to sell it immediately to cover fertilizer costs. One female farmer stated, "I doubt that there is anyone who stores (their teff) these days… We don't store. We don't have enough land (to produce enough for storage). Whether you get 5 or 6 sacks full of teff, you just sell it and use the money to buy fertilizer. We don't have much left to keep at home. It is not profitable as we mostly work on other people's plot of land (to then share the yield)." She added, "thankfully, we produce enough to cover daily expenses. But we don't store…"

Appendix 3: Regression Output for Drivers of Adoption of Individual BPs

Note: the level of adoption of some BPs was 100% or almost 100%, while for others, the adoption rate was 0% or almost 0%. Therefore, regressions are run on the 8 BPs where adoption rates had sufficient variation in order to run the analysis.

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Adoption of specific best practices	Land prep	Weeding	Fertilizer application			Sowing	Harvesting
	(1)	(2)	(4)	(5)	(6)	(8)	(9)
	Land prep	Weed time	Fert time	Fert type	Fert freq	Sow month	Harv time
Division of Labor							
Man is involved in the activity	-	2.588**	1.881	7.922***		1.366	1.172
		(1.040)	(1.460)	(4.271)		(0.697)	(0.831)
Access factors							
Man has access to information on teff activity	1.419**	0.992	1.335	1.367	0.868	0.524**	5.050***
	(0.236)	(0.148)	(0.264)	(0.251)	(0.142)	(0.133)	(1.680)
Man has control over teff income	1.316	0.990	1.465	1.554*	1.183	0.872	1.421
	(0.453)	(0.183)	(0.435)	(0.357)	(0.483)	(0.263)	(0.438)
Man has ever been trained on teff farming	1.104	1.259	0.810	0.877	0.662	0.844	0.412**
	(0.480)	(0.331)	(0.285)	(0.252)	(0.202)	(0.288)	(0.143)
Man is not a member of a group	2.137	1.637	1.190	0.811	1.316	0.633	0.982
	(1.596)	(0.593)	(0.507)	(0.363)	(0.568)	(0.380)	(0.537)
Number of credit sources man has access to	1.083	1.277*	1.158	1.266**	1.147	0.792*	0.828
	(0.112)	(0.173)	(0.111)	(0.124)	(0.167)	(0.104)	(0.122)
Decision-making							
Man's level of input into decisions	0.999	1.015	1.133	1.095	1.093	0.943	0.792**
	(0.202)	(0.057)	(0.122)	(0.126)	(0.165)	(0.472)	(0.080)
Social & cultural norms							
Man is confident in applying new practices	0.622	1.147	1.418	2.595	0.275	5.696***	0.736
	(0.674)	(0.690)	(0.887)	(1.569)	(0.219)	(2.405)	(0.496)
Man feels respected by community as teff farmer	0.292	1.132	0.631	1.045	4.696	2.234	0.226***
	(0.316)	(0.598)	(0.320)	(0.488)	(6.012)	(1.152)	(0.113)
Household and individual controls							
Man's age	1.007	1.004	0.999	0.997	1.008	1.009	1.002
	(0.009)	(0.007)	(0.006)	(0.008)	(0.018)	(0.009)	(0.012)
Man's education	1.256*	0.966	1.173	0.885	1.238	0.981	0.941
	(0.159)	(0.091)	(0.127)	(0.071)	(0.270)	(0.187)	(0.105)
Number of household members	1.194	0.926	1.002	0.901	1.253***	0.968	1.069
	(0.134)	(0.053)	(0.103)	(0.062)	(0.071)	(0.144)	(0.111)
Household wealth	1.069	0.970	0.976	1.008	1.006	1.246*	0.891
	(0.071)	(0.069)	(0.083)	(0.101)	(0.089)	(0.147)	(0.104)
Farm size (hectares)	0.858	2.262***	1.799**	1.690*	0.716	0.729	1.020
	(0.353)	(0.519)	(0.436)	(0.454)	(0.296)	(0.387)	(0.419)
Constant	0.854	0.090**	0.010***	0.013***	0.021	4.440	0.012**
	(1.715)	(0.091)	(0.012)	(0.017)	(0.049)	(5.911)	(0.023)
Observations	552	555	555	555	535	555	555

Logistic regressions; coefficients are quoted in odds ratios.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

In (1), 3 observations were excluded from the analysis due to the strong correlation between the variable 'Man is involved in activity' and the outcome variable. Sensitivity analysis indicated that the inclusion or exclusion of these observations did not significantly affect the interpretation of coefficients.
In (6), 20 observations were excluded from the analysis due to the strong correlation between the variable 'Man is involved in activity' and the outcome variable. Sensitivity analysis indicated that the inclusion or exclusion of these observations did not significantly affect the interpretation of coefficients.

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Adoption of specific best practices	Land prep	Weeding	Fertilizer application			Sowing	Harvesting
	(1)	(2)	(4)	(5)	(6)	(8)	(9)
	Land prep	Weed time	Fert time	Fert type	Fert freq	Sow month	Harvesting
Division of Labor							
Woman is involved in the activity	1.202	0.934	1.983**	1.465	1.641	0.639	2.035
	(0.452)	(0.360)	(0.528)	(0.328)	(0.692)	(0.248)	(1.136)
Access factors							
Woman has access to information on teff activity	1.160	0.920	0.785	1.155*	1.095	0.979	1.148
	(0.155)	(0.091)	(0.117)	(0.096)	(0.217)	(0.193)	(0.168)
Woman has control over teff income	1.122	0.830	0.775	0.757*	0.864	1.140	0.706*
	(0.183)	(0.109)	(0.130)	(0.116)	(0.150)	(0.203)	(0.142)
Woman has ever been trained on teff farming	0.830	2.475***	0.811	1.428	0.611	1.221	0.319**
	(0.284)	(0.479)	(0.287)	(0.467)	(0.247)	(0.526)	(0.153)
Woman is not a member of a group	1.423	2.698***	2.551*	2.814	0.914	3.339*	0.440*
	(0.789)	(0.864)	(1.345)	(2.100)	(0.498)	(2.036)	(0.192)
Number of credit sources woman has access to	0.953	1.208	1.067	1.140	0.998	0.915	1.000
	(0.140)	(0.170)	(0.154)	(0.120)	(0.101)	(0.101)	(0.156)
Decision-making							
Woman's level of input into decisions	1.107	1.357***	1.193	1.451***	0.817	0.839	0.647**
	(0.153)	(0.136)	(0.175)	(0.189)	(0.141)	(0.126)	(0.130)
Social & cultural norms							
Woman is confident in applying new practices	0.548	1.664**	1.283	1.046	2.694*	1.153	1.272
	(0.220)	(0.400)	(0.322)	(0.288)	(1.463)	(0.445)	(0.442)
Woman feels respected by community as teff farmer	0.866	1.177	1.092	1.178	1.129	0.779	0.418***
	(0.206)	(0.258)	(0.292)	(0.279)	(0.475)	(0.412)	(0.093)
Household and individual controls							
Woman's age	1.000	1.002	1.010	1.001	1.020	1.013	0.983*
	(0.012)	(0.008)	(0.010)	(0.011)	(0.022)	(0.013)	(0.009)
Woman's education	0.957	0.839*	1.094	0.843	1.139	0.943	1.196
	(0.182)	(0.085)	(0.146)	(0.134)	(0.296)	(0.208)	(0.213)
Number of household members	1.173	0.947	0.986	0.916	1.174**	1.001	1.006
	(0.151)	(0.053)	(0.109)	(0.051)	(0.076)	(0.169)	(0.068)
Household wealth	1.113	0.949	1.039	1.058	1.049	1.259	0.921
	(0.081)	(0.058)	(0.077)	(0.083)	(0.095)	(0.175)	(0.084)
Farm size (hectares)	0.903	2.180***	1.761**	1.422	0.685	0.651	1.322
	(0.380)	(0.419)	(0.430)	(0.333)	(0.282)	(0.416)	(0.315)
Constant	1.794	0.231*	0.089**	0.647	0.012***	3.069	4.642
	(2.168)	(0.167)	(0.086)	(0.695)	(0.018)	(3.923)	(5.047)
Observations	555	555	555	555	555	555	555

Logistic regressions; coefficients are quoted in odds ratios.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

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Adoption of specific best practices	Weed frequencies		Sowing in rows	
	(3a) Women	(3b) Men	(7a) Women	(7b) Men
Division of Labor				
Farmer is involved in the activity	0.951	1.247	2.841***	
	(0.434)	(1.049)	(0.790)	
Access factors				
Farmer has access to information on teff activity	1.271*	0.974	1.121	0.691
	(0.153)	(0.110)	(0.152)	(0.193)
Farmer has control over teff income	1.314	1.560*	0.843	1.658
	(0.313)	(0.399)	(0.204)	(0.895)
Farmer has ever been trained on teff farming	1.880*	2.266***	1.851*	3.783
	(0.649)	(0.513)	(0.568)	(3.660)
Farmer is not a member of a group	1.801	1.023	1.872*	1.789*
	(0.805)	(0.444)	(0.644)	(0.537)
Number of credit sources Farmer has access to	0.579***	1.320**	0.798	1.184
	(0.070)	(0.156)	(0.136)	(0.251)
Decision-making				
Farmer's level of input into decisions	0.876	0.914	0.970	
	(0.178)	(0.091)	(0.097)	
Social & cultural norms				
Farmer is confident in applying new practices	0.730	0.692	1.070	
	(0.302)	(0.462)	(0.387)	
Farmer feels respected by community as teff farmer	0.912	2.474	1.186	0.629
	(0.270)	(1.546)	(0.315)	(0.536)
Household and individual controls				
Farmer's age	0.978	0.988	0.989	0.966***
	(0.013)	(0.008)	(0.011)	(0.008)
Farmer's education	0.680**	0.975	0.962	1.190
	(0.119)	(0.133)	(0.147)	(0.176)
Number of household members	0.945	0.917	1.057	1.060
	(0.113)	(0.067)	(0.065)	(0.101)
Household wealth	1.201	0.871*	1.253*	1.195
	(0.150)	(0.069)	(0.146)	(0.155)
Farm size (hectares)	1.316	1.284	0.829	1.379
	(0.559)	(0.388)	(0.244)	(0.287)
Constant			0.023***	0.018**
			(0.021)	(0.027)
Observations	523	522	555	520

Logistic regressions; coefficients are quoted in odds ratios.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

In (7b), 35 observations were excluded from the analysis due to the strong correlation between the variable "Man is involved in activity", "Man is confident in applying new practices", "Man's level of input into decisions" respectively with the outcome variable. Sensitivity analysis indicated that the inclusion or exclusion of these observations did not significantly affect the interpretation of coefficients.

In (3a) and (3b) sample size is reduced because the question was asked only to farmers which attempted partial adoption of sowing in rows.

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Appendix 4: Summary statistics

N=1,110		Total
	N	(%)
Livestock and aquaculture		
Large livestock	1,036	(93.33%)
Small livestock	689	(62.07%)
Poultry and other small animals	704	(63.42%)
Fish pond (in owned land) or fishing equipment	1	(0.09%)
Assets		
Non-mechanized farm equipment	1,064	(95.86%)
Mechanized farm equipment	19	(1.71%)
Non-farm business equipment	302	(27.21%)
House/s or building/s	1,086	(97.84%)
Large consumer durables	689	(62.07%)
Small consumer durables	671	(60.45%)
Cell phone/s	708	(63.78%)
Other land not used for agricultural purposes	177	(15.95%)
Means of transportation	5	(0.45%)
No large agricultural asset	931	(86.36%)
MDP Index and income		
Electricity	147	(13.24%)
Improved toilet - Private	1	(0.09%)
Improved Cooking Fuel	2	(0.18%)
Access to safe drinking water	883	(79.55%)
Improved floors	10	(0.90%)
Teff proportion income		
No income from teff (0%)	45	(4.05%)
Around a quarter (25%)	173	(15.59%)
Around half (50%)	290	(26.13%)
Around three-fourths (75%)	551	(49.64%)
Almost all (100%)	50	(4.50%)
Don't know	1	(0.09%)
Respondents relationship		
Married	512	(93.09%)
Daughter or son	25	(4.55%)
Mother or Father	9	(1.64%)
Daughter-in-law or Son-in-law	1	(0.18%)
Granddaughter or grandson	1	(0.18%)
Sister or Brother	1	(0.18%)
Other relationship	1	(0.18%)
Gender of plot manager		
Plot manager is female	26	(2.34%)
	Mean	**(SD)**
Plots and Land farmed		
Number of plots own or rent	5	(1.8)
Number of plots growing teff	2.6	(1.3)
Farm size	1.1	(.49)
Household composition		
HH size	3.6	(1.5)
Number of adult household members	1.8	(.9)
Number of children in household	1.8	(1.2)

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Statistics by gender

Individual descriptive statistics n = 1100

	Men N=555	Women N=555	p-value
Age	46.14 (14.56)	38.77 (11.28)	<0.001
Education			<0.001
None	282 (50.81%)	440 (79.28%)	
Informal education	114 (20.54%)	24 (4.32%)	
Primary education	138 (24.86%)	77 (13.87%)	
Secondary education	18 (3.24%)	14 (2.52%)	
University undergraduate	3 (0.54%)	0 (0.00%)	

Data are presented as mean (SD) for continuous measures, and n (%) for categorical measures.

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THE COMMODITY ASSOCIATION TRADERS/TRAINERS EXTENSION APPROACH: SMALLHOLDER PRODUCTIVITY, INPUT AND MARKET LINKAGES IN NIGERIA

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ABSTRACT

The Commodity Association Traders/Trainers (CATs) extension approach was an initiative of the Sasakawa Africa Association (SAA) to address the challenges of the low margin of agricultural extension agents and farm family ratio in Nigeria. This study, therefore, provides an assessment of the initiative in supporting agricultural extension service delivery in Nigeria. The study was carried out in Kano, Jigawa, Nasarawa and Gombe states, Nigeria being the four major states where the CATs extension approach was tested. The study used a causal research design involving before and after intervention assessment of 396 beneficiary farmers. Data collected using semi-structured questionnaire were analysed using descriptive statistics and linear regression at $\alpha_{0.05.}$ Majority of the farmers were male (71.5%), middle-aged (42.59±10.91 years) and had small to moderate household sizes (63.4%). Maize (77.6%) and Rice (57.3%) were the foremost crops grown. The farmers received extension service support from CATs in a broad area, including innovation dissemination, training on Good Agricultural Practices, linkage to agro-input dealers, market and credit. About 63.0-86.0% were positive about most aspects of engagement with the CATs except for payment of fees for services received and connecting farmers to credit. The number of farmers that practiced market-oriented agriculture doubled. The number of agribusiness enterprises established and the number of farmers successfully linked to off-takers for their produce also rose from an average of 3 to 8 persons; and 4 to 14 persons per group, respectively. The volume of maize crop marketed through cooperative efforts increased from 7.64±5.15 Kg to 15.66±6.94 Kg per person in each group. Farmers' size of land cultivated, their total produce harvested and productivity for maize and paddy increased after being members of the CATs group. Being male, young, educated, having ease of access to CATs master trainers and farmers' motivation enhanced the performance of the CATs extension approach. The commodity association trainers/traders have enhanced extension services in the project states. The initiative is recommended for up-scaling to cover other regions of Nigeria.

Key words: Agricultural extension, Farmers' group, Sasakawa Nigeria, Market-oriented agriculture

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INTRODUCTION

Agricultural extension plays an important role in the lives and livelihood of the rural people where agriculture dominates as the economic mainstay. This is because a functional extension system enhances the capacity of stakeholders in the farming system and contributes to increased productivity. Extension provides critical support for the farmers to enable them to cope with any emerging challenges and achieve transformation in the global food and agricultural system [1]. The impact of extension has been argued to go beyond rural and agricultural transformation as it is also regarded as a policy tool for promoting the safety and quality of agricultural products [2]. The impacts of agricultural extension are intricately linked to most countries' economic growth and development [3]. This is because agriculture which serves as the mainstay of many countries, providing income, employment and foreign exchange has witnessed several changes as a result of technological revolutions after World War II. The extension system has been the vehicle through which information on these technological advances has been efficiently transferred to the farmers.

However, extension systems in Africa face numerous challenges, which, in turn, limit their effectiveness in promoting smallholder farmers' productivity. These challenges were identified as including poor job satisfaction, weak capacity to mainstream the use of Information and Communication Technologies (ICTs) in the current era of technological sophistication, use of old extension methods and strategies and poor training for extension workers. It is arguable that the neglect of the public extension system by the governments of most African countries paved the way for the aforementioned challenges, especially the low margin of extension agents and farm-family ratio.

In Nigeria, extension services have not been effective as they ought to be due to a low margin of extension agents and farm family ratio, including poor access linking road infrastructure to remote areas where a lot of farming work is being done [4]. On average and across Nigeria, the Agricultural Development Programmes' extension agents: farm families ratio oscillated from 1:1,700; 1:2,132; 1:3,385; 1:2,950 and 1: 3,011 between the years 2008 and 2012 [5]. Similar gaps are observed in many other developing countries, especially in Africa. The understanding of the fact that the biggest improvement for rural farmers comes from getting adequate and timely information on regenerative farming, nutrition-sensitive agriculture and market-oriented agriculture, therefore, calls for a paradigm shift from the conventional extension approaches to a more effective and efficient method. This point was emphasized by Msuya *et al.* [1] who called for re-thinking the reformation of extension by re-positioning extension in the field such that it serves as a neutral facilitator of development across sectors. Some authors

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have also made the case for the privatization of extension services and an introduction to pluralistic concepts of extension involving a variety of service providers [6, 7].

To this end, the idea of Commodity Association Traders/Trainers (CATs) by the Sasakawa Africa Association (SAA) gives a lot of hope for addressing the challenge of manpower deficit, especially the subject matter specialists and extension workers who play vital roles in successful agriculture. The use of commodity association traders/trainers has leveraged the advantage of social networking for revolutionizing agriculture. This is increasingly becoming important, especially in the current era of poor coverage of farmers by extension services due to a shortage of manpower. This is in line with pillar 3 of the SAA Strategic Plan (2021-2025) which focuses on market-oriented agriculture with the aim of developing farming as a business enterprise to ensure food security and improve livelihoods. Therefore, the SAA-Nigeria has developed the Private and Extension Service Provision (PESP) approach, supporting Commodity Association Traders/Trainers (CATs) who provide services for a fee to farmers at the local level.

The CATs extension approach as a peculiar private extension strategy, however, requires empirical information on its performance so as to guide future actions and policies for repositioning extension service. This study, therefore, provides an unbiased assessment of the Sasakawa Nigeria project in supporting extension service delivery. Specifically, the study investigated the farmers' experience of partnership with the CATs under the SAA Nigeria on market-oriented agriculture, the influence of CATs on extension service delivery, farmers' perception of the CATs extension approach, and the associated challenges faced in the approach. The outputs and outcomes give the necessary feedback on the performance of the project and the associated intervention in the coverage states to the concerned stakeholders, especially the Sasakawa Africa Association (SAA). This should provide useful lessons for the scale up of efforts in its promotion of regenerative agriculture and marketing of nutritious crops (biofortified and nutrient-dense) in Nigeria. It will also guide future investments and give indications on the kinds of incentives needed for more efficient project delivery.

LITERATURE REVIEW

The Sasakawa CATs Extension Approach

The CATs extension approach is one of the strategies of the SAA for achieving its target of promoting market-oriented agriculture among farmers. The SAA is convinced that stable farm incomes can be realized when production plans are based on market trends [8]. The CATs' extension approach is, therefore, imbued

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with strategies and structure that encourage the entrepreneurial spirit among farmers. In this vein, innovative individuals are trained as CATs (master trainers) to cascade the training to farmers in their localities and also render services in linking farmers to agri-inputs, markets for their produce, and financial support among others. The process started with a collaborative effort between the SAA Nigeria and the Agricultural Development Programmes (ADP) in project states to form farmers into groups and activate/strengthen existing groups. Each group consists of 20-25 farmers that are registered under the SAA project as direct beneficiaries. Each Extension Agent (EA) and CATs are attached to four and 16-20 groups, respectively. The impact of the extension services rendered by CATs to the registered groups of farmers is expected to trigger the interest of more farmers in the CATs extension approach thereby leading to the formation of more groups who are at the beginning termed indirect beneficiaries.

The Sasakawa CATs Extension Approach: Principal-Agent Theory

This study was underpinned by the principal-agent theory. The theory gained popularity in the 1970s when it was first used to explain the interplay of interests (Figure 1) between institutional factors and economics. Ever since, the theory has been widely applied in various fields to explain the challenges and risks of information asymmetry that could arise between two entities bonded in a form of contractual arrangement. The theory explains the conflict of interest that arises between a principal and their agent or the risk involved when a principal hires an agent to negotiate on their behalf [9, 10]. The principal is an individual or entity who contracts another person or entity (agent) to act on their behalf to protect certain interests of the principal. Usually, the agent is assumed to have the required information, time and skills to protect certain interests of the principal. Conflict, however, arises when the agent acts contrary to the interests of the principal, which is usually the case when the agent has multiple principals to service simultaneously. Examples of a principal-agent relationship are seen in the case of an elected political office holder (agent) and the electorates (principal) or the extension workers (agents) and the farmers (principals). In the context of this study, the public extension service (agent) is underperforming and unable to satisfy the current information requirements and demands of most farmers (principal) leading to a conflict of interest and hence, posing a serious threat to agriculture and food security. The risk becomes more severe as the ratio of the agents to farmers especially in the sub-Sahara African countries is unacceptable. The challenges associated with multiple principals were explained by Voorn *et al.* [11]. For this reason, the private sector's involvement in introducing a new principal-agent model in the delivery of extension services becomes paramount. The Sasakawa-led CATs extension approach could be seen as an attempt to create a new principal-agent approach.

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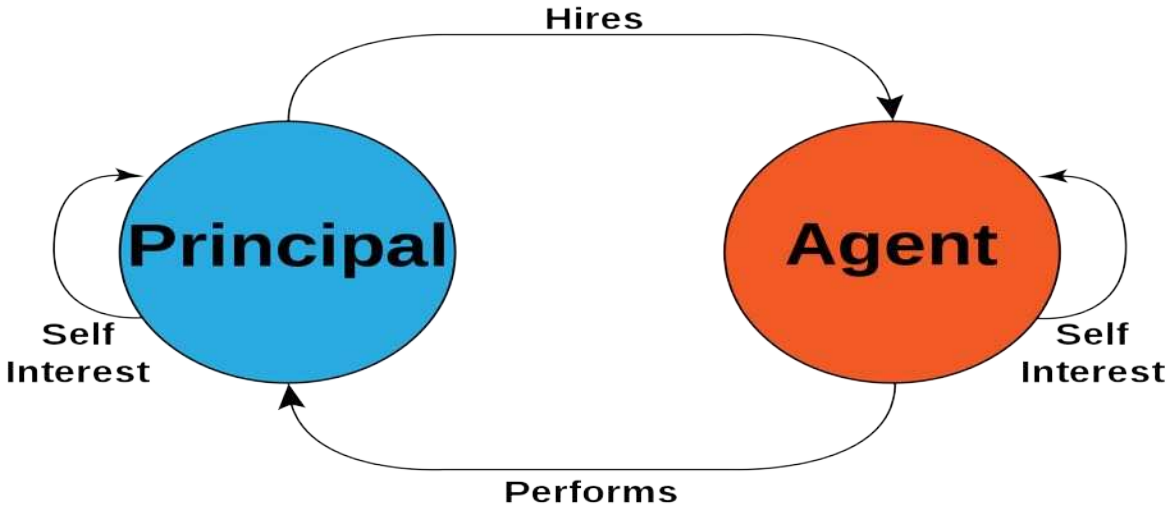

Figure 1: Principal-Agent interrelationship
Source: Gong *et al.* [9].

MATERIALS AND METHODS

The Study Area

This study was carried out in Kano, Jigawa, Nasarawa and Gombe states, Nigeria. These states were selected for preliminary investigation being the four major states where Sasakawa Nigeria has tested the Commodity Association Traders/Trainers extension approach in the region. The states are described as follows: Jigawa State is in the Northwestern part of Nigeria. Jigawa state has latitudes 11.00° N to 13.00° N and longitudes 8.00° E to 10.15° E. The state is originally part of the Kano region and it has Kano and Kastina states to the west, Yobe state to the North, and Bauchi state to the East [12]. Jigawa also shares an international border with the Niger republic. Annually, Jigawa state experiences about 700mm of rainfall between the months of June and September. About 90% of the people in Jigawa state live in rural and semi-urban areas and primarily engage in agriculture as a means of livelihood. The people engage in active cultivation, processing, and marketing of agricultural produce/products within the state and with neighboring states [13]. The state is also characterized by high land areas which are almost 750m high. According to Lawan *et al.* [14], Jigawa has an estimated population of 5,828,200 people.

Kano State is the commercial center of Northern Nigeria and the second largest city in Nigeria. According to Lawan *et al.* [14], Kano has about 9,383,682,000 people. Kano state has boundaries with Kastina state, Jigawa state, Bauchi state, and Kaduna State in the North-West, North-East, South East, and South West, respectively. The state lies between Latitudes 9° 30 and 10° 33 North and Longitudes 7° 34 and 9° 25 East of the Greenwich Meridian [15]. The state has an

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altitude of 500m to 750m above sea level. Annual rainfall of between 300 -1200mm is experienced between May and early October in variations along Guinea and Sudan savannah areas of the state. The people of Kano state are mostly involved in irrigated Agriculture.

Gombe State has a land mass of 20,265 km2 and lies on a Longitude of 8° 5 and 11° 45 East and Latitudes 9° 30 and 12° North. The state has savanna grasslands and some woody trees. Gombe state's annual rainfall distribution is 880mm between the month of April and October with some distributions of dry spells [16]. The total population of Gombe is 2,364,284 people [14]. Gombe state shares a boundary with Yobe state to the North, Borno and Adamawa states to the East, Bauchi State to the West and Taraba State to the South. Gombe has three distinctive agroecological zones: the Sudan savanna, the Southern Guinea savanna and the Northern Guinea savanna [17].

Nasarawa State is in North-central Nigeria and lies between Latitudes 7° and 9° North, Longitudes 7° and 10° East. The state shares a boundary with Federal Capital Territory (FCT) to the North-west, Kaduna, and Plateau states to the northeast, Kogi state to the west, and Benue state to the South. Agriculture is the dominant occupation of the people in Nasarawa state [18]. The climate and soil conditions of Nasarawa state are suitable for the growth of cereal crops and vegetables, thus, farmers are mainly into arable crop production. The total population in Nasarawa state is 1,863,275 as of 2006 population count [14].

Research Design

The study used causal research design involving a before and after intervention assessment to address the stated objectives. The survey focused on all farmers who were direct beneficiaries of the CATs extension approach of the SAA and used comparative analysis of beneficiaries' experiences before and after involvement in the intervention as a basis for gauging the influence made by the CATs initiative.

Sampling Procedure and Sample Size

The farmers were sampled using a multi-stage sampling procedure. The first stage involved a random selection of 50% of the Local Government Areas (LGAs) in each state where registered farmer groups exist and where the CATs extension approach was prominent. This led to the sampling of Gwarzo, Kura, Warawa, Bankure (Kano); Auyo, Birnin Kudu, Biriniwa, Taura, Yankwashi, Babura (Jigawa); Lafia, Keffi, Akwanga, Doma (Nasarawa); Shomgom, Funakaye, Kaltungo and Yamaltu/Deba (Gombe) LGAs. Figure 2 shows the map of the study areas and the selected sites where respondents were sampled. In the second stage, lists were obtained of CATs beneficiaries in each of the LGAs from the Sasakawa state

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coordinators. Using a simple random sampling technique, a representative proportion of the farmers in each LGAs were sampled. Therefore, 95, 95, 103 and 103 beneficiary farmers from Kano, Jigawa, Nasarawa and Gombe states, respectively were captured in the field survey resulting in a total of 396 farmers.

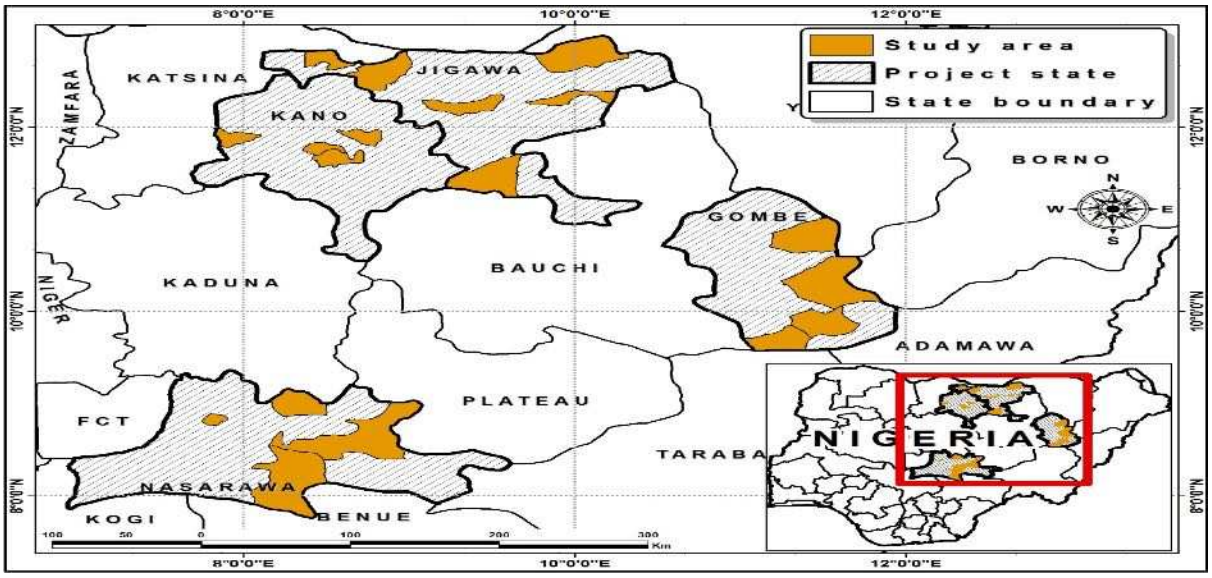

Figure 2: Map showing the study sites

Procedures for Data Collection and Analysis

Quantitative data were collected using structured questionnaire with the aid of computer-assisted personal interview software (Open Data Kit-ODK). Farmers' personal characteristics, experience of partnership with the CATs under the SAA Nigeria on market-oriented agriculture, the influence of CATs on extension service delivery, farmers' perception of the CATs extension approach, and the associated challenges faced in the approach were investigated. Farmers' experience of engagement with commodity association trainers was measured on a three-point scale of positive (2), neutral (1) and negative (0). The statements covered various aspects of engagement such as training, market and credit linkages, and commission for services received. The influence of CATs on extension service delivery was measured using the targeted outcomes of changes in respondents' access to inputs, market access, access to financial support, better income and enhanced productivity. Other indicators used include the number of farmers (direct and indirect beneficiaries) reached with extension support, the number of agribusiness enterprises that were established per farmer group, and the number of farmers per group that practice market-oriented agriculture. Information on these indicators was garnered before and after respondents' involvement in the CATs project and the direction of changes observed, whether positive or negative was used to adjudge the influence of the project on extension service delivery in the study locations. Improvement in each of the indicators was interpreted as a

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positive influence of CATs while the reverse would mean a negative influence. Farmers' perception of the CATs initiative was determined by presenting respondents with 10 perception items on a three-point scale of agree to disagree. The most positive perception was scored 3, while the most negative perception attracted a score of 1. Respondents were classified as having a favourable or unfavourable perception using the mean perception scores as a benchmark. Challenges faced in the CATs extension approach were identified by asking respondents to identify what they considered as challenges and also rank them as severe or mild by awarding scores of 2 and 1, respectively. Weighted mean values for each of the constraint items were used to discuss the findings. The quantitative data collected were analyzed using descriptive statistics such as frequency counts, percentages, and mean on the Statistical Package for the Social Sciences (SPSS) software. Regression analysis was used to establish the factors influencing change in farmers' productivity before and after the CATs initiative. Figure 2 shows some pictures taken during the field data collection.

Figure 2: Photo shots taken during survey and training of enumerators

RESULTS AND DISCUSSION

Demographic Characteristics of the Respondents

Table 1 shows the demographic characteristics of the sampled farmers registered under the Sasakawa CATs extension approach. The table shows that majority of the farmers (71.5%) were male. The dominance of the male also reflects across the project states as no state had less than 60% of the total sample as male farmers. This distribution suggests the dominance of males among the Sasakawa farmer groups in the project states. The reason for this is not far-fetched as most

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studies on the gender distribution of the farming population in most parts of Africa confirms the dominance of the male folks [19, 20]. However, the sizeable proportion of the female farmers observed in Nasarawa (38.8%) and Gombe (33.0%) states imply that steady efforts are being made by the Sasakawa CATs project to bridge the gender gap in farming populations.

The mean age of 42.59±10.91 years of the farmers indicates that the farmers were mostly young people. This shows that middle-aged persons constitute a significant proportion of the farmers in the study locations. This finding is consistent with the report from research works on the average age of cassava farmers in Nigeria which is indicated to range from 45 to 48 years [21, 22]. Also, Okoye *et al.* [23] opined that the typical farmer in Madagascar is 46.05 years old. The ageof the farming population has a significant influence on productivity, as productive capacity tends to decline with increasing age. Most respondents were married (93.9%) and had small to moderate household sizes (63.4%). About 72% of the farmers had at least primary school-level education, suggesting a moderate level of literacy among the farmers. A positive relationship between education and innovativeness is widely assumed in the literature [24, 25].

Farmers' Experience of Engagement with Commodity Association Trainers (CATs)

Table 2 shows farmers' experience of engagements with the CATs. In Table 2 (a), farmers indicated that they were trained in market-oriented agriculture (97.2%) by CATs through Sasakawa support (94.5%) confirming the trickle-down effects of the "Train the Trainers" effort of the organization. Maize (77.6%), Rice (57.3%) and Groundnut (31.8%) were foremost among the list of crops for which the farmers received extension services from CATs. These crops perhaps play the most significant roles in household economy and food security in the study region. Maize is one of Africa's dominant food crops, rich in carbohydrates and essential minerals as well as 9% protein [26]. Also, the table shows that the farmers received extension service support in a broad area, including innovation dissemination, training on Good Agricultural Practice, linkage to agro-input dealers, market and credit, and support for group formation. The broad coverage of extension services rendered by the CATs to the farmers is expected to bridge the information and practice gaps in the area, leading to improvement in productivity, income and welfare of the farmers and their households. Eighty-two-point six percent of the farmers agreed that receiving private extension services from CATs was neither tedious nor complicated, hence most of the farmers (56.3%) affirmed their willingness to continue receiving extension support from CATs. In a similar vein, about 80% of the farmers expressed the likelihood to recommend the CATs approach to other farmers. Positive reactions observed from the farmers with

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respect to their views about the CATs extension approach, the willingness to continue with the process, and the likelihood of recommending it to other farmers are strong indications of satisfactory performance of the approach in the study locations, and hence high chances of sustainability likelihood of the CATs initiative.

Table 2 (b) on ratings of farmers' experience of engagement with the CATs processes, however, suggests areas for possible improvement in the approach. The table shows that an overwhelming proportion of the farmers (between 63-86%) were positive about most aspects of engagement with the CATs except for payment of fees for services received and connecting farmers to credit for which most farmers were either negative or neutral (75.8% and 76.2%, respectively). The prevailing mentality that extension services are a public good and as such services rendered in the extension must be free to farmers [27] will take a long time to change; and the process must be gradual. It is expected that the CATs extension approach can achieve this in the long run. A comparative view of the respondent's experience of engagement with the CATs in the project states (Figure 3) shows that most of the farmers in Kano, Jigawa and Gombe states (between 56-95%) were more positive in their experience of CATs than the farmers in Nasarawa where only 33% were more positive. The larger proportion of the farmers in Nasarawa with less positive experience of engagement with CAT could plausibly be explained by the challenge of communal clashes faced in some parts of the region which has reduced their opportunities of engagement with the CATs. Participants mentioned during the focus group discussions that many group meetings were halted due to communal conflicts. Many farmlands in the state were also affected by the recent flooding that ravaged most places in Nigeria around October/November 2022.

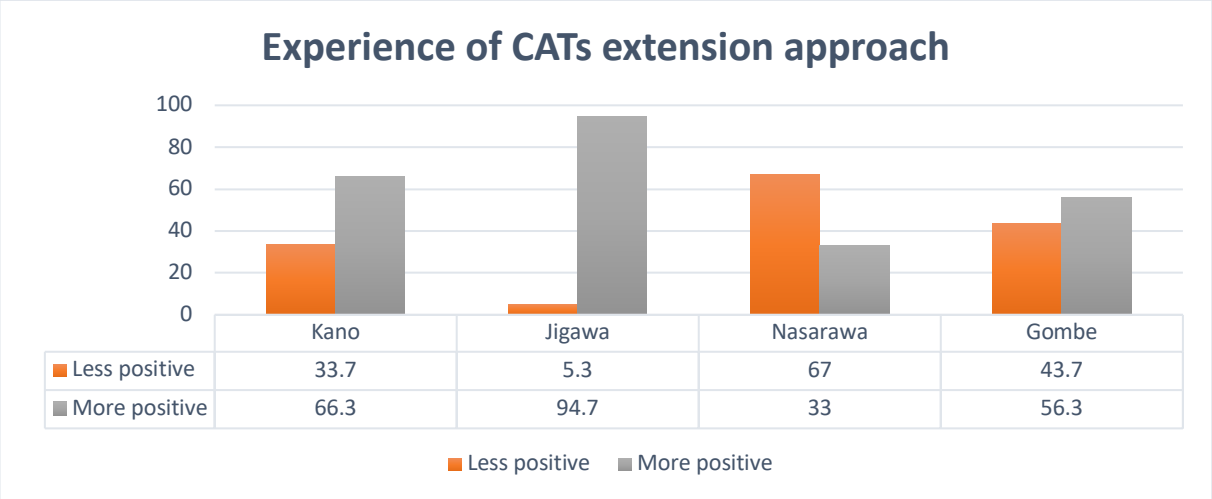

Figure 3: Farmers' summary of the experience of engagement with CATs in project states

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Influence of CATs in Supporting Extension Services

Table 3 shows the influence of the CATs on the various aspects of the extension service needs of the farmers in the project states. Comparing the mean values of the number of farmers reached by CATs for each area of extension service with the average number of farmers that were covered for the same service before the era of CATs shows a major improvement in all areas of the services as a result of the CATs initiative. As an example, the number of female farmers assisted with extension services improved (the number of adult female farmers reached rose from about 8 to 32 persons; youth female farmers rose from about 6 to 17 persons) since the introduction of the CATs initiative. Similarly, the number of farmers in each group that practiced market-oriented agriculture doubled (from 7 to about 15 persons per group). The number of agribusiness enterprises established and the number of farmers successfully linked to off-takers for their produce also rose from an average of 3 to 8 persons and 4 to 14 persons per group, respectively. The volume of crops (maize) marketed through cooperative efforts also increased from 7.64±5.15 Kg to 15.66±6.94 Kg per person in each group.

Influence of the CATs on Farmers' Enterprise Scale and Productivity (maize)

Table 4 shows that the farmers' size of land cultivated for maize increased from 2.01±1.41 to 3.28±2.06 acres; their total maize harvested increased from 1,073.13±964.05 to 2,555.82±2,264.08 kg while their productivity got boosted from 623.27±520.94 to 954.22±718.03 kg/acre before and after being involved in the CATs extension approach. In 2019, Nigeria produced 1.69 tons per hectare of maize [26] representing 1,690 Kg/hectare or about 684.2kg/acre (About 2.47 acres equal to 1 hectare). However, the CATs farmers have achieved an average of 954 Kg/acre, a massive improvement compared to the achievable value across Nigeria. The result implies that the performance of the farmers as measured by their productivity was better under the CATs extension approach than in their previous period.

Comparative Analysis of Farmers' Maize Productivity in Project States (n=335)

Figure 4 compares the maize productivity of the CATs farmers in study locations using their group average productivity value of 954.22 ± 718.03 kg/acre. The table reveals that most farmers in Kano (65.3%) and Gombe (70.6%) states recorded maize productivity values of more than the average performance of the entire farmers in the CATs network. The below group average productivity amongst most farmers in Nasarawa and Jigawa state is plausibly due to the inability of most farmers in this region to access credit support from financial institutions to support their farming enterprises unlike in Kano where a considerable proportion of the farmers were reported (Focus group discussions) to have accessed microfinance

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support for their farm business. Also, factors mentioned earlier to explain the less positive experience of most farmers in Nasarawa with regard to their engagements with CATs could have also influenced this trend in both states. These include communal conflict, climate change effects such as flooding and herdsmen attacks.

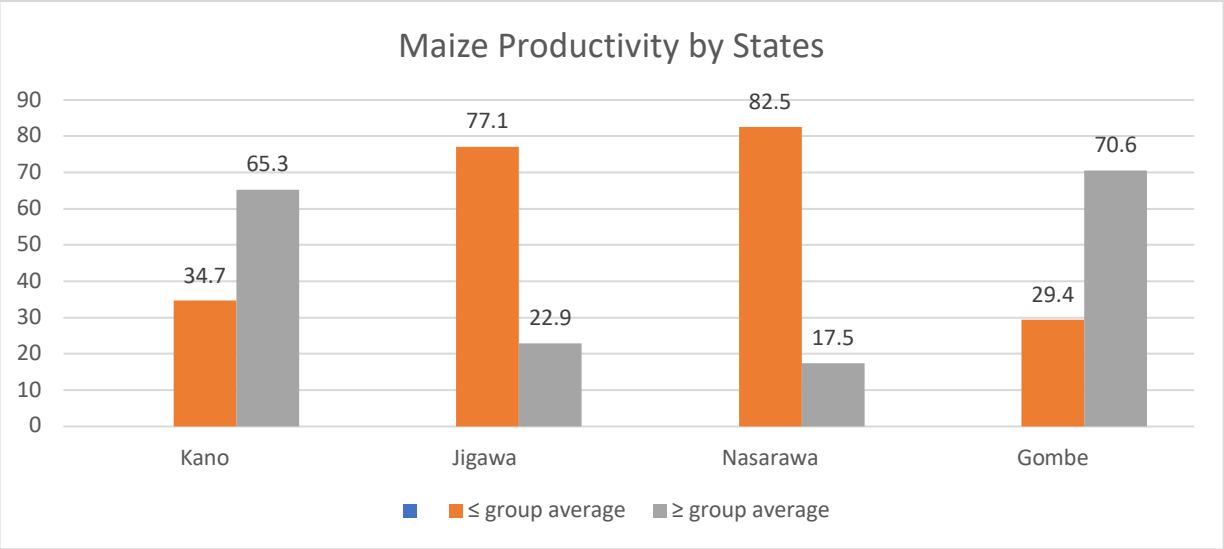

Figure 4: Maize productivity in project states

Influence of the CATs on Farmers' *Paddy Scale of Operation and Productivity

The influence of the CATs on paddy farmers' scale of operation and productivity was measured by estimating changes in land area cultivated, the quantity of paddy harvested, and the productivity of the respondents before and after their involvement in the CATs initiative. There was a general improvement in the CATs farmers' enterprise scale and productivity after involvement in the program (Table 5). The total land area cultivated by the CATs farmers increased from 2.77 ± 4.31 acres to 4.17 ± 5.61 acres, as the maximum acreage cultivated rose from 30 to 40 acres. Also, the average paddy production of the farmers improved from 786.70 ± 661.93 kg before involvement in CATs to 1,973.01 ± 2,077.09 kg after involving in the CATs project, representing more than a doubling of the average yield. In this case, too, the minimum paddy harvested rose from 0 kg to 150 kg and the maximum from 3,900 kg to 22,500 kg in a cycle. Furthermore, the average productivity of the respondents increased from 559.55 ± 533.10 kg/acre to 818.06 ± 800.11 kg/acre.

Comparative Analysis of Farmers' Maize Productivity in Project States

Table 6 shows the comparative analysis of the paddy productivity of the farmers across the project states using the group mean productivity of 818.06 ± 800.11 as a benchmark. The distribution shows that 55.9% of the proportion of farmers from Kano State had paddy productivity above the group average. Less than fifty

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percent of the farmers from other project-participating states recorded productivity of above the group means. Nasarawa State had the fewest proportion (2.6%) of its farmers scaled above the average productivity value. A similar trend was observed in the comparative analysis of the farmers' maize productivity across the project states. The foregoing, therefore, suggests that while all the project states are faring well under the CATs extension approach, farmers from Nasarawa state occupy the lowest rung of the ladder in terms of maize and paddy productivity. The probable reason for this may be the challenges of herders' attacks and poor accessibility to credit support from financial institutions which came to the fore during a focus group discussion as serious challenges faced in the state.

Influence of CATs on Access to Agri-support Services

Table 7 shows the respondents' access to some essential agri-support services before and after being involved in the CATs project. Generally, the farmers' access to each of the items tested in the study was higher after being involved in the CATs groups. However, while marginal improvements were recorded for some items, some others witnessed a major boost. For instance, the index of access to financial support/loans from credit institutions marginally increased from 1.13 to 1.22. In fact, only 2.5% of the farmers indicated a high level of access to financial support/loans before and after joining the CATs group. This implies no change in the proportion of the farmers who had better access to loans at before and after joining the CATs group. On the other hand, more farmers witnessed increased access to a stable market and better prices for their produce after being part of the CATs project. As an example, only 38.1% of the farmers had a high level of access to a stable market for harvested produce before CATs. This proportion grew to 78.5% during CATs intervention. The highest access was indicated for a stable market ($\bar{x}$=2.70) followed by better prices for produce ($\bar{x}$=2.66) and fertilizers ($\bar{x}$=2.15). The lowest access was observed for financial support/loans.

Farmers' Perception of the Commodity Trainers/Trader's Extension Approach

Table 8 shows the respondents' perception of the CATs extension approach. In Table 8 (a) showing the distribution of responses to the perception statements, it can be inferred that the majority of the respondents had positive opinions about most of the perception statements. As an example, an overwhelming proportion of the farmers (97.2%) agreed that CATs can guarantee increased access to extension services and 87.4% indicated that the approach can imbue a business-like attitude in farmers. The trend of responses was generally positive for most statements except for about 87.9% who opined that the CATs approach takes too much of farmers' time. Table 8 (b) which shows the respondents' summary of responses to the perception scale reveals that slightly above half of the farmers

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(50.3%) fell within the more favorable category for the CATs extension approach using the mean perception score of 22.58 ± 1.58 as a basis for categorization. The table further revealed that the highest proportion of the farmers from Gombe state (91.3%) followed by Kano (66.3%) fell within the more favorable category of perception than farmers from other participating states.

Factors Influencing Farmers' Change in Maize and Paddy Productivity

It is essential to understand the factors affecting farmers' generally positive change in maize and paddy productivity after involving in the CATs extension approach in order to guide effectively future extension initiatives and scale up of the current intervention. Table 9 shows the contributions of independent variables (such as sex, age, ease of accessing CATs services, experience, and perception of CATs among others) to one of the major performance indicators of the project, which is enhanced productivity. The results show that maize farmers' area of farm location ($\beta = 0.214$; sig < 0.05), their sex ($\beta = 0.125$; sig < 0.05), age ($\beta = 0.144$; sig < 0.05), education ($\beta = 0.164$; sig < 0.05), willingness to continue in CATs group ($\beta = 0.217$; sig < 0.05) and experience of CATs ($\beta = 0.243$; sig < 0.05) significantly and positively influenced their enhanced maize productivity after participating in the CATs project. However, only 22% of the variation in the farmers' boost in maize productivity is accounted for by the explanatory variables tested in this study. Also, respondents' area of farm location [study cites] ($\beta = 0.216$; sig < 0.05), sex ($\beta = 0.326$; sig < 0.05), and ease of accessing CATs extension services ($\beta = 0.306$; sig < 0.05) positively and significantly contributed to improvement in paddy productivity among farmers. About 15% of the variation in the farmers' increase in paddy productivity is accounted for by the explanatory variables tested in this study. Thus, farmers in some locations, especially from Kano and Jigawa states performed better in terms of positive change in maize and paddy productivity after membership in the CATs than others from different areas. This may be due to the longer period of exposure to the CATs initiative enjoyed by participating farmers in Kano and Jigawa states compared to their colleagues. Thus, continued implementation of the CATs extension approach has the prospect of further boosting farmers' productivity and income in the study locations. The CATs intervention started in Kano and later in Jigawa state. Records show that the intervention started in Nasarawa state about two years ago. The male farmers especially the younger and more educated ones (among maize producers) also had a better change in their crop productivity. This suggests that younger age and education among beneficiary farmers granted an impetus to the attainment of the CATs goals. The reason for this is not far-fetched as education and youthfulness have been established as precursors for innovation adoption behavior among the target of any agricultural intervention [28, 29, 30]. Furthermore, paddy farmers' ease of accessing CATs extension services and maize farmers' willingness to

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continue in CATs groups enhanced the positive changes attained in their crop productivity. This indicates that the accessibility of the CATs master trainers to the farmers and the farmers' interest (motivation) played essential roles in appropriating the benefits of the extension support received. This is consistent with the findings in a study conducted in China which showed that farmers' motivation was significantly contributory to technology adoption among Litchi farmers [31].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The study concluded that the commodity association trainers/traders have enhanced extension services in the project states. Considerable impacts have been made in facilitating farmers' access to extension support, linking farmers with inputs dealers, and ensuring guaranteed markets and better prices for farmers' produce. These impacts cut across all the participating states. However, not much has been achieved in brokering arrangements for credit between farmers and financial institutions in some participating states. While some states such as Kano have recorded modest success in accessing financial support for farmers from financial institutions, other states have not. Successes achieved and farmers' favorable disposition towards the CATs extension approach give hope for the sustainability likelihood of the system. Continued implementation of the CATs extension approach has the prospect of further boosting farmers' productivity and income in the study locations. Farmers in some locations, especially from Kano and Jigawa states performed better in terms of positive change in maize and paddy productivity after membership of the CATs than others. Being male, young, educated, having ease of accessing CATs master trainers and farmers' motivation enhanced the chances of performance of the CATs extension approach among the farmers.

The commodity association trainers/traders' initiative is recommended for up-scaling to cover other regions of the country where there still exists the problem of low margin of extension agents and farm family ratio. The master trainers should be provided with items such as branded caps and t-shirts for ease of identification, especially by new farmers. The SAA Nigeria should consider how CATs can generate commission for their services rendered to farmers, especially in the areas of facilitating linkage to markets (off-takers) and brokerage of partnerships between farmers and agri-input dealers. Strategies to generate commissions for their efforts should be incorporated into their regular training. This will ensure some modest rewards for their efforts, hence boosting their motivation for more effective services and guaranteeing the sustainability of the approach.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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Table 1: Respondents' demographic characteristics (n=396)

Variable	Response	Kano	Jigawa	Nasarawa	Gombe	All respondents
		F (%)	F (%)	F (%)	F (%)	F (%)
Sex	Male	69 (72.6)	82 (86.3)	63 (61.2)	69 (67.0)	283 (71.5)
	Female	26 (27.4)	13 (13.7)	40 (38.8)	34 (33.0)	113 (28.5)
Age (years)	≤ 30	15 (15.8)	8 (8.4)	23 (22.3)	15 (14.6)	61 (15.4)
(42.59±10.91)	31-40	23 (24.2)	21 (22.1)	48 (46.6)	41 (39.8)	133 (36.6)
	41-50	32 (33.7)	32 (33.7)	25 (24.3)	30 (29.1)	119 (30.1)
	51-60	20 (21.1)	26 (27.4)	7 (6.8)	12 (11.7)	65 (16.4)
	> 60	5 (5.3)	8 (8.4)	0 (0)	5 (4.9)	18 (4.5)
Marital Status	Single	5 (5.3)	2 (2.1)	2 (1.9)	7 (6.8)	16 (4.0)
	Married	86 (90.5)	92 (96.8)	99 (96.1)	95 (92.2)	372 (93.9)
	Divorced	2 (2.1)	0 (0)	1 (1.0)	0 (0)	3 (0.8)
	Separated	0 (0)	1 (1.1)	0 (0)	1 (1.0)	2 (0.5)
	Widowed	2 (2.1)	0 (0)	1 (1.0)	0 (0)	3 (0.8)
Household Size (persons)	≤ 5 (Small)	22 (23.2)	14 (14.7)	53 (51.5)	22 (21.4)	111 (28.0)
(10.27±7.52)	6-10 (Moderate)	28 (29.5)	17 (17.9)	43 (41.7)	52 (50.5)	140 (35.4)
	11-15 (Fairly Large)	21 (22.1)	36 (37.9)	5 (4.9)	21 (20.4)	83 (21.0)
	16-20 (Large)	11 (11.6)	15 (15.8)	1 (1.0)	4 (3.9)	31 (7.8)
	> 20 (Extra Large)	13 (13.7)	13 (13.7)	1 (1.0)	4 (3.9)	31 (7.8)
Highest Education	Non-formal	3 (3.2)	0 (0)	11 (10.7)	4 (3.9)	18 (4.5)
	Quranic	27 (28.4)	27 (28.4)	7 (6.8)	21 (20.4)	82 (20.7)
	Adult Education	1 (1.1)	4 (4.2)	4 (3.9)	5 (4.9)	14 (3.5)
	Primary School	17 (17.9)	17 (17.9)	23 (22.3)	16 (15.5)	73 (18.4)
	Secondary School	21 (22.1)	21 (22.1)	46 (44.7)	42 (40.8)	130 (32.8)
	Tertiary	26 (27.4)	26 (27.4)	12 (11.7)	15 (14.6)	79 (19.9)

*Figures in parentheses are the percentage

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Table 2 (a): Farmers' experience of engagement with CATs

Variable	Response	F	%
Have received training on market-oriented agriculture before	Yes	385	97.2
	No	11	2.8
Organiser of the training on market-oriented agriculture	Sasakawa/CATs	374	94.5
	ADP	22	5.6
Commodities of focus for the extension service received*	Rice	227	57.3
	Maize	307	77.6
	Cassava	65	16.5
	Sorghum	94	23.7
	Millet	121	30.7
	Soyabean	92	23.3
	Groundnut	126	31.8
	Cowpea	99	25.0
	Vegetables	34	8.7
Areas of extension services received from CATs*	Information/innovation dissemination	322	81.5
	GAP	323	81.6
	Input supply/Linkage	321	81.8
	Agro-processing support	290	73.2
	Market linkage	326	82.3
	Credit linkage	203	51.3
	Group formation	307	77.5
View about receiving private extension services from CATs	Very easy	268	67.7
	Somewhat easy	59	14.9
	Tedious	67	16.9
	Complicated	2	0.5
Willingness to continue receiving extension service from CATs	No	61	15.4
	Probably Yes	112	28.3
	Affirmative	223	56.3
Likelihood to recommend CATs approach to other farmers	Not likely	2	0.5
	Probably	79	19.9
	Affirmative	315	79.5

*Multiple responses

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Table 2 (b): Farmers' experience of engagement with CATs

Statements	Negative %	Neutral %	Positive %	Mean ±SD
General attitudinal disposition of farmers to private extension provision	8.3	22.7	68.9	2.61±0.64
Experience of receiving support from Sasakawa Africa Association Nigeria on market-oriented agriculture	7.6	6,6	85.9	2.78±0.57
Provision of training to farmers on good agricultural practices	7.6	16.4	76.0	2.68±0.61
Provision of services for a fee to farmers	38.4	37.4	24.2	1.86±0.78
Connecting farmers to input suppliers	9.1	28.3	62.6	2.54±0.66
Connecting farmers to credit	37.6	38.6	23.7	1.86±0.77
Linking farmers to markets off-takers (market)	7.6	8.3	84.1	2.77±0.58

Table 3: Influence of CATs extension coverage within farmers' groups

Indicators	Before CATs	During CATs
Estimated number of adult Male farmers assisted with extension services	16.98±38.43	43.33±80.26
Estimated number of adult female farmers assisted with extension services	8.03±15.23	31.62±61.82
Estimated number of youth male farmers assisted with extension services	13.80±24.33	27.13±34.27
Estimated number of youth female farmers assisted with extension services	6.41±11.27	16.54±21.01
Number of agribusiness enterprises established per group through CATs	2.78±3.33	8.07±6.03
Number of farmers per group that practice market-oriented agriculture through CATs support? i.e., the average number of farmers per group that produces for sale and not just for personal consumption only	7.38±7.61	14.75±8.27
Number of farmers per group that have been successfully linked to off-takers for their produce	3.98±5.16	14.41±8.31
Number of farmers per your group that was able to obtain credit from financial institutions and other market actors through CATs	1.41±2.69	5.46±6.67
Number of farmers per group that was able to obtain agri-inputs from suppliers	6.01±7.18	14.71±8.46
Number of farmers per group that were linked with repair and maintenance technicians	1.39±2.06	3.14±2.76
Volume of crops sale marketed through cooperatives in tones in last season (using maize as a focal crop; 1 bag = 100kg; 10 bags [1000kg] = 1 tons) per group	7.64±5.15 Kg	15.66±6.94 Kg

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Table 4: Influence of CATs on farmers' maize scale and productivity (n=335)

Variable	Period	Minimum	Maximum	Mean±SD
Land cultivated (Acres)	Before CATs	0	10	2.01±1.41
	During CATs	1	12	3.28±2.06
Total maize harvest (kg)	Before CATs	0	7000	1,073.13±964.05
	During CATs	100	17,000	2,555.82±2,264.08
Productivity (Kg/Acre)	Before CATs	40	5000	623.27±520.94
	During CATs	80	4000	954.22±718.03

Table 5: Influence of CATs on farmers' paddy productivity (n=282)

Variable	Period	Minimum	Maximum	Mean±SD
Land cultivated	Before CATs	0	30	2.77±4.31
(Acres)	During CATs	0	40	4.17±5.61
Total paddy harvest	Before CATs	0	3,900	786.70±661.93
(kg)	During CATs	150	22,500	1,973.01±2,077.09
Productivity	Before CATs	5	3,750	559.55±533.10
(Kg/Acre)	During CATs	50	4,500	818.06±800.11

Table 6: Paddy's productivity in project states

Productivity	Kano F (%)	Jigawa F (%)	Nasarawa F (%)	Gombe F (%)	All Respondents	Mean± SD
≤ group average	30 (44.1)	39 (68.4)	75 (87.4)	60 (75.0)	204 (72.3)	818.06 ± 800.11
> group average	38 (55.9)	18 (31.6)	2 (2.6)	20 (25.0)	78 (27.7)	

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Table 7: Farmers' access to agri-support services before and after membership of CATs group

	Before CATs		After CATs		Index of access before CATs	Index of access after CATs
	High %	Moderate / Low %	High %	Moderate / Low %		
Financial support/loans	2.5	97.5	2.5	97.5	1.13	1.22
Improved crop seedlings/stem	0.8	99.3	0.8	99.2	1.32	1.41
Fertilisers	33.1	66.9	33.1	66.9	2.10	2.15
Pesticides/herbicides	6.6	93.4	6.6	93.5	1.22	1.27
Stable market for harvested produce	38.1	61.9	78.5	21.4	2.16	2.70
Better price offer for produce	52.0	48.0	76.5	23.5	2.35	2.66

Table 8 (a): Farmers' perception of the commodity trainers/trader's extension approach

Statements	Agree %	Uncertain %	Disagree %
The Commodity Association Traders/Training (CATs) approach can guarantee increased access to extension services at the community level	97.2	2.8	0
Use of the CATs approach cannot guarantee adequate and effective extension information dissemination	95.7	2.8	1.5
The CATs approach is the right step to make extension delivery more efficient and effective	89.1	2.0	8.8
The CATs approach can encourage the co-creation of knowledge among farmers	33.6	14.1	52.3
The CATs approach is too costly to be affordable by smallholder farmers	0	12.1	87.9
The CATs approach can imbue a business-like attitude in farmers	87.4	10.6	2.0
The CATs approach assures quick and timely response to farmers' challenges	0	98.0	2.0
The CATs approach takes too much of farmers' time	87.9	9.1	3.0
The CATs approach enables improved access to extension services for youth and women farmers	0.3	99.2	0.5
The CATs approach builds the capacity of farmers as both producers and trainers	39.1	33.8	27.0

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Table 8 (b): Summary of farmers' perception of the commodity trainers/trader's extension approach

Perception of CATs extension approach	Kano F (%)	Jigawa F (%)	Nasarawa F (%)	Gombe F (%)	All Respondents	Mean± SD
Less favourable	32 (33.7)	44 (46.3)	74 (71.8)	9 (8.7)	197 (49.7)	22.58 ± 1.58
More favourable	63 (66.3)	51 (53.7)	29 (28.2)	94 (91.3)	199 (50.3)	

Table 9: Factors influencing farmers' change in maize and paddy productivity before and during the CATs initiative

	Changes in maize productivity			Changes in Paddy productivity		
	Standardized coefficients (β)	t-value	p-value	Standardized coefficients (β)	t-value	p-value
(constant)		0.787	0.432		-0.988	0.324
Study sites (state)	0.214	0.354	0.000*	0.216	3.087	0.002*
Sex	0.125	2.101	0.036*	0.326	5.262	0.000*
Age	0.144	2.188	0.029*	0.080	1.137	0.257
Marital status	0.015	0.274	0.785	0.078	1.340	0.182
Household size	0,000	0.005	0.996	0.008	0.127	0.899
Education	0.164	2.761	0.006*	0.122	1.913	0.057
Ease of accessing CATs extension services	0.127	1.343	0.180	0.306	3.098	0.002*
Willingness to continue in CATs groups	0.217	2.189	0.029*	0.156	1.599	0.120
Likelihood to recommend CATs	0.026	0.439	0.661	0.059	0.937	0.350
Experience of CATs	0.243	3.683	0.000*	0.047	0.671	0.503
Perception of CATs support	0.117	1.847	0.066	0.029	0.405	0.686
	R=0.38, R^2=0.219, Adjusted R^2= 0.188, Standard error= 428.4, $\alpha_{0.05}$			R=0.47, R^2=0.146, Adjusted R^2= 0.117, Standard error= 721.3, $\alpha_{0.05}$		

REFERENCES

1. **Msuya CP, Annor-Frempong FK, Magheni MN, Agunga R, Igodan C, Ladele AA and A Ndiaye** The role of agricultural extension in Africa's development, the importance of extension workers and the need for change. *International Journal of Agricultural Extension.* 2017; **5(1):** 51-58.

2. **Danso-Abbeam G, Ehiakpor DS and R Aidoo** Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. *Agric and Food Security*. 2018; **7(74):**1-10.

3. **Birkhaeuser D, Evenson RE and G Feder** The economic impact of agricultural extension: A review. *Economic Development and Cultural Change.* 1991; **39(3):** 607-650.

4. **Ladele AA, Igodan CO, Agunga R and OS Fadairo** Agricultural extension in Nigeria's transformation agenda: key recommendations based on a field study. *International Journal of Agricultural Extension.* 2016; **3(3):**173-185.

5. **Haruna SK and YMG Abdullahi** Training of public extension agents in Nigeria and the implications for government's agricultural transformation agenda. *Journal of Agricultural Extension.* 2013; **17(2):** 98-104.

6. **Feder G, Birner R and JR Anderson** The private sector's role in agricultural extension systems: potential and limitations. *Journal of Agribusiness in Developing and Emerging Economies.* 2011; **1(1):** 31-54.

7. **Umali-Deininger D and LA Schwartz** Public and private agricultural extension: Beyond traditional frontiers (**Vol. 236**). World Bank Publications, 1994.

8. **Sasakawa Africa Association-SAA.** Strategic Plan 2021-2025. 2021. https://www.saa-safe.org/wwd/ *Accessed November 2022.*

9. **Gong D, Tang M, Liu S and Q Li** Reconsidering production coordination: A principal-agent theory-based analysis. *Advances in Production Engineering & Management.* 2017; **12(1):** 51-61.

10. **Bernhold T and N Wiesweg** Principal-agent theory: Perspectives and practices for effective workplace solutions. A Handbook of Management Theories and Models for Office Environments and Services. 2021, 117-128.

11. **Voorn B, Van Genugten M and S Van** Thiel Multiple principals, multiple problems: Implications for effective governance and a research agenda for joint service delivery. *Public Administration*. 2019; **97(3):** 671-685.

12. **Tundunwada IY and A Abbas** Flood vulnerability mapping and prediction for early warning in Jigawa State, Northern Nigeria, using geospatial techniques. *International Journal of Disaster Risk Reduction.* 2022; **79:** 103156.

13. **Musa S** Problems associated with Date Palm Fruit marketing in Jigawa State, Nigeria. *FUOYE Journal of Agriculture and Human Ecology.* 2021; **5(1):** 48 – 58.

14. **Lawan UM, Abubakar IS, Jibo AM and A Rufai** Pattern, awareness and perceptions of health hazards associated with self-medication among adult residents of Kano metropolis, North-western Nigeria. *Indian Journal of Community Medicine.* 2013; **38(3):** 144-151.

15. **Irohibe IJ and AE Agwu** Assessment of food security situation among farming households in rural areas of Kano State, Nigeria. *Journal of Central European Agriculture.* 2014; **15(1):** 94 -107.

16. **Sani AA, Sanni SA, Damisa MA and YU Oladimeji** Assessment of household food security among sorghum Farmers under Agricultural Transformation Agenda in Gombe State, Nigeria. *Journal of Sustainable Development in Africa. 2017*; **19(4):** 1 – 12.

17. **Bello Y, Adebayo AA and B Abubakar** Analysis of rainfall and temperature changes in Gombe State, Nigeria. *FUDMA Journal of Sciences*. 2020; **4(1):** 632 – 646.

18. **Salau ES and AJ Attah** A socio-economic Analysis of Urban Agriculture in Nasarawa State, Nigeria. *Production Agriculture and Technology*. 2012; **8(1):** 17 – 29.

19. **De Brauw A** Gender, control, and crop choice in northern Mozambique. *Agricultural Economics.* 2015; **46(3):** 435-448.

20. **Lu JL** Gender differentiation among farmers in the agricultural sector in Benguet, Philippines. *Journal of International Women's Studies*. 2007; **9(1):** 176-199.

21. **Atser GL, Dixon A, Ekeleme F, Hauser S, Fadairo O, Adekoya A and B Vanlauwe** The effect of communication media on the uptake of agricultural innovations in selected states of Nigeria. *Agricultural Education and Extension*. 2022; **29(5):** 583-604.

22. **Omolehin RA, Akogun EO and SO Oyewole** Analysis of factors influencing adoption of Good Agronomic Practices (GAP) among cassava farmers under Nigeria Agricultural Transformation Agenda. *Journal of Agriculture and Ecology Research International*. 2020; **21(6):** 11-20.

23. **Okoye BC, Abass A, Bachwenkizi B, Asumugha G, Alenkhe B, Ranaivoson R and I Ralimanana** Differentials in technical efficiency among smallholder cassava farmers in Central Madagascar: A Cobb Douglas stochastic frontier production approach. *Cogent Economics & Finance.* 2016; **4(1):** 1143345.

24. **Weir S and J Knight** Externality effects of education: dynamics of the adoption and diffusion of an innovation in rural Ethiopia. *Economic development and cultural change*. 2004, **53(1):** 93-113.

25. **Makate C, Makate M, Mango N and S Siziba** Increasing resilience of smallholder farmers to climate change through multiple adoption of proven climate-smart agriculture innovations. Lessons from Southern Africa. *Journal of Environmental Management.* 2019; **231:** 858-868.

26. **IITA.** IITA-BIP sets record for maize production per hectare in Nigeria. 2020. https://www.iita.org/news-item/iita-bip-sets-record-for-maize-production-per-hectare-in-nigeria/ *Accessed December 2022.*

27. **Collins CS** Land-Grant Extension: defining public good and identifying pitfalls in evaluation. *Higher Education Outreach and Engagement*. 2015; **19(2):** 37-64.

28. **Acevedo M, Pixley K, Zinyengere N, Meng S, Tufan H, Cichy K and J Porciello** A Scoping review of adoption of climate-resilient crops by small-scale producers in low-and middle-income countries. *Nature Plants*. 2020; **6(10):** 1231-1241.

29. **Dhakal A, Cockfield G and TN Maraseni** Deriving an index of adoption rate and assessing factors affecting adoption of an agroforestry-based farming system in Dhanusha District, Nepal. *Agroforestry systems.* 2015; **89(4):** 645-661.

30. **Coffman M, Bernstein P and S Wee** Electric vehicles revisited: a review of factors that affect adoption. *Transport Reviews*. 2017; **37(1):** 79-93.

31. **Li H, Huang D, Ma Q, Qi W and H Li** Factors influencing the technology adoption behaviours of litchi farmers in China. *Sustainability.* 2019; **12(1):** 1-13.

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MEDIA USE FOR *SOYGARI*: A CASE STUDY OF WOMEN'S BEHAVIOUR TO NUTRITION-SPECIFIC INFORMATION IN SOUTH WEST NIGERIA

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ABSTRACT

Gari is the most popular form in which cassava is consumed in most households in Nigeria. However, gari is deficient in most food nutrients and its excessive consumption without supplementation leads to malnutrition. *Soygari* (Gari fortified with soyabean) could help reduce malnutrition if positive behaviour is elicited through appropriate Communication Media (CM). However, empirical evidence on suitable CM mix to elicit positive behaviour towards *Soygari* nutrition is scarce. Therefore, CM mix for behavioural change in *Soygari* nutrition information dissemination among rural households in southwestern Nigeria was investigated. This study evaluated the effect of consistent dosage of *Soygari* information on rural women's behaviour in South Western Nigeria. A quasi-experimental research design was used. Data were collected from 224 women in soybean-producing households in the region through a systematic sampling procedure. This study trained women in *Soygari* information for twelve weeks using podcasts (audio and video messages), and interactive (demonstrations and visual teaching methods). The study targeted change in women's knowledge, attitude, and utilization. Empirical analyses are described in tables and percentages, while parametric tests were used to analyze a priori hypotheses. The podcast method influenced higher change in Knowledge ($\Delta\bar{x}$ = 2.68) and attitude ($\Delta\bar{x}$ =5.94) of women while a higher change in utilization ($\Delta\bar{x}$= 7.32) was found among women exposed to the interactive method. A significant difference existed in the utilization (T = 4.018; $p < 0.05$) of *Soygari* among women exposed to the podcast and interactive methods. Both media types effectively promoted positive behavioural change towards *Soygari* nutrition among rural households in South western Nigeria. Audio and practical demonstration mix were most suitable. An interactive method of communication is best if the target of nutrition information is for immediate household utilization. Multiple dosages of information can be a motivation to change an already existing human behaviour even when distractions exist.

Key words: Change in behaviour, *Soygari*, Nutrition-Specific diet, media use, Women

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INTRODUCTION

Low-income earners consume more low-quality diets than high-income earners [1]. This is connected to the inability to afford an exorbitant quality/protein-rich diet and inadequate knowledge of the nutrition fortification of the diets. Gari is probably the most popular form in which cassava (*Manihot esculenta*) is consumed in Nigeria as it constitutes a daily meal for over 150 million people in the country and beyond. It could be compared to what potato flour is to Westerners [2]. However, despite the popularity of Gari, the product is highly deficient in almost all food nutrients, especially protein, 4], except carbohydrates [3, 4]. Malnutrition problems exist in sub-Saharan Africa where pure cassava gari is a staple food [4].

Over a quarter of all undernourished West Africans are noted to reside in Nigeria while the southwest, north central and northeast regions of Nigeria are reported to represent the majority of those affected by malnutrition [5]. The need to fortify cassava which is an inexpensive source of energy but very low in protein with a more nutritious food prompted the development of *Soygari*, sweet potato gari [3] and some other soybean-based food like Soy-ogi, Soymilk, Soy-vita, Soymusa, Soy biscuit among others. *Soygari* produced from cassava tubers and soybean in correct proportion has been shown to have improved protein content and low hydrogen cyanide level [3, 6]. Bankole *et al.* [7] corroborated this finding by asserting that the incorporation of soybean, groundnut and other seed protein into cassava meal has yielded fortified products of high-protein value. Gari fortified with soybean was developed by the Institute of Agricultural Research and Training (IAR&T) in Collaboration with the International Institute of Tropical Agriculture (IITA) in 1989 and was disseminated through practical demonstrations in some communities in Oyo state, Nigeria. However, a discontinued adoption of the fortified gari (otherwise known as *Soygari*) was observed among the women in Southwest Nigeria, the study area. Little or no fortified food product is known to meet the processing and storage requirements of *Soygari*. It is cheap and a staple food among rural households. Thus, such change in adoption behaviour is mainly informed by key attitudinal change and knowledge as regards nutrition information [8]. Information platforms such as digital and traditional health-related promotions can influence the behaviour of the audience category to change in knowledge, attitude and use [9]. The behaviour change towards *Soygari*, thus requires effective information dissemination for a key attitudinal and knowledge change on the production and processing of the product. The prevalence of malnutrition among children in developing countries amplifies the importance of mass media, be it print, broadcast or social media platforms to educate parents on the need for proper feeding of children and the need for *Soygari*[10].

According to Nindi *et al.* [11] effective dissemination of information in the field of nutrition can be achieved by using various media of communication that combine

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both individual and mass methods. These communication media play the unique role of creating demand and building consciousness about the importance of nutrition at all levels and among all key stakeholders in nutrition development. The case of "Massagana 99" project, reported by Yahaya (12) explained how radio broadcast and teaching methods were strategically used in the Philippines, to increase rice production among farmers through positive behavioural change. Likewise, observation learning using Bandura's Social learning theory was used on health education for children and results showed that children tested were endowed with positive behaviour change outcomes in areas of nourishment [13]. These outcomes are necessary for behaviour change in *Soygari* information. These two interventions do not give an effective medium, both in mass media use or in interactions for replicating in a study as *Soygari* dissemination. Thus, this study aimed to ask: 1. Which of these communication types is effective for nutritional information among rural women? 2. How much will a consistent dosage of nutritional information influence behaviour change? and, what media mix would be appropriate and effective in the dissemination of *Soygari* technology?

A priori, the study hypothesized a difference in behavioural attributes after the dissemination of *Soygari* information in different media and a difference in the mean contributions of the four mediums used for behaviour change. This study, thus, provides the background information for the assessment of the divergent behaviour of the respondents in response to communication strategies used for *Soygari* nutrition information in Southwest Nigeria.

Objectives of the study

This study aimed to determine the influence of a consistent dosage of *Soygari* information disseminated in media tools that could produce a change in behaviour towards *Soygari* utilization in Southwest Nigeria. Specifically, this study assessed respondents' baseline nutritional behaviour (attitude, knowledge, and utilization) toward *Soygari* in southwest Nigeria, determined the post-dissemination behaviour to *Soygari* and the communication approach most appropriate for nutrition information dissemination among rural audiences.

MATERIALS AND METHODS

The study area is southwest Nigeria. The study purposely selected soybean-producing communities to aid motivation for utilization and effective communication of intervention. The study focused on women, arguing that empowering women is the surest way to improve nutrition for mothers, their children and other household members [14, 15].

The multi-stage sampling procedure was used to select rural women for the study. The first stage was a purposive selection of Ondo and Oyo States in southwestern Nigeria.

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A study by the Agricultural Media Resources and Extension Centre (AMREC) (16) of the Federal University of Agriculture, Abeokuta, Nigeria, identified the two states in Nigeria as major soyabean producing areas of the Southwestern part of the country. The study randomly selected rural local government areas from southwest Nigeria (Figure 1). These local areas include Tede, Ilua, Ara Oyo, Onirebara, Sabe Idi-apa Murano in Oyo State and Akunu Akoko, Isua Akoko, Owode, Eloyoowo, Epinin Akoko and Ise Akoko in Ondo state.

Research design and sampling procedures

A quasi-experimental research design which involved assessing the knowledge, attitude and utilization of *Soygari* by the women before and after exposure to the *Soygari* information package in a podcast and interactive messages for a period of 12 weeks was used. Two hundred and twenty-four (224) women across 12 communities of the study areas were selected using a systematic sampling procedure on households. Volunteers (women) who were approached for consent in participation during the preliminary phase (reconnaissance survey), were trained and designated as respondents and information was obtained before and after the intervention. The survey instruments (questionnaire) which sourced respondents' primary data (behavioural change observed in women's knowledge of *Soygari*, attitude towards utilization of *Soygari* in diets and level of utilization of *Soygari* in diets) were subject to test pretest validation. Using the split-half method, a reliability coefficient of 0.74 was obtained for the whole instrument testifying that the instrument was reliable for the study. The research was in three phases as follows:

Baseline survey: Pre-intervention assessment of the respondents' knowledge, and attitude towards the utilisation of soybean and their level of utilisation of soybean in diets were carried out using quantitative research tools. Basic personal details of respondents were assessed at this level. Intervention: Dissemination of *Soygari* nutrition information using interactive (practical demonstrations of processing and teaching) and podcast (video and audio) method types. The intervention was for 12 weeks. For the podcast message, nutrition and processing information were packaged into a 10-minute video and audio mp3 clips format and transferred through mobile phones to interested women in six communities of the study. The interactive communication method engaged the researcher along with other agricultural extension workers for women in six communities. All methods were used in a mutually exclusive way.

Post-intervention: The effectiveness of the media used was assessed twelve weeks after the intervention. The influence of the media on the respondents' knowledge of *Soygari*, attitude towards *Soygari* utilisation and actual utilisation of *Soygari* in household diets was determined.

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Data collection

Primary data were used for this study. Data were obtained before and after the intervention through the use of an interview schedule consisting of both open and close-ended questions. Data on personal variables such as marital status, religion, educational status, years of formal education training, and household size were obtained. The key variable considered in the study was the behavioural change observed in women's knowledge of *Soygari*, attitude towards utilisation of *Soygari* in diets and level of utilisation of *Soygari* in diets. Knowledge –*Soygari* knowledge statements were presented to the respondents and responses were obtained on whether statements were considered true, not sure, or false by the respondents. Response means were taken at ante and post-interventions. Mean responses were determined before and after the intervention.

Attitude - A comprehensive list of items measuring attitudes towards nutritional innovation adapted from National Obesity Observatory (NOO) [17] was presented to the respondents on a Likert-type scale of strongly agree (SA), agree (A), undecided (U), disagree (D) and strongly disagree (SD). Mean attitudinal scores for each statement were obtained at ante and post-interventions. Utilisation - Statements on the different purposes/ways *Soygari* could be utilised were presented to the respondents. Responses were obtained on a three-point utilisation scale of frequently, occasionally, and never used. Differentials of response mean were taken.

Data analysis - Data obtained were subjected to frequency analysis and visualizers (like bar and pie charts) while the impact of the communication strategy was measured using t-tests and the difference in the mean of each method (video, audio, practical demonstration and teaching) was analyzed with Analysis of variance (ANOVA). The respondents' knowledge, attitude and utilization status before and after the communication intervention were compared using t-independent statistics. The data analysis was done using both International Business Machines Corporation-Statistical package for the Social Sciences (IBM-SPSS version 21) and Excel.

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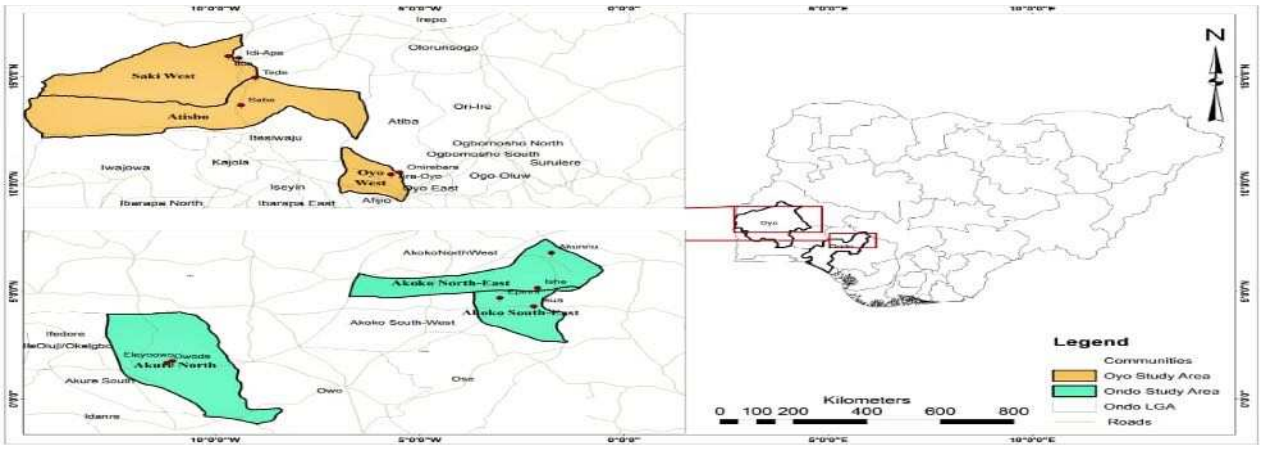

Figure 1: Map of Nigeria showing the study areas (South West Nigeria)

RESULTS AND DISCUSSION

Personal Characteristics description

Majority of the respondents (88.8%) were married, while a few of them (8.5%) were single mothers and 0.9% were divorced. Most of the women (62.1%) had basic education or more (Figure 2) which also reflects in the number of years they spent in school (1 – 12 years, 63%) in Table 1. The women were mainly into farming (57.1%) and practiced Christianity (67.9%). Exposure to formal education settings combined with informal familiarisation with communication methods in the study was expected to positively influence women's ability to understand and internalise nutritional messages and, hence, boost chances of achieving behavioural change outcomes. Although the ability to understand and internalise messages is expected to be enhanced by a higher level of education [18], the minimum education attained is thus, sufficient for the understanding of messages that women were exposed to in this study. The low educational status of the respondents falls in line with the results of Bechoff *et al.* [19] who established that most gari processors were illiterate and that few of them attended primary school. Married women are generally considered to be more relevant in matters relating to household nutrition when compared to their male or unmarried counterparts [20, 21]. This coherence can be hinged on the environmental and economic conditions of the study areas, which compel women to fend for the home in support of their spouses. Religion influences an individual's diet, food preferences, processes or feeding practices [22]. However, the two main religions (Christianity and Islam) in the study area do not have any known negative assertion on the processing and consumption of either soyabean, cassava or gari. This implies that the continuous use of *Soygari* is not likely to be hindered by any religious belief of the rural women; rather it should be regarded as additional knowledge to the existing belief [23].

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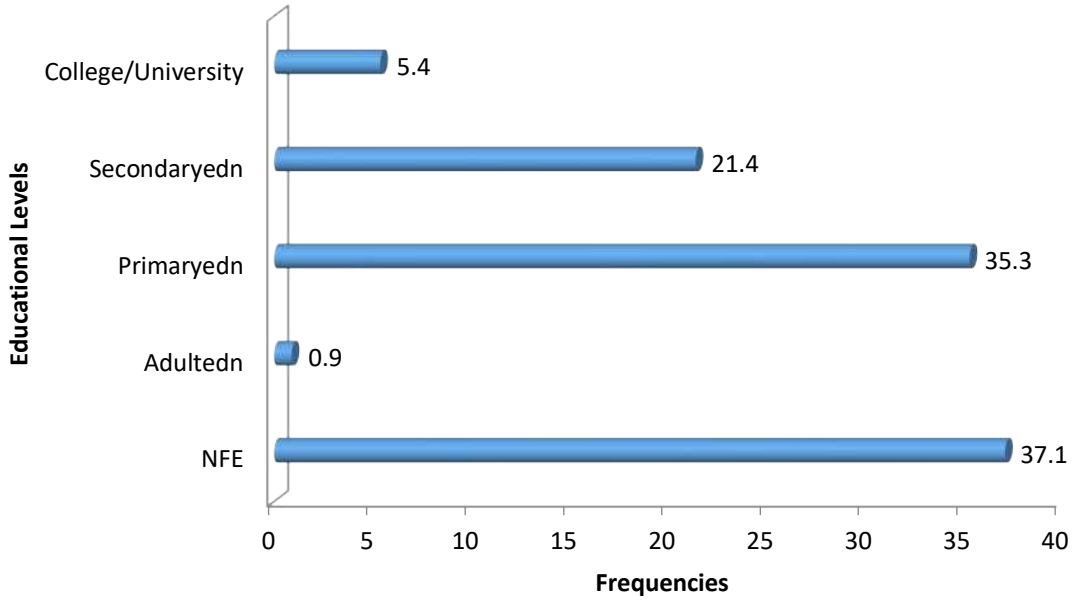

(NFE – No Formal Education)

Figure 2: Distribution of Respondents according to their educational groups

Knowledge, Attitude and Utilisation of *Soygari* Nutrition Information Ante and Post Communication Intervention

The communication intervention impacted the attributes of respondents (Table 2) on *Soygari* use. Comparing the group mean responses on the knowledge of *Soygari*, the women group in the interactive method had a moderately higher knowledge ($\bar{x}$= 42.49±6.64) than the women in the podcast group ($\bar{x}$=42.02±6.02). However, at post-communication intervention (PCI) the two different categories in which knowledge of *Soygari* was assessed show a positive knowledge change for respondents exposed to the podcast ($\Delta\bar{x}$ = 7.95) and interactive methods ($\Delta\bar{x}$ = 7.20). The mean figures imply that the sum of the respondents affirming their knowledge of the benefits of the *Soygari* PCI was more than those that affirmed their knowledge at ante-communication intervention (ACI). There was an overall significant knowledge change (t = 8.94 and t = 10.09; p> 0.05) with the use of podcasts and interactive methods, respectively. Furthermore, the study found a positive change in women's attitude toward *Soygari* information through podcasts and interactive methods of dissemination. Furthermore, table 2 shows that at ACI the mean responses ($\bar{x}$ =76.63±8.36 and $\bar{x}$ = 77.48±10.41) to attitudinal issues were lower than what was obtained at PCI ($\bar{x}$ = 85.54±5.94 and $\bar{x}$ = 84.32±6.68) for women in the podcast and interactive groups, respectively. As with the knowledge change, there was a clear media effect on attitude to *Soygari* information with the use of interactive (t = 5.68; p > 0.05) and podcast (t = 8.73; p>0.05). This is because more of the respondents agreed with the positive attitude

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statements at PCI than ACI. Women's responses to utilization options of *Soygari* in households show the consistent influence of communication methods used. Table 2 reveals a very low utilization at ACI ($\bar{x}$ = 0.42±2.28 and 0.71±3.02) for the utilization options inquired from the respondents. The result at PCI with more positive mean responses to the same options shows the influence of both interactive ($\bar{x}$ = 10.24±5.41) and podcast ($\bar{x}$ =6.74 ± 4.68) methods of communication on the two groups of women. However, comparing a change in the utilization, table 2 shows a higher mean response ($\Delta\bar{x}$ = 9.53) with the use of interactive methods (practical demonstrations and teachings) than with the use of podcasts ($\Delta\bar{x}$ = 6.63). This implies that the interactive methods of communication build confidence in the subject of the discussion thus driving immediate trials. However, results for knowledge and attitude show that the knowledge and attitude of respondents were more influenced positively by messages from the podcast communication (audio and video) media, and utilisation of the *Soygari* message was more influenced positively by the interactive method. Two (2) major strategies for attitude and behavioural changes are persuasion and the use of incentives [24]. Further analysis of mean contribution indicates a significant weight of influence of each method to the change in the attributes. The easy archiving of the audio message and repeated practical demonstrations served as motivations to learn for change. The utilisation of soybeans among women could be helped by continuous exposure to knowledge of processing [25]. Furthermore, to achieve a positive influence, effective communication should be mainstreamed, beginning with the innovation itself and the social and organizational context of the receiver to address negative external influences. [13, 26].

Differences in respondents' change in behavioural attributes associated with Podcast and interactive communication methods

The test of difference of change in knowledge, attitude and utilisation of *Soygari* associated with either podcast and interactive methods in Table 3 shows a significant difference only in the utilisation of *Soygari* ($t=4.0180$; $p<0.05$) for the two media used while no significant difference was established for knowledge ($t=0.643$; $p<0.05$) and attitude ($t=1.230$; $p<0.05$). The mean difference for utilization ($\bar{x}$ = 6.363 ± 5.24 for podcast messages and $\bar{x}$ = 9.534 ± 6.15 for interactive messages) indicates a higher influence of practical demonstrations and teaching over the video and audio messages on utilization. This result, thus, implies that a satisfactory level of knowledge and attitudinal change could be achieved among rural women with the effective use of podcasts and interactive methods. However, the adoption and use of an innovation in the nutrition space such as *Soygari* may require consistent interactive approaches to intervention. Communication is a source of persuasion which is a factor of change in the beliefs, attitudes and behaviour of others. The mean differences as well as their significances at the ACI

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and PCI connote changes in the knowledge, attitude, and utilization of *Soygari* as influenced by the communication intervention. Change through communication intervention could also be enhanced by the presence of little or no interference/distractions. Although findings have established that distraction while listening to persuasive communication impairs reception [27], possible "distractions" in rural settings are institutionalized, thus posing little or no disruption in the communication process. The little distraction that existed could be taken as a facilitator of impactful intervention because it has been established that distraction, where it exists, would aid pro-persuasive communication [28]. The communication intervention in the research can be classified as a pro-persuasive one (appealing to respondents to accept the *Soygari* technology using interpersonal and mediated information) hence, the existing distraction is said to have enhanced persuasion acceptance. The acceptance of the persuasive messages leading to the impact could also be linked with the nature of the carrier of the persuasion. Respondents have been found to trust and accept persuasive communication from extension personnel (either health personnel or agricultural social agents) who are their peers when compared to other groups [29]. The nature of the message (in the form of attitude, knowledge and utilization statements) can also aid persuasion impacts. Research has suggested that metaphorical language elicits an assimilation effect wherein positive metaphors elicit positive attitudes toward the communication topic and negative metaphors enhance negative attitudes [28]. Lastly, changes in respondents' knowledge, attitude and utilization are interdependently related and can be linked to both convincing arguments (like communication intervention as in the present work) and experiencing behaviour that affects one's attitude [30]. The podcast (audio) influenced better change in knowledge and attitudes and behaviour of women while the interactive demonstration of processing method improved the utilisation of *Soygari*. Uninterrupted consistent access to podcast messages reinforced knowledge and enforced a change in attitude. Frequent treatment with a regular dose of information reinforces people's knowledge of any developmental issue [31]. In addition, familiarization and relative local context use during interactive method fostered confidence in the subject among the women and propelled use in targeted households.

Mean differences in communication mediums' influence on change in behavioural attributes

Further inquiry on which type of interaction and podcast influenced more change in behavioural attributes prompted the use of analysis of variance. Table 4(a) shows a significant difference ($p < 0.05$) in a change in knowledge ($F=4.553$), attitude ($F=2.756$) and utilisation ($F= 7.233$) among rural women, where each of the communication mediums was used for dissemination of *Soygari*. This result implies that each of the communication mediums used contributed to the change observed

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in knowledge, attitude and utilisation at different levels. Duncan multiple range tests (Table 4(b)) at 95% alpha significant level, however, show the difference in the mean contribution of each medium to the attributes, a higher mean contribution of the audio podcasts and the least impact of the teaching method on the change in knowledge of *Soygari*. The change in attitude was more influenced by the audio message and practical demonstrations. The utilization of *Soygari* was more influenced by practical demonstrations. However, there was no significant difference ($p < 0.05$) in mean contributions of teaching, audio and practical demonstration messages to the change in utilization. Table 4(a) further reveals that the teaching method had a low/ insignificant influence on behaviour change. The communication intervention has greatly enhanced respondents' knowledge, attitude, utilization and overall behaviour in *Soygari* information. Thus, household malnutrition can be reduced with consistent interaction with the target recipient of nutrition-specific information. The study, therefore, recommends that this work be expanded to cover other nutrition-specific products to evaluate the effectiveness of the intervention.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

This study concludes that effective media use can bring the desired behavioural change in nutrition information campaigns if tools are accessible and information well-tailored for household nutrition needs. Also, audio tools promote abstract knowledge and easy recalling of nutrition messages among women while practical demonstration methods promote utilization of information faster. Only a minimum level of literacy is required in the internalization of nutrition education through accessible media tools. Based on these findings, it is recommended that Developmental agencies should primarily use locally available media tools to promote rural nutrition interventions to ensure sustainable use. Interactive communication methods should be employed in nutrition campaigns to build confidence in the use of the information.

This study advocates the importance of audio messages for behaviour change in nutrition-specific diets for rural households. Audio messages are less distorted by the presence of distractions in the communication process while the interactive method of communication increases the utilization of household nutrition information. Thus, pre-recorded audio messages and practical demonstration mix should be incorporated as an effective tool in national extension communication strategies among rural dwellers. Agricultural extension interventions for nutrition should be flexible and inclusive to achieve both learning and development goals. A focus to determine the appropriate communication mix for influencing behavioural change for the promotion of a locally sourced nutrition-specific diet in other regions

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of Nigeria would be necessary to establish similarities and differences across these regions in terms of responses to different modes of communication media.

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Table 1: Distribution of the Respondents by some Socio-economic Variables

Variable	Options	Percentage
Methods	Podcast	40.6
	Interactive	59.4
Years in formal school	No formal Education	37.1
	1-6yrs	38.4
	7-12yrs	19.2
	>12yrs	5.4
Household Size	1-5 people	41.5
	16-20 people	0.9
	11-15 people	5.4
	6-10 people	52.2
	1 person	4
Marital Status	Married	199
	Singles	21
Religion	Islam	32.1
	Christianity	67.9
Major occupation	Artisan	4.9
	Civil servant	2.2
	Farming	57.1
	Processing	16.1
	Trading	19.6

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Table 2: Knowledge, Attitude and Utilisation change to the podcast and interactive messages on *Soygari* nutrition and processing information

Knowledge	**Podcast**	**t**	**P**	**Interactive**	**t**	**P**
Mean	$\bar{x}$ ± SD			$\bar{x}$ ± SD		
ACI	42.02±6.02	10.09	0.00	42.49±6.64	8.94	0.00
PCI	49.97±4.15			49.69±4.49		
Mean change	$\Delta\bar{x}$ = 7.95			$\Delta\bar{x}$= 7.20		
Attitude	Podcast	t	P	Interactive	t	P
Mean	$\bar{x}$ ± SD			$\bar{x}$ ± SD		
ACI	76.63±8.36	8.72	0.00	77.48±10.41	5.68	0.00
PCI	85.54±5.94			84.32±6.68		
Mean change	$\Delta\bar{x}$ = 8.91			$\Delta\bar{x}$= 6.84		
Utilization	Podcast	T	P	Interactive	t	p
Mean	$\bar{x}$ ± SD			$\bar{x}$ ± SD		
ACI	0.42±2.28	8.47	0.00	0.71±3.02	17.87	0.00
PCI	6.78±4.68			10.24±5.41		
Mean change	$\Delta\bar{x}$ = 6.36			$\Delta\bar{x}$= 9.53		

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Table 3: Analysis of the difference in change in knowledge, attitude, utilisation and overall behaviour of rural women exposed to the podcast and interactive communications

Change in	Communication type	Mean	Df	t-independent statistics
Knowledge	Podcast	7.956±7.52	222	0.643
	Interactive	7.203 ±9.29		
Attitude	Podcast	8.912±9.73	222	1.230
	Interactive	6.842±13.88		
Utilisation	Podcast	6.363±5.24	222	4.018*
	Interactive	9.534±6.15		
Behaviour	Podcast	1.910±1.83	222	-0.0284
	Interactive	2.003±2.75		

*Significant at 5%

Table 4a: Analysis of Variance for differences in knowledge, attitude and utilisation of *Soygari* as influenced by individual medium used (Practical demonstrations, teachings, video and audio methods)

Change	Groups	Df	Mean square	F
In knowledge	Between	3	435.994	4.553**
	Within	220	69.575	
	Total	223		
In Attitude	Between		409.716	2.756*
	Within	220	148.665	
	Total	223		
In Utilisation	Between	3	233.773	7.233**
	Within	220	32.321	
	Total	223		
In Behaviour	Between	3	26.753	6.220**
	Within	220	5.437	
	Total	223		

*Significant at 5% ** significant at 1%

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Table 4b: Alpha subset in Duncan range tests for mean difference in methods used for knowledge, attitude and utilization change in *Soygari* information

Change in knowledge	**Subset 1**	**Subset 2**				
	Teaching	video	Practical	Audio		
	4.0	6.36	7.80	12.29		
Change in Attitude	**Subset 1**	**Subset 2**			**Subset 3**	
	Teaching	Video	video	Practical	Practical	Audio
	1.95	6.67	6.67	7.75	7.75	12.67
Change in Utilisation	**Subset 1**	**Subset 2**				
	Video	Audio	Teaching	Practical		
	6.22	8.26	8.71	9.68		
Change in behaviour	**Subset 1**	**Subset 2**			**Subset 3**	
	Teaching	video	Video	Practical	Practical	Audio
	7.08	7.85	7.85	8.79	8.79	9.38

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ISSN 1684 5374

REFERENCES

1. **French AS, Tangney CC, Crane MM, Wang Y and BN Appelhan** Nutrition quality of food purchases varies by household income: the SHoPPER study. *BMC Public Health* 2019; **19:** 231. http://doi.org/10.1186/s12889-019-6546-2

2. **Tortoe C. Akonor PT and ES Buckman** Potential uses of sweet potato-wheat composite flour in the pastry industry based on proximate composition, physiochemical, functional and sensory properties of four pastry products. *Food Proc Pres.* 2017; **41(5):** 1 – 32. http://doi.org/10.1111/JFPP.13206

3. **Ojo A and EA Akande** Quality evaluation of gari produced from cassava and sweet potato tuber mixes. *Afric Jour of Biot.* 2013; **12(31):** 4920 – 4924.

4. **Thomas R, David T, Lenis SO, Liverpool-Tasie, Titus A, Jessica F, Bart M, Rob V, Michael D, Christine S, Rahul D, Carolina V, Anna L, Ahmed R and MP Barry** The processed food revolution in African food systems and the double burden of malnutrition. *Global Food Security.* 2021; **28:** 100466, https://doi.org/10.1016/j.gfs.2020.100466

5. **Kuku-Shittu O, Onabanjo O, Fadare O and M Oyeyemi** Child Malnutrition in Nigeria: Evidence from Kwara State. *International Food Policy Research Institute (IFPRI) Working Paper.* 2016; **33:** 1 – 64.

6. **Ugwu SOC and AE Onyimonyi** Carcass, organ and organoleptic characteristics of spent layers fed Bambara nut. *Intl Jour Poultry Sci*. 2008; **7(1):** 81 – 84.

7. **Bankole YO, Tanimola AO, Odunukan RO and DO Samuel** Functional and Nutritional Characteristics of Cassava flour (Lafun) fortified with Soyabeans. *Edu and Soc Res.* 2013; **3(8):** 163 – 170. http://doi.org/10.5901/jesr.2013.v3n8p163

8. **Laverack G** The challenge of behaviour change and Health Promotion. *Challenges*. 2019; **8(2):** 25. http://doi.org/10.3390/challe8020025

9. **McGloin AF and S Eslami** Digital and Social media opportunities for dietary behaviour change. *Nutr. Soc.* 2015; **74:** 139 – 148. http://doi.org/10.1017/S0029665114001505

10. **Huo S, Wang K, Liu Z, Yang Y, Hee JY, He Q, Takesue R and K Tang** Influence of Maternal Exposure to Mass Media on Growth Stunting Among

Children Under Five: Mediation Analysis Through the Water, Sanitation, and Hygiene Program. *JMIR Public Health and Surveillance.* 2022; **8(4):** e33394. https://doi.org/10.2196/33394

11. **Nindi BP, Bogor PM and DS Bogor** Effectiveness of agricultural information dissemination through media mobile phones on vegetable farmers in the District Pacet, Cianjur Regency. *Asi. Jour. Hum. and Soc. Sci.* 2014; **2(1):** 68 – 76.

12. **Yahaya MK** Development Communication: Lessons from social change and engineering projects. Corporate graphics Ltd Ibadan 2003; 79-81.

13. **Yildirim H, Isik K, Gulcek E and R Aylaz** Effect of the Education Offered in Accordance with Bandura's Social Learning Theory on Children's Health Locus of Control, Perceptions and Behaviors. *Inter. Jour. Car. Sci.* 2020 **13(2):** 1365 – 1371.

14. **Food and Agricultural Organisation (FAO).** The State of Food and Agriculture Social protection and agriculture: Breaking the cycle of rural poverty. 2015: ISBN 978-92-5-108861-6.

15. **Cathy RF, Humphrey J, Phil EO, Alessandra G, Emily O, Valerie LF., Mary-Ann S and C Kathleen** Gender roles and masculinities in leveraging milk for household nutrition: Evidence from two districts in Rwanda. *Food Policy*. 2023; **118:** 102486, https://doi.org/10.1016/j.foodpol.2023.102486

16. **Agricultural Media Resources and Extension Centre (AMREC).** Mapping of Soybean Production Areas in Nigeria, Making Nigerian Agricultural Markets Work for the Poor. Prepared for the Department for International Development (DFID). 2007: 36pp.

17. **National Obesity Observatory (NOO).** Knowledge and attitudes towards healthy eating and physical activity: what the data tell us 2011; http://support-hardy.org/wp-content/uploads/2017/01/vid_11171_HEalthy-Eating-Attitudes.pdf

18. **Akinbile LA** Use of Alternative Communication Media in HIV/AIDS Campaigns and behavioural change among youths in Lagelu Local Government Area of Oyo state, Nigeria. *Nig. Jour. Rur. Soc.* 2010; **10(1):** 1 – 8.

19. **Bechoff A, Tomlins KI, Chijioke U and P Ilona** Variability in traditional processing of gari: a major food security product from cassava. *Food Chain.* 2019; **8(1):** 39-57. http://doi.org/10.3362/2046-1887.18-00015

20. **Acharya DR, Bell JS, Simkhada P, Teijlingen ER and PR Regmi** Women's autonomy in household decision–making; a demographic study in Nepal. *US Nat. Libr. of Med.* 2010; **7(15):** 1 – 7.

21. **Aminu FO and EO Asogba** Utilization of healthcare facilities among Farming households in Yewa South Local Government Area, Ogun State, Nigeria. *Jour. Trop. Agric., Food, Envir. and Ext.* 2020; **19(1):** 43 – 48.

22. **Elena BA** The impact of culture, religion and traditional knowledge on food and nutrition security in developing countries. *Foodsecure working paper* 2015; **30:** 7.

23. **Ekwochi V, Osuorah CDI, Ndu IK, Ifediora C, Asinobi IN and CB Eke** Food Taboos and Myths in South Eastern Nigeria: The belief and Practice of Mothers in the Region. *Jour. Ethno. and Ethno.* 2016; **12(7):** 1- 6.

24. **Stroebe W** Strategies of attitude and behaviour change. **In** M. Hewstone, W. Stroebe, & K. Jonas (Eds.), Introduction to social psychology Blackwell Publishing 2012; 201-234

25. **Fadairo AO, Oyegbami A. and MO Oyedokun** Determinants of Competence in Soybean Processing for Improved Nutrition among Secondary School Students in Oyo State. *Afri Jour Food Agric Nutr and Dev.* 2020; **20(1):** 15252 – 15266. https://doi.org/10.18697/ajfand.89.17920

26. **Kibe CW** Effects of Communication Strategies on Organizational Performance: A Case Study of Kenya Ports Authority. *Eur Jour Bus and Magt.* 2014; **6(11):** 6 – 10. ISSN 2616-8472

27. **Petty RE, Wells GL and TC Brock** Distraction Can Enhance or Reduce Yielding to Propaganda: Thought Disruption versus Effort Justification. *Jour Pers. and Soc. Psycho.* 1976; **34(5):** 874-884. http://doi.org/10.1037/0022-3514.34.5.874

28. **Ottati VC and R Renstrom** Metaphor and Persuasive Communication: A Multifunctional Approach. *Social and Personality Psychology Compass.* 2010; **4(9):** 783 – 794. http://doi.org/10.1111/j.1751-9004.2010.00292.x

29. **Fadairo AO, Oyebode LA and AS Amusat** Assess to nutrition information: a key to improving nutrition status among under-five children in farming households of Oyo state, Nigeria. *Agric. Trop. et Subtr.* 2020; **53(1):** 29 – 37. https://doi.org/10.10.24/ats-2020-0004

30. **Hogg MA and GM Vaughan** Social psychology (5th ed.). Harlow: Pears Educ Ltd, 2008; 567.

31. **Lwoga ED, Stilwell C and P Ngulube** Access and Use of Agricultural Information and Knowledge in Tanzania. *Library Review.* 2011; **60(5):** 383 – 395. http://doi.org/10.1108/00242531111135263

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IMPACT OF COVID-19 ON AGRI-FOOD SYSTEMS: AN ASSESSMENT OF ACTORS ALONG THE FOOD VALUE CHAIN IN ETHIOPIA, UGANDA, NIGERIA AND MALI

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ABSTRACT

Food security in Africa was impacted as a result of supply chain disruptions and government lockdowns brought on by the Coronavirus Disease of 2019 (COVID-19) pandemic. With participation from important actors in the agricultural value chain, the Sasakawa Africa Association (SAA) assessed the effect of COVID-19 on agri-food system in Ethiopia, Mali, Nigeria, and Uganda. Farmers, agro-processors, private service providers, off-takers and merchants, input dealers, and Ministry of Agriculture Extension service personnel are among the value chain actors that took part in the study. The survey, which was held from April 13 to April 16, 2020, used semi-structured tools and questionnaires aimed at the different stakeholders. The study used a cluster sample technique. The data were analyzed using SPSS software, which included frequency counts, percentages, rank correlation, and categorical regression. Based on the severity of the lockdowns associated to COVID-19, the survey found that the outcomes differed by country. The analysis shows a negative association between e-extension and education during the COVID-19 epidemic, but a high and positive correlation ($p < 0.01$) between extension services and postharvest services, as well as credit availability. Factors such as transportation, labor availability, price fluctuations, output market activity, loan availability, and food and nutrition security were significantly and positively correlated with COVID-19 awareness. Additionally, the respondents indicated that price changes were favourably correlated with labour availability and transportation, and that farming activities were significantly and positively correlated with food and nutrition security, labour availability, and the output market. According to the perspective data collected in every country during the COVID-19 epidemic, postharvest services, agricultural input activities, and food and nutrition security all heavily relied on extension services, with postharvest services having a negative correlation with extension services. The results of the analysis show that COVID-19 impacted several variables that are associated with extension services across the four countries. For instance, the R2 value of the relationship between value chain variables and extension service delivery across Mali (0.485), Nigeria (0.621), Ethiopia (0.426), Uganda (0.529), and the combined countries (0.511) indicates that the variation of the dependent variables can account for 48.5% of the variation in the values of the independent variable (extension service delivery) in Mali, 62.1% in Nigeria, 42.6% in Ethiopia, 52.9% in Uganda, and 51.1% in the combined countries. Farmers' access to agricultural labour, credit services, inputs for agriculture, and output markets was restricted by the ban on travel and social gatherings. Smallholder farmers should employ digital solutions more to strengthen the agricultural value chain's actors' resilience against potential pandemics or conflicts, according to the study's implications for extension services. This will reduce the requirement for extensive personal touch and travel in the delivery of extension services. The study also highlights how crucial it is for extension services to show tangible outcomes and benefits in order to increase farming communities' and value chain actors' resilience in any difficult circumstances.

Key words: COVID-19, food systems, extension services, value chain actors, output markets

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INTRODUCTION

The COVID-19 pandemic has significantly impacted the global economy, particularly Africa, with the agricultural sector playing a crucial role. The crisis has led to rising food costs and limited food supply, making it difficult to adjust and potentially causing a global food security catastrophe. Africa faces issues like decreased tourism, supply chain disruptions, and trade slowdowns. Governments face numerous challenges in mitigating the pandemic's effects, safeguarding livelihoods, and ensuring adequate food supply.

The COVID-19 pandemic has impacted African nations differently, with millions losing their means of subsistence and GDP predicted to decrease by 1.6%. The International Food Policy Research Institute (IFPRI) estimated that the global economic downturn could lead to over 140 million people becoming impoverished. The International Monetary Fund (IMF) also predicted a global recession, leading to food insecurity due to trade-related distortions and price spikes. Food exports from African nations were expected to fall by 3% in the worst-case scenario, resulting in a 1.4% contraction in the region's GDP [1]. The COVID-19 pandemic significantly impacted African nations' export earnings, particularly food items, due to lockdowns, travel bans, and health precautions. This led to delayed and higher export costs, and influenced consumer behavior and export trends. The pandemic underscored the importance of maintaining economic ties to minimize food supply disruptions. Food and nutrition security suffered directly as a result of COVID-19. Because of the pandemic, there was a rise in the incidence of poor nutrition as a result of altered consumption patterns and a loss of purchasing capacity [2, 3]. According to Beltrami [4], COVID-19 would cause an economic collapse in nations that depend heavily on imports of gasoline and food because imports would be more expensive and export revenue would be significantly lower. According to Nkanjeni [3], "Africans' purchasing power was eventually affected as a result of employment dropouts, income loss, and risk aversion behaviors." According to Hall [5], how each nation responds to the pandemic will decide how it affects food security and the resilience of livelihoods.

The COVID-19 transmission trajectory and scale in Africa remain unknown due to insufficient testing. With 258,884 deaths and 12,860,287 official cases [6, 7], governments prioritize minimizing the spread while focusing on economic well-being, food security, and nutrition. The pandemic has had a greater impact on agriculture than previous Ebola outbreaks in Uganda, the Democratic Republic of the Congo, Liberia, Sierra Leone, and Guinea. Restrictive measures, such as lockdowns and travel bans, have disrupted the region's educational system. COVID-19's severe effects on Africa, exacerbated by high poverty rates, inadequate healthcare systems, and densely populated cities, may lead to further

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declines in agricultural productivity and economic impact. The global South, particularly Africa, is most vulnerable to the effects of rising food costs and restricted supply, which could lead to a worldwide food security crisis if not addressed promptly. To prevent disruptions, policies should ensure access to food and nutrition, establish social safety nets, reduce obstacles to the safe movement and transportation, and maintain open trade routes for food and agriculture.

The Sasakawa Africa Association conducted an analysis of the COVID-19 pandemic's impact on African agricultural and food systems, in collaboration with their network of extension and advisory services actors throughout the agriculture value chain. The analysis aimed to determine the pandemic's impact on food systems and to ascertain whether rural producers and the input and output market systems have appropriate extension services during the government lockdowns associated with the pandemic.

Objective of the study

The study aimed to assess the impact of COVID-19 related challenges on food systems in African countries, focusing on the agricultural value chain, public awareness, and mitigation strategies. It also examined the functionality of input and output systems and their interaction with extension and advisory services.

MATERIALS AND METHODS

Study area

The study was conducted in the SAA intervention zones in Ethiopia, Mali, Nigeria and Uganda.

Research Design

The study utilized a cross-sectional research design, utilizing a phone survey and the Rapid Assessment Procedure. This approach combined elements from various approaches and critical elements, incorporating established implementation science frameworks into data collection and analysis [8]. Rapid Assessment is a brief, topic-specific collection of data from international development fields, typically conducted within 10 minutes or less. Rapid assessment is a team-based qualitative inquiry that uses triangulation, iterative data analysis, and additional data collection to quickly understand a situation from an insider's perspective [11]. It is ideal for practical outreach work because of its small scope and is used when time and resources are limited [10, 12].

Population of Study, Sampling procedure and sample size

The study surveyed various stakeholders in the agriculture value chain, including farmers, off-takers/traders, input dealers, Agriculture extension personnel, private service providers, agro-processors, financial services, and development partners.

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Geographically, the assessment was carried out among the stakeholders in SAA operational regions/districts in Ethiopia, Nigeria, Mali and Uganda. The study used cluster sampling, selecting stakeholders based on geographical locations, institutions, and respondents. The study controlled frame error by excluding administrative and support staff, and eliminated selection error by focusing only on those involved in the activities. The sample size was 360, with 80% male and 20% female, with varying proportions across Ethiopia (98), Mali (89), Nigeria (83), and Uganda (90) (Tables 1 and 2).

Data collection

A semi-structured questionnaire was used to gather data on socio-economic characteristics, COVID-19 awareness, knowledge, agricultural extension services, impact on input and output demand, and supply activities and mitigation measures. The instrument's validity was tested by comparing stakeholders' assessments of the same food system in the same country. SAA staff and thematic coordinators administered a questionnaire through telephone, e-mails, WhatsApp and skype from April 13-16, 2020, aiming to gather stakeholder responses on specific objectives through various communication methods.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of respondents

Among the sample respondents, 80% of them were male, 50% between 30 and 50 years old, and 40% above 50 years old. The majority have tertiary education, possibly due to a skewness associated with the selection of the ministry of agriculture staff as part of the respondents (Figure 1). The sample structure selection, however, highlights the low proportion of women, and age groups involved in agricultural enterprises, and education levels [13].

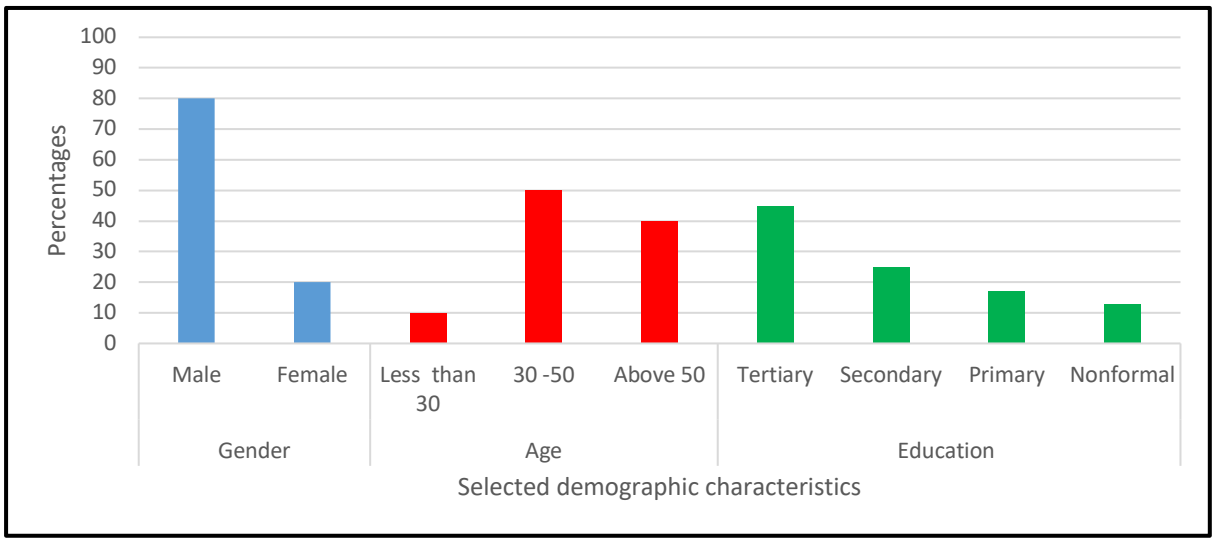

Figure 1: Selected socio economic characteristics of respondents (n = 360)

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Respondents' awareness on the COVID-19 pandemic

Table 2 shows that extension officers and Agriculture Ministry representatives have a higher knowledge of COVID-19 preventive measures, including hand washing, maintaining social distance, and abstaining from coughing, spitting, and sneezing. These precautions were prototypes for guidelines and methods published by the World Health Organization during the outbreak [14]. IFPRI [13] and WHO [14] suggest social distancing, handwashing, and avoiding coughing, spitting, and sneezing as effective strategies to prevent COVID-19 spread.

Perceptions on overall effect of COVID-19 on the agricultural sector

The quick assessment of COVID-19's effects on African food systems is presented in Table 3, focusing on various aspects of the value-chain such as the agricultural sector's state, farmers' impact, extension services, input and output markets, and off-takers' influence. The responses were disaggregated by country. COVID-19's effects differed by country. Based on the severity of the government lockdowns in each country—Uganda having the strictest lockdowns.

The pandemic significantly impacted the agriculture industry, limiting farmers' access to financial services, farm labor markets, and agricultural inputs (such as seed, fertilizer, and agrochemicals). The restrictions also hindered agricultural extension services, which curtailed farmers' access to capacity building, potentially affecting crop production and productivity, endangering Africa's food security and nutrition. The pandemic significantly impacted Nigeria's agricultural value chain, impacting training farmers and extension agents (84%), labor availability (68%), input availability, access, and distribution (92%), and food security and nutrition (78%). In Uganda, stakeholders were generally aware of the disease and preventive measures, largely through media, including radio, TV, social media, and community announcements (Table 3).

The government's standard operating procedures significantly impacted agricultural activities (100%), farmer trainings (75%), input availability and access (75%), output markets (63%), and food and nutrition security (50%) (Table 3). However, stakeholders were unaware of additional precautions, such as staying away from gatherings, reporting suspicious patients, wearing face masks, and using hand sanitizers, and thus highlighting the need for behavior modification and communication tactics.

Ethiopian farmers faced COVID-19 risks due to lack of access to credit services, extension services, input/output market access, and sufficient awareness, posing a threat to food and nutrition security and agricultural productivity (Table 3). The COVID-19 pandemic significantly impacted the provision of extension and advisory services for agriculture in Mali.

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Effect on the farming communities

Table 3 shows the impact of COVID-19 on farmers in Nigeria, Uganda, Ethiopia, and Mali. Nigeria faced challenges in accessing pre- or post-harvest handling services (71%), farms (88%), extension services, and trainings (83%). Some 95% of farmers reported higher input prices, while 90% had limited access to labor, transportation services, and output markets. Ugandan farmers faced restricted access to inputs (100%), sales (86%), higher input prices (42%), transaction costs (29%), delayed delivery on imported inputs (29%), delayed debtor payment and higher food prices (33%), and increased producer prices for rice, beans, and maize (49%, 36%, and 14%, respectively).

Over 75% of Ethiopian farmers anticipated limited labor availability due to the COVID-19 pandemic, with 83% unable to access technical assistance and training. The Extension agents (EAs) (51%) were unable to provide training to farmers, 43% of the EAs were only able to assist 6% of farmers in accessing loans or inputs. The pandemic also hindered the transfer of information, skills, and knowledge to Extension Agents and farmers, hindered the implementation of community work campaigns like building canals for conserving water and soil, and stopped farmer group planning and resource mobilization efforts. The pandemic also made it more challenging for 55% of farmers to obtain inputs such as seed, fertilizer, and agrochemicals (Table 3).

The COVID-19 pandemic in Mali significantly impacted farmers' access to extension services (81%), farming activities (81%, labor availability (90%), postharvest activities (52%), input stock (40%), and output market access (100%). Furthermore, the pandemic caused a disruption to the regular schedule of the major planting season. The closure of borders with neighboring countries limited trade opportunities, such as access to imported agricultural inputs like fertilizers, agrochemicals, and vegetable seeds, leading to delays in agricultural activities (Table 3).

Effect on access to agricultural inputs

COVID-19's main effects on agricultural input activities were limited sales (74%), limited stock (58%), and scarcity (92%) (Table 3). Government limitations and mobility restrictions may have disrupted food supply systems, leading to a lack of market for agricultural chemicals and delayed input supply. According to reports from IFPRI [13], the OECD [14], and the WTO [15], mobility restrictions during COVID-19 might have the unintended consequence of upsetting food supply systems. Agro-dealer merchants in Ethiopia were frustrated by the lack of a market for agricultural chemicals and the inability of importers to provide timely inputs (Table 3).

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The pandemic significantly impacted Nigeria's agricultural input distribution, accessibility, and availability, leading to increased costs and supply delays even after normalcy returned. In Uganda, limited stock and sales of targeted inputs were reported (68%), with transportation limitations making it difficult to obtain inputs. All respondents reported a shortage or restricted supply of inputs. On the other hand, eighty-two percent of Malians experienced a decline in commerce and sales due to the epidemic, disrupting the major agricultural season and activities, and potentially affecting cropping campaign performance (Table 3).

Effect on agricultural extension service delivery

COVID-19 has significantly impacted Extension services, causing reduced monitoring and technical support for farmers (70%), higher service delivery costs (58%), and discontinuation of activities (such as trainings, demonstrations, and data collection) (48%). These constraints were largely due to lockdown measures and non-implementation of development operations by governments (Table 3). AFAAS [16] and AESA [17] have reported that COVID-19 caused an interruption in extension services. Ethiopian Development agents (51%) faced challenges in providing extension services due to mobility constraints, staff shortages, and access to transportation services. They struggled with on-site technical support (43%), loan assistance (6%), and planning community rural development campaigns. In Mali, The COVID-19 pandemic disrupted agricultural extension services, limiting farmers' access to technology and oversight. (Table 3). Nigeria's Extension agents believe they could have used the e-extension system more successfully with internet connectivity. However, only 44% of respondents believe e-extension helped overcome pandemic limitations. In Uganda, limited access to extension services was due to restrictions on movements and banned gatherings. 75% of respondents believe farmers' suspension of activities was due to inadequate monitoring and service provision (Table 3).

The Mali Ministry of Agriculture confirmed that COVID-19 significantly impacted crop yield and production, with 92% of respondents stating this. Factors affected include face-to-face training (77%), capacity building of extension agents and farmers (85%), and access to high-quality seed (100%). E-extension was mentioned as a solution (85%). Travel restrictions have also reduced labor availability in farms, potentially leading to increased unemployment in rural areas and resulting in low crop productivity and production (Table 3).

Effect on output markets

The pandemic significantly impacted output markets, leading to limited stock (60%), produce scarcity (58%), high transport costs (42%), restricted market access (40%), business closures (33%), and income decline (39%), primarily due

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to nationwide curfews and movement restrictions (Table 3). Similar trends presented by IFPRI, OECD, and WTO [13, 14, 15] corroborate these conclusions.

COVID-19 has significantly impacted off-takers' output markets in Nigeria, with 56% having limited input supply, 60% experiencing poor market demand, 48% experiencing increased grain product costs, fewer markets (42%), increased input costs (23%), and limited transportation (51%) (Table 3). Uganda's output markets faced challenges due to high transportation costs (83%), resulting in increased transaction costs, lack of produce (67%), and closed traders (67%), affecting households' access to meals and food variety. Ethiopian agribusinesses faced significant challenges due to government-imposed movement restrictions, with 55% of output traders stating their grain stock was insufficient (Table 3).

Effect on Food and Nutrition Security

The study reveals that over 70% of stakeholders in Ethiopia and Uganda believe COVID-19 will impact food security, compared to 80% in Nigeria and Mali (Figure 2). This aligns with previous studies which anticipated the impact, suggesting reduced food rations, poor nutrient consumption, and fewer daily meals may have jeopardized food security.

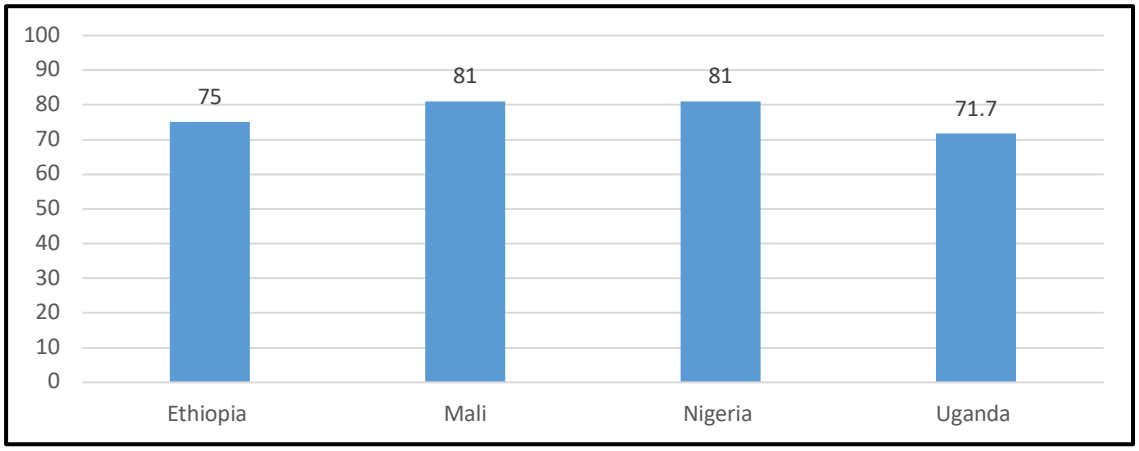

Figure 2: Percentage response on COVID-19s effect on food and nutrition security

Effect on postharvest and agro-processing services

In Nigeria, agro-processors and private service providers faced low demand for grain milling (67%), as well as limited availability of input stocks (67%), processed grain products (73%), and processing raw materials (68%). During the lockout, agro-dealers faced constraints in obtaining inputs (67%), decreased stock levels (63%), and restricted access to input suppliers (85%) (Fig 3a). Private service supply and processing in Uganda decreased due to low demand (87%), expensive transportation (75%), and constrained working hours (37%) (Fig 3d). The impact of COVID-19 effects in Ethiopia was much less than the other countries largely

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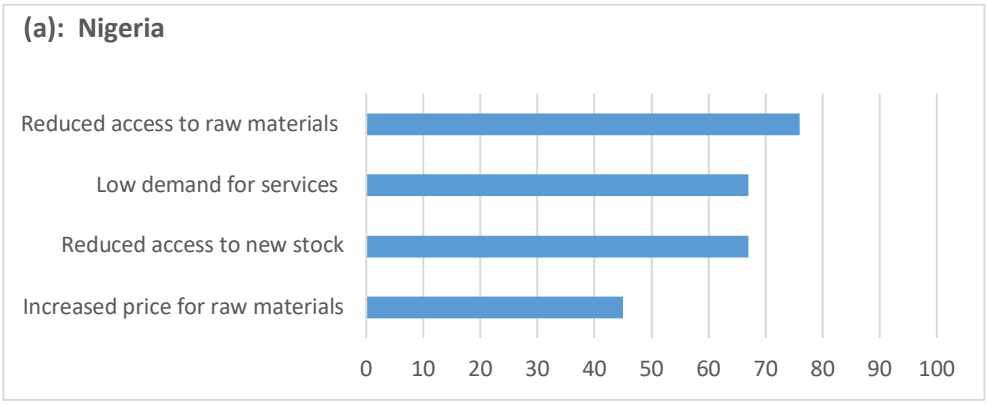
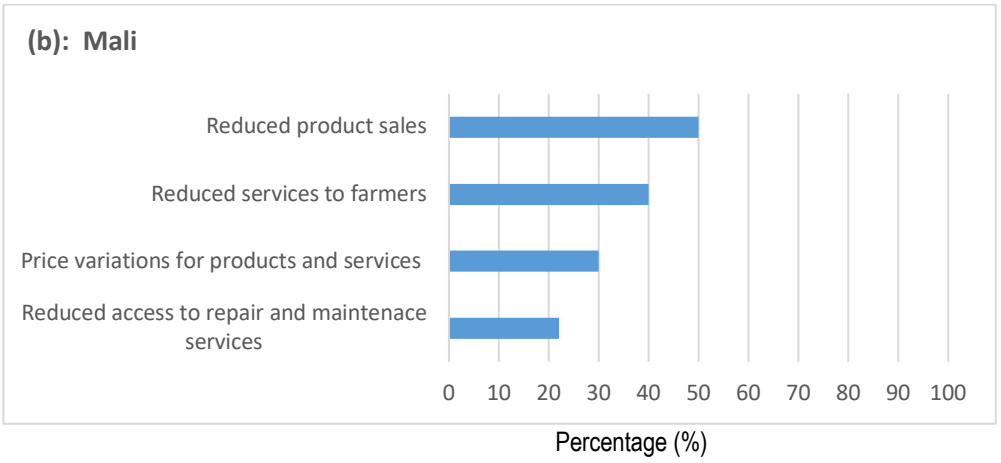
because in Ethiopia, there was partial lockdown, as compared to full lockdown in the other countries. Nevertheless, less than 20% of Ethiopian service providers reported a shortage and high cost of raw materials, affecting agro-processing capacity and grain sales. Transportation costs increased, forcing farmers to employ human and animal power, putting more burden on women and increasing labour drudgery. Agro-processors struggled with raw material shortages due to farmer movement restrictions and hoarding, while traders faced working capital deficits due to lack of credit access from financial institutions and thus unable to aggregate/retail agricultural products (Fig 3c).

The government's restrictive measures in Mali reduced market opening times, affecting all value chain actors (including. output traders, agro-dealers, processors and private service providers), leading to reduced business activities, particularly for input dealers (82%) and processors (50%), and affecting agricultural product availability (Fig 3b). Respondents found reduced access to raw materials in Nigeria (79%), product sales in Mali (55%), input supply decline in Ethiopia (19%), and low product demand in Uganda (90%) due to COVID-19, consistent with the overall impact of COVID-19 on extension services.





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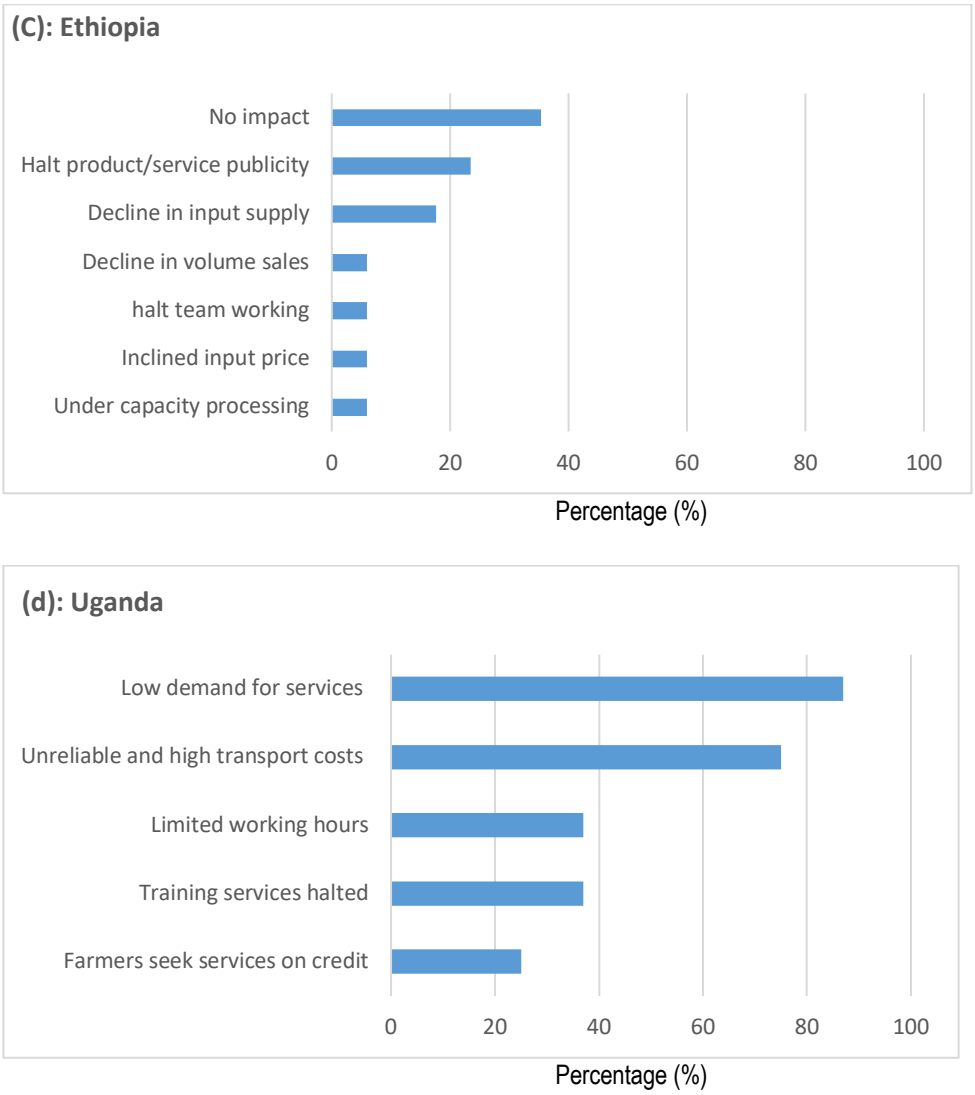

Figure 3: Effect of COVID 19 on Post-harvest and handling (PHAP) Services (%)

Correlation analysis of the Stakeholder perceptions of the effects of COVID-19

Table 4 displays the Spearman Rho rank order correlation matrix findings on value chain activities and extension services during the COVID-19 pandemic, based on stakeholder survey perspectives. The perception study reveals a strong positive correlation between e-extension, labour availability, price fluctuations, and farming activity during COVID-19 pandemic. Education was positively and significantly correlated to Post-harvest and handling services, transportation, and gender, while negatively correlated to loan availability. Factors such as transportation, labor availability, price fluctuations, output market activity, loan availability, and food and nutrition security were significantly and positively correlated with COVID-19 awareness. Farming operations and respondents' food security were also strongly associated to labor availability, transportation, and output markets.; while credit access was positively and strongly correlated to postharvest handling services,

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transportation, labour availability, price fluctuations and output markets. There seem to be a strong negative correlation between Gender and credit access as well as education and credit access. Morsy [30], points to the fact that worldwide, women's access to finance is disproportionately low, and in Africa, the gender gap in access to financial services is driven by women entrepreneurs' own self-perception. Similarly, the study revealed a negative correlation between extension services and education, as well as extension services and e-extension. Onyeaka *et al.* [31) examined the relationship between food security indicators (accessibility, availability, utilization, stability) and COVID-19 in Benin, Burkina Faso, Cameroon, Chad, Madagascar, Mali, Mauritania, Nigeria, and Senegal and found that a rise in COVID-19 levels negatively impacts all the 4 indicators of food security without exception. This study offers a bivariate perspective on the interactions between variables and suggests ways to improve the effectiveness of agricultural extension services during pandemics or other challenges. The linkages shows a public extension system which is not effective during a pandemic.

Categorical regression analysis

Table 5 presents strong associations between extension service provision and other factors across Ethiopia, Uganda, Nigeria, and Mali, as indicated by the categorical regression analysis. This study employed factors associated with food value chain and performed a multivariate regression analysis. The R2 value of the relationship between value chain variables and extension service delivery across Mali (0.485), Nigeria (0.621), Ethiopia (0.426), Uganda (0.529), and the combined countries (0.511) indicates that the variation of the dependent variables can account for 48.5% of the variation in the values of the independent variable (extension service delivery) in Mali, 62.1% in Nigeria, 42.6% in Ethiopia, 52.9% in Uganda, and 51.1% in the combined countries.

Factors such as gender, education, and output market were significant but negatively associated with extension services in Mali, while agricultural input activities had a significant but positive association in Mali. Food and nutrition security is positively associated and significant in Nigeria, while postharvest services, and output market activities are significant and positively associated with extension services in Uganda, while education is negatively associated with extension services in Uganda. The study indicates that in Ethiopia, extension service had a significant but a negative relations with postharvest services, and positive relationship with COVID-19 awareness. The data from all countries revealed that postharvest services, agricultural input activities, and food and nutrition security were the significant variables, with postharvest services negatively associated with extension service delivery. Conversely, it is believed that the direct effects of agricultural extension's paralysis—which primarily consists

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of in-person training—were not yet evident at the time of the study, but it is evident that farmers were worried about it, which implies that many of them have high expectations on extension programs. Extension services give farmers access to capital-boosting inputs, such as information flows that can raise household livelihoods and productivity, which can result in food security for the family [18, 19, 20, 21, 22].

Research has shown that investments on extension services, particularly in developing nations, can raise farmers' incomes and enhance agricultural output [23]. Education fosters a good mental attitude for accepting new practices, particularly information- and management-intensive practices, according to research by Ragasa *et al.* [24] and Boehene [25]. It has also been shown to positively relate to the provision of extension services. According to Danso-Abbeam *et al.* [26], farm-specific characteristics, socioeconomic, institutional, and extension program factors were found to have a substantial impact on farmers' income and productivity. According to Sebaggala and Matovu [27], efforts must be made to enhance the quality of extension services that have a direct impact on productivity in order to increase the impact of extension on agricultural productivity, while Cawley *et al.* [29] show that extension had a positive influence on farm income engagement. On the other hand, Asres *et al.* [28] revealed that involvement in extension programs increased farm production among Three Peasant Associations in Ethiopia's Highlands.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The study highlights the immediate impact of COVID-19 pandemic on food systems, including input, production, distribution and consumption, and the more delayed impact on agricultural technology extension, based on the perceptions of the different actors in the food value chain. It highlights the need for better information, preventative measures, availability of credit services, extension services, and input/output markets. Agriculture Ministries warn of government-imposed limitations on crop productivity, but e-extension could help overcome these restrictions.

During the pandemic, farmers and value chain participants in target countries experienced restricted access to inputs, sales, and an inaccessible output market. Higher input prices, increased transaction costs, and delayed importation led to higher food prices, reduced food rations, and fewer daily meals. COVID-19 led to farm inaccessibility, lack of extension services and training, shortage of pre- and post-harvest handling services, and decreased demand for private service providers and agro-processors, resulting in lower loan deposits, repayments, and servicing.

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The COVID-19 pandemic significantly impacted the food market and systems, potentially affecting food and nutrition security, price stability, supply chain, agricultural inputs, labor availability, and livelihoods of smallholder farmers. However, it can be assumed that while the impact of the restricted access to agricultural inputs from upstream food value chains was significant, the extent of the lockdowns in each country had varied effects and the impact of the subsequent prolonged downstream shrinkage in demand for agricultural products did not immediately become apparent in Ethiopia where there was partial lockdown.

What has become apparent with the spread of COVID-19 is the fragility of the food value chains and agricultural technology extension systems in African countries. More resilient food value chains and agricultural technology extension systems need to be built, which may include strengthening access to agricultural inputs, finance and postharvest services in rural areas and accelerating remote technology extension (digital solutions) using ICT. The study across the four countries recommend addressing the effects COVID-19's through building more resilient measures such as using e-extension, alternative extension delivery methods like WhatsApp groups, TV and radio use, local language manuals, and postharvest labor-saving technologies and services. This would help build the resilience of agricultural value chain actors in the event of COVID or any other pandemic or conflict that may occur in the future with related restrictions in the movement of people and goods. The SAA will continue “walking with the farmer” in Africa to introduce resilient measures that helps the African farmer to withstand shocks in the event of future disease outbreaks, climate change and conflicts.

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Table 1: Respondents by category and countries

Respondents Category	Ethiopia	Mali	Nigeria	Uganda	Total
Agro-processors & Private Service Providers	10	10	10	8	38
Extension Service (Extension/Development Agents)	26	15	14	11	66
Farmers	24	20	30	46	129
Financial Institutions	8	6	2	4	20
Input dealers (seeds, fertilizer and agro-chemicals)	13	11	5	7	35
Ministry of Agriculture & related Partners	4	17	3	8	32
Off-takers & Traders	13	10	19	6	48
Total	98	89	83	90	360

Table 2: Stakeholders' awareness level on COVID-19 and prevention measures (percentage responses)

Country	Stakeholders' Category	Hand washing	Social distancing	Avoid gatherings/ stay at home	Report suspected persons	Avoid touching eyes, nose and mouth	Hand sanitizer	Wear Mask	Avoid Sneezing, coughing & spitting etiquettes
Ethiopia	Agro-Input dealers	100	100	20	60	70	NA	NA	NA
	Extension Agents	100	100	5	75	90	NA	NA	NA
	Farmers	100	100	4	39	89	NA	NA	NA
	Financial Service Providers	100	100	25	75	100	NA	NA	NA
	Off-takers	100	100	8	33	100	NA	NA	NA
	Processors	100	100	25	58	91	NA	NA	NA
Mali	Ministry of Agriculture	100	100	NA	NA	100	NA	100	NA
	Farmers	100	86	NA	NA	76	NA	86	NA
	Extension Agents	100	100	NA	NA	100	NA	100	NA
	Agro-processors and PSP	90	100	NA	NA	0	NA	70	NA
	Agro dealers	91	73	NA	NA	55	NA	73	NA
	Output traders	80	60	NA	NA	10	NA	50	NA
	Financial Institutions	83	83	NA	NA	33	NA	67	NA
Nigeria	Agro-input Dealers	93	90	NA	NA	0	85	86	70
	Extension Agents	100	100	NA	NA	85	58	80	100
	Farmers	100	45	NA	NA	38	40	16	18
	Financial Institutions	100	100	NA	NA	100	100	100	100
	MoA /ADPs	100	100	NA	NA	100	100	100	100
	Off-takers & Traders	82	56	NA	NA	50	100	28	65
	Private Service Provision and Processing	80	29	NA	NA	50	86	57	29
Uganda	Extension Agents	100	13	100	0	88	13	13	NA
	Farmers	95	64	21	2	10	2	5	2
	Financial Institutions	100	100	NA	NA	100	NA	75	NA
	Input traders	100	86	29	NA	57	29	29	NA
	Off-takers	100	100	NA	50	100	NA	83	NA
	Private Service Provision	82	100	27	18	9	45	NA	NA

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Table 3: Stakeholders' perceptions on the effect of COVID-19

	Ethiopia	Mali	Nigeria	Uganda
Overall agricultural sector				
Food and nutrition security	75	81	78	50
Labour availability and mobility	58	91	68	13
Input availability and access	41	100	92	75
Trainings for Farmers and EAs	75	77	84	75
Agricultural activities	86	92	100	100
Output markets	64	100	68	63
Limited access to credit	46	62	44	25
Effect of COVID-19 on farmers				
Access to extension	83	81	83.3	82.6
access to PHH	NA	52	71.4	23.9
Transportation	NA	100	95.2	52.2
Labour availability	75	90	90.5	63
Price changes	NA	67	95.2	76.1
Output markets	NA	100	92.9	82.6
Access to credit	NA	62	90.5	87
Access to farms	NA	52.4	88.1	NA
Food and nutrition security	75	81	81	71.7
Reduced farming activities	NA	81	67	NA
Access to inputs	90	76	72	NA
Agricultural input and product				
Delayed delivery of imported inputs	NA	40	54.2	33.3
Delayed payments by debtors	NA	60	63	16.7
Increased cost of business	NA	82	55.6	16.7
Increased prices	18	30	67	16.7
Limited sales	NA	40	81	66.7
Scarcity of inputs/lack of access to supply	NA	91	85	100.0
Limited stock/shortage of inputs	55	46	63	66.7
Transport	36	40	66	NA
Lack of access to loans	18	70	30	NA
Out of stock	NA	46	80	16.7
Extension service provision				
Limited monitoring/technical support to farmers	42.3	81	92	75
Suspended activities (trainings, demonstrations, data collection)	51.3	67	60	33
Inability to facilitate input delivery/distribution	5.7	100	NA	20

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Increased cost of service delivery	NA	71.4	90	25
Output markets				
Increased input & Post Harvest Handling materials prices	NA	NA	23	12
Scarcity of produce	15	60	60	67
Increase food prices and other essentials	15	20	48	45
Limited market access due to ban of weekly markets	8	20	51	81
Access to finance				
Decline on debtors	NA	65	69	80
Decline on savers/deposits	40	70	89	NA
Poor loan servicing	30	67	67	60
Suspension of loan disbursement	20	60	58	40
Deficit in loanable funds	10	67	62	20
Constrained credit flow	NA	10	72	60
Effects on Off-takers' output markets				
Closure of business	NA	55	51.0	33.3
High transport	7.7	40	NA	66.7
Scarcity of produce	15.4	60.0	56.0	100.0
Limited stock	NA	40.0	48.0	83.3
Price variation	15.4	20.0	33.2	100.0
increased sales	15.4	10	44.6	NA
Decline in income	38.5	70	52	NA
Lack of access to loans	7.7	70	NA	NA

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Table 4: Spearman's rho correlations analysis matrix for extension services and value chain activities during COVID 19 (n=125)

	Postharvest & handling services	Transportation	Labour availability	Price changes	Output Markets	Credit access	Food and nutrition security	Farming activity	e-extension	Gender	Age	Education	Awareness of COVID-19	Extension services
Postharvest & Handling Services	1.000	.144	.176*	.035	.020	.308**	-.001	-.003	.042	-.007	.264**	.295**	-.007	.225*
Transportation		1.000	.427**	.293**	.630**	.226*	.474**	.399**	.138	-.115	.000	.195*	.359**	.069
Labour availability			1.000	.318**	.331**	.216*	.466**	.493**	.268**	-.146	-.050	.061	.392**	.007
Price changes				1.000	.308**	.206*	.194*	.144	.198*	-.059	.015	-.028	.430**	.011
Output Market					1.000	.325**	.515**	.424**	.114	-.105	.020	-.041	.507**	.027
Credit access						1.000	.282**	-.008	.135	-.237**	-.036	-.222*	.414**	.331**
Food & Nutrition Security							1.000	.280**	-.012	-.099	-.114	.056	.430**	-.024
Farming activity								1.000	.191*	-.137	-.018	.074	.027	-.031
e-extension									1.000	-.007	-.056	.060	-.001	-.189*
Gender										1.000	.262**	.261**	-.163	-.132
Age											1.000	.131	-.031	.105
Education												1.000	-.162	-.251**
Awareness of COVID-19													1.000	.137
Extension services														1.000

*Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

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Table 5: Categorical regression analysis of relationships between extension service delivery and other variables across Mali, Uganda, Nigeria and Ethiopia during COVID-19 Pandemic

Variable	Mali	Nigeria	Ethiopia	Uganda	All countries
	(Beta (Bootstrap Estimate of Std. Error)).				
Postharvest handling & services	-.145(.386)	.288(.226)	-.159(.101) *	.324(.096)***	-.440(.285)*
Input market	.340(.157) **	-.054(.304)	-.174(.113)	.195(.132)	.489(.273) *
Output market	-.377(.121) ***	-.268(.233)	.129(.287)	.381(.181)**	.134(.239)
Credit access	.424(.401)	.194(.157)	.070(.169)	.002(.133)	-.080(.347)
Food & Nutrition security	-.220(.306)	.710(.191) ***	.258(.267)	-.103(.180)	.686(.333) ***
Gender	-.139(.089) *	.139(.413)	-.348(.263)	-.152(.125)	-.026(.040)
Age	-.144(.186)	.108(.121)	.157(.183)	-.152(.167)	-.034(.079)
Education	-.264(.151) **	-.061(.145)	-.270(.181)	-.185(.086) **	-.058(.046)
Awareness of COVID-19	.085(.165)	-.128(.128)	.178(.064) ***	.166(.129)	-.008(.100)
Multiple R	0.697	0.788	0.653	0.727	0.715
R Square	0.485	0.621	0.426	0.529	0.511
Adjusted R Square	0.297	0.522	0.270	0.421	0.487
Ftest	2.57	6.268	2.725	4.934	22.053
Pvalue	0.00	0.00	0.002	0.00	0.00

REFERENCES

1. **UNCTAD.** COVID-19: A threat to food security in Africa. 2020 https://oecd-development-matters.org/2020/08/11/covid-19-a-threat-to-food-security-in-africa/ *Accessed August 2023.*

2. **Chen K** If coronavirus disrupts staple crop production the impact of food security could be grave. 2020. The Telegraph.

3. **Nkanjeni U** 'SA shoppers ignore pleas to stop panic buying and stockpiling.' 2020 The Times Live.

4. **Beltrami S** How to minimize the impact of coronavirus on food security. The World Food Programme. 2020 Insight. https://insight.wfp/how-to-minimize-the-impact-of-coronavirus-onfood-security-be2fa7885d7e *Accessed November 2023.*

5. **Hall B** Coronavirus and the Implications for Food Systems and Policy. AGRILINKS. 2020 https://www.agrilinks.org/post/coronavirus-and-implications-food-systems-and policy *Accessed February 2022.*

6. **Worldometer dashboard.** Coronavirus update (live). https://www.worldometers.info/coronavirus/#countries https://africacenter.org/spotlight/mapping-risk-factors-spread-covid-19-africa/ *Accessed March 5, 2024.*

7. **Africa CDC.** Africa CDC Dashboard. https://africacdc.org/covid-19/ *Accessed May 5, 2023.*

8. **Bovaird JA and KA Kupzyk** Sequential Design. **In:** Encyclopedia of Research Design. Neil J. Salkind, ed. Thousand Oaks, CA: Sage, 2010.

9. **McMullen CK, Ash JS, Sittig DF, Bunce A, Guappone K and R Dykstra** Rapid assessment of clinical information systems in healthcare setting: an efficient method for time-pressed evaluation. *Methods Inf Med.* 2011; **50:** 299–307.

10. **Yongsatianchot N and S Marsella** Computational models of appraisal to understand the person-situation relation, Chapter 19 - Editor(s): Dustin Wood, Stephen J. Read, P.D. Harms, Andrew Slaughter, Measuring and Modeling Persons and Situations, Academic Press. 2021; 651-674, https://doi.org/10.1016/B978-0-12-819200-9.00005-3

11. **Given LM** (eds) Rapid Assessment Process **In:** The SAGE Encyclopedia of Qualitative Research Methods. 2008. https://dx.doi.org/10.4135/9781412963909.n365

12. **Holdsworth LM, Safaeinili N and M Winget** Adapting rapid assessment procedures for implementation research using a team-based approach to analysis: a case example of patient quality and safety interventions in the ICU. *Implementation Sci.* 2020; **15(12)**. https://doi.org/10.1186/s13012-020-0972-5

13. **International Food Policy Research Institute**. As COVID-19 spreads, no major concern for global food security. IFPRI 2020. www.ifpri.or/blog/covid-19-spreads-no-major-concernglobal-food-security-yet *Accessed October 2023.*

14. **OECD.** OECD Policy Responses to Coronavirus (COVID-19) Food Supply Chains and COVID-19: Impacts and Policy Lessons. 2 June 2020. https://www.oecd.org/coronavirus/policy-responses/food-supply-chains-and-covid-19-impacts-and-policy-lessons-71b57aea/ *Accessed October 2023.*

15. **World Trade Organization.** Responding to the COVID-19 Pandemic with Open and Predictable Trade in Agricultural and Food Products, 14 May 2020, WT/GC/208/Rev.1; G/AG/30/Rev.1.

16. **AFAAS.** Videos for Farmers; Innovative Tool for Agricultural Extension Advisory Service Delivery. 2020. https://www.afaas-africa.org/videos-for-farmers-innovative-tool-for-agricultural-extension-advisory-service-delivery/ *Accessed September 2023.*

17. **AESA.** Is COVID crisis a tipping point for transformational changes in digital extension? https://www.aesanetwork.org/blog-125-is-covid-crisis-a-tipping-point-for-transformational-changes-in-digital-extension/ *Accessed September 2023.*

18. **Leonard DK** Reaching the Peasant Farmer: Organization, Theory, and Practice in Kenya. Chicago: University of Chicago Press 1977.

19. **Garforth C** Reaching the rural poor: A review of extension strategies and methods. In Progress in Rural Extension and Community Development, Vol. I. G.E. Jones and M.J. Rolls (eds.), New York: Wiley. 1982.

20. **Jarrett FG** Sources and Models of agricultural innovation in developed and developing countries. *Agricultural Administration.* 1985; **18(4):** 217-234.1986. https://doi.org/10.1016/0309-586X(85)90092-5

21. **Feder G, Just RE and D Zilberman** Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change.* 1986; **33(2):** 255-298.

22. **Roberts N** (ed.). Agricultural Extension in Africa, Proceedings of a World Bank Symposium, Eldoret, Kenya, June 20, 1984. The World Bank, Washington, D.C. 1989.

23. **Anderson JR and G Feder** Agricultural extension: Good intentions and hard realities. *The World Bank Research Observer.* 2004; **19(1):** 41-60.

24. **Ragasa C, Ulimwengu J, Randriamamonjy J and T Badibanga** Factors affecting performance of agricultural extension: Evidence from Democratic Republic of Congo. *The Journal of Agricultural Education and Extension.* 2016; **22(2):** 113-143.

25. **Boahene K** Innovation adoption as a socio-economic process: The case of the Ghanaian cocoa industry. Published doctoral thesis. Amsterdam: Thesis Publishers 1995.

26. **Danso-Abbeam G, Ehiakpor DS and R Aidoo** Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. *Agric. & Food Secur.* 2018; **7:74**. https://doi.org/10.1186/s40066-018-0225-x

27. **Sebaggala R and F Matovu** Effects of Agricultural Extension Services on Farm Productivity in Uganda. AERC Research Paper 379 African Economic Research Consortium, Nairobi June 2020.

28. **Asres E, Nohmi M, Yasunobu K and A Ishida** Effect of Agricultural Extension Program on Smallholders' Farm Productivity: Evidence from Three Peasant Associations in the Highlands of Ethiopia. *Journal of Agricultural Science.* 2013; **Vol. 5, No. 8**: 163-181 2013.

29. **Cawley AP, Heanue K, O'Donoghue C and M Sheehan** The Impact of Extension Services on Farm Level Outcomes: An Instrumental Variable Approach. Paper presented at the 150th EAAE Seminar *"The spatial dimension in analyzing the linkages between agriculture, rural development, and the environment"* Jointly Organised between Scotland's Rural College (SRUC) and Teagasc Scotland's Rural College, Edinburgh, Scotland October 22-23, 2015.

30. **Morsy H** Access to Finance: Why Aren't Women Leaning In? Women are self-selecting out of the African credit market. March 2020, Finance and Development, Pp 52-53 https://www.imf.org/en/Publications/fandd/issues/2020/03/africa-gender-gap-access-to-finance-morsy#:~:text=In%20Africa%2C%20the%20gender%20gap,to%20finance%20is%20disproportionately%20low *Accessed December 2023.*

31. **Onyeaka H, Tamasiga P, Nkoutchou H and AT Guta** Food insecurity and outcomes during COVID-19 pandemic in sub-Saharan Africa (SSA). *Agric. & Food Secur.* 2022; 11(56). https://doi.org/10.1186/s40066-022-00394-1

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