Africa RISING Technical Report Template

Instruction: *This template should be used for interim and full technical reports.*

Reporting Period: INTERIM REPORT (1st January 2022 – 28th February 2022)

Section A. Partner Information

A.1. Institution: CSIR-STEPRI

A.2. Contact person: RICHARD AMPADU AMEYAW (PhD)

A.3. Intervention sites, country: Africa RISING and non-Africa RISING communities in three regions of northern Ghana

Upper West Communities	Upper East Communities	Northern Region Communities
Zanko	Nyangua	Langa
Goli	Gia	Tibali
Duosa	Somologo	Kpendua
Nator	Nantaga	Tingoli and Cheyohi

A.4. Other partners: IITA, Tamale

Section B. Progress/achievements during the reporting period

Excecutive summary of achievements

Several project start meetings have been held by team members to brainstorm and come out strategies to undertake the tasks in the current project. The meetings were held in January, February and March. The first meetings were to decide which of the reports and data collected during the pevious project phases during the project period (2018-2021) could be used to carry out the current project. In this regard responsibilities were assigned to each team members to follow up with stakeholders

In the subsequent meeting, responsibilities were assigned to team members to draft policy briefs and fact sheets from the data and information gathered during the previous project phases. Meanwhile arrangements are being made to contact community leaders and relevant stakeholders for more information to complete briefs.

The team has assembled the selected reports fro the previous reports of the Africa RISING Project from 2019 to 2021, from which five policy briefs were drafted to be used for policy dialogues and dissemination exercises at selected locations with relevant stakeholders. These policy dialogues and disseminations activities are aimed to popularize the outcomes of the project and promote SIPS adoption among farmers, and gain support from policymakers. The policy briefs are designed in recognition of the objectives of the current project. The working title of the briefs are as follows;

What Factors Promote Adoption of Sustainable Intensification Practices?
Agricultural Mechanisation Policy Gaps in Ghana
Sustainable Extension Delivery Pathways
Smallholder farmers input and output markets preference.

In addition, there is a draft paper on gender and technology adoption coming out of the previous report and work. The main objective in this brief is to identify factors that influence male and female SIPs adoption decision, separately. Preliminary results show different factors affect males and females differently, and at different levels. Some of the factors identified for females are AGE, FBO membership and ease of adoption (PEC). On the other hand, seven (7) factors influence the SIPs adoption decision of male farmers. These are marital status (MRS), educational level (EDU), FBO membership, Distance (DTF), amount of credit received (CRD), extension visits (EXT) and PEC. FBO membership and PEC affect both male and female farmers positively, and significantly.

Table 1: Achievements (progress and/or results) against outputs towards outcome 4

Project Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices.				
Output 4.1: Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale	Planned Activities Policy Briefs Write-ups Fact Sheets Write - ups Community/ district level engagements Preparations Policy Dialogue at the National Level Preparations	Planned Milestones Four policy briefs as a summarized synthesis of previous work for increasing visibility and subsequent adoption of SI technologies Knowledge sharing events at the community and district/regional levels Stakeholder policy engagement events and synthesis of the proceedings	Deviation from Planned Milestones There was no deviation for the planned milestones	Achievements towards Output Three fact sheets on the outcomes of Africa RISING Project have been developed. These fact sheetss highlight the key issues obtained from the project for the policymakers and general statement. The policy briefs and fact sheets are under review for printing. Preparation for the dissemination exercises are still on going. Meetings have been held to outline and plan a comprehensive strategy for field works, which

				involved workshops with farmers, policymakers, CSOs and other relevant stakeholders. Two individuals (AEA and Community mobilizer) in each regions of Upper West, Upper East and Northern regions have been assigned to coordinate farmers mobility from communities to regional dissemination workshops to be held in Wa, Bolgatanga and Tamale. Contacts with MDAs, CSOs, scientist and other relevant stakeholders needed for the workshop are on-going. Budget for the workshops, both in Accra and northern Ghana (Wa, Bolgatanga

				and Tamale) have been done.

Tables and graphs in support of achievements

Some of the draft Policy Briefs have been placed under the Appendix.

Analysis, interpretation and discussion of results

Highlight SI indicators and their defining metric

Economic: Production costs, income (on-farm and off-farm), net revenues/losses at the farm/ household level.

Productivity: Yield (kg/acre) from adapted crop technologies at the farm/ household level.

Social cohesion- Participation in technology practice activities, collective action at the community level on adoption of technologies demonstrated.

Human- Capacity to households to adopt the technologies (number of farmers adopting the validated technologies, access to extension services).

Environment- the effect of crop-livestock technologies adopted on ecological processes at the farm and household levels, active ingredients level applied per acre (pesticides and fertilizers).

B.6. Synthesis

Use the SI indicator results to illustrate how outputs under the 4 outcomes are defining your innovation/technology.

B.7. Capacity Building

Tabulate: Type/title of training, where, when, number and category of people trained

Section C. Problems/challenges and measures taken

Section D. Partnership/linkages with other projects

This project is partnering with the Forum for Agricultural Research in Africa (FARA) via their available knowledge management platform (FARA's DataInformS). The platform will be used to disseminate widely policy briefs, leaflets, fact sheets etc. to inform different stakeholders about lessons learned from the intervention.

Section E. Lessons learned

N/A

Section F. Monitoring and Evaluation

N/A

F.1. Feed the Future indicators

Tabulation with the following columns: (i) FtF indicator, (ii) Annual target (iii) Progress toward target, (iv) Segregation, (v) explanation for over/under achievement (only for full report)

Info must also be provided to the Africa RISING Economist and/or to the project M&E specialist when needed for reporting to USAID FTFMS (usually during October each year) using PMMT.

F.2. Custom indicators

Tabulate (i) Custom indicator, (ii) Annual target, (iii) Progress toward target, (iii) explanation for over/under achievement

Table 2: Custom Indicators for Outputs 4.1

Custom Indicators For Output 4.1	Annual Target	Progress toward target	Explanation for over/under achievement
Community engagements Policy dialogues/ workshops held Technical leaflet Fact sheets, Policy briefs produced (printed and distributed by STEPRI) Two journal articles submitted/published	17 8 1 3 4 2	Preparations towards the community engagements and the Policy dialogues are currently on-going for a successful dissemination and deliberations The facts sheets, technical leaflet and the policy briefs are in draft stages and under review. The Journal articles are currently been developed.	

Section G. Success stories

N/A

Appendix

BRIEF …

Transforming African agriculture through sustainable intensification

February, 2022

What Factors Promote Adoption of Sustainable Intensification Practices?

Executive statement/summary

Low farm productivity is observed among smallholder farmers, who are also confronted with the adverse effect of climate change such as rising temperature, low and unpredictable precipitations, drought, erosion and poor soil fertility. To mitigate the impact of these climatic conditions on agricultural production, particularly to smallholder farmers, many climate-resilient agricultural production practices and developed and disseminated to farmers, one of which is sustainable intensification practices; increasing productivity by maximising farm output from limited and deteriorating production resources. Smallholder farmers from selected communities in northern Ghana were exposed to Sustainable Intensification Practices (SIPs). Adoption of these practices is expected to maximise farm output, and improve food security among rural households. However, the factors influencing the adoptions of these practices to inform policy remaining lacking. This study therefore, used data from 465 adopters and non-adopters of SIPs under the Africa RISING Project to analyse the factors influencing adoption to inform policy. The study employed econometric regression procedure to analyse the factors influencing adoption among the farmers. The study, among others factors observed policy relevant variables; agricultural extension services delivery, FBO membership, access to credit or financial services, and market as critical factors promoting adoption of SIPs among the farmers. Strengthening FBOs or groups, regular agricultural service support and state-private partnership to make it possible to access credit and financial support are crucial to improving and sustaining SIPs among farmers

Introduction

Orthodox agricultural production practice to increase farm output in sub-Saharan Africa and Ghana in particular relies on acreage expansion, and this has stretched production resources. Every year about 0.9% of Ghana's forest reserves is lost to agricultural production (Acheampong, 2016). This system of production is deemed unsustainable. There are also imbalances in food demand and supply due to increasing human

population and uneven global food distribution systems. Further, climate change is also having adverse effect of food production. In fact, globally about 800 million people are food in-secured (FAO, 2020) while US$23 billion per annum is lost to agricultural production because of climate change and dwindling production resources (IPCC, 2016). The impact of climate change is more pronounced in northern Ghana, where reports suggest poor crop yields, rising food insecurity, stagnating income levels, and seasonal migration.

Few strategies to promote sustainable and climate resilient agricultural production and resource use have been proposed, one of which is Sustainable Intensification Practices (SIPs). SIPs are agricultural technologies or production practices that enable farmers to maximize output while minimizing the economic, sociocultural and environmental cost of production. Field trials of these technologies with smallholder farmers under the Africa RISING Project have shown promising results; increase productivity, food security and improved farm households' welfare. These technologies have been deployed to rural communities in northern Ghana, however, as observed by Anang et at 2020, adoption of these technologies remain unsustainably low, thus poor yields, food insecurity and poor living standard of the rural farmers. Since there are potential benefits to adopting SIPs, and yet adoption is low, by understanding the factors that promote or inhibit adoptions, policies can formulated to improve adoption and consequently improve the living standard of smallholder farmers and rural folks at large.

About the study/project

Africa RISING is a project that is involved in the development and dissemination of agricultural technologies to resource poor farmers in rural areas, who are challenged with limited production resources and environmental challenges; poor and unpredictable rainfall patterns, erosion and poor soil fertility and rising temperature. These technologies are object to mitigate the impact of climate change and maximize output without overexploitation of the production resources, for example, land and water. The goal is to ensure that food and fibre are produced with minimal economic, social and environmental cost.

So, under the Africa RISING Project smallholder farmers in selected rural communities in northern Ghana, where the effect of climate change is more noticeable were exposed to improved/climate resilient varieties (maize and cowpea), mixed farming, climate-resilient and yield-enhancing production practices; maize leaving stripping, use of animal manure, mulching, row planting, right quantity and timely application of fertilizer. Field trials with farmers on the project have shown that these technologies improve farm productivity, mitigate the impact of climate change, and promote sustainable production.

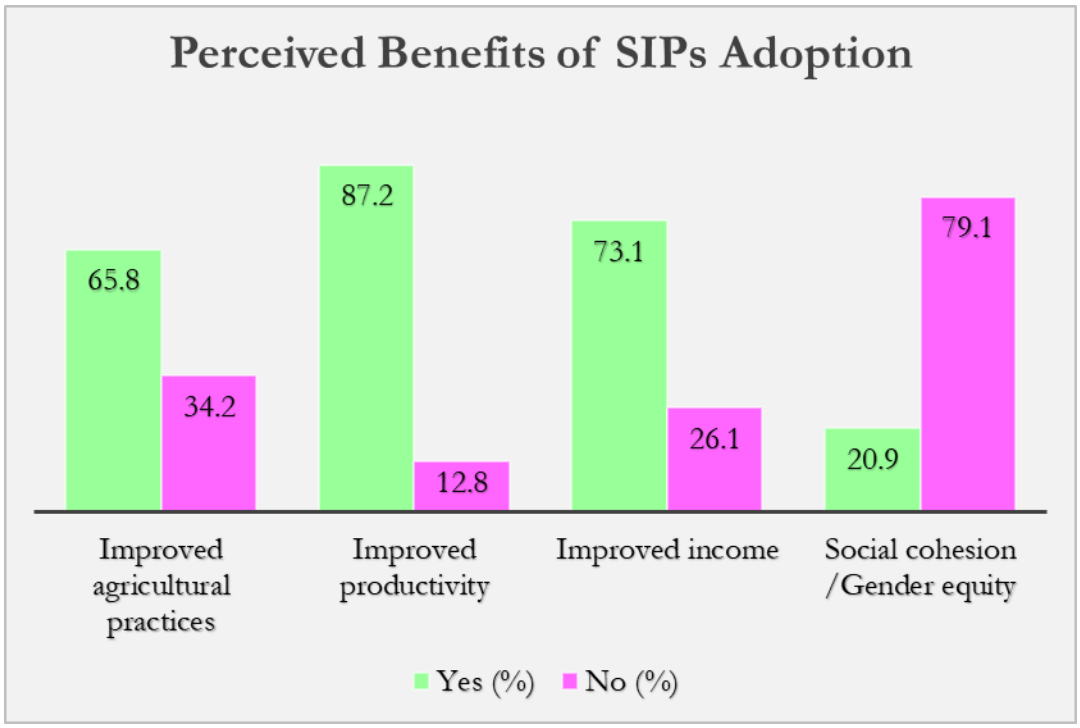
Despite the potential benefits adoption rate among farmers are not encouraging (Anang, 2020). Thus, the study analysed the factors that influence farmers decision to adopt or not of these technologies. The study interviewed 237 adopters and 228 non-adopters in 16 communities across 8 districts in northern Ghana. The study ensured that most of the

adopters in the communities were randomly selected for the interview, in addition to non-adopters.

Obtaining the data from adopters and non-adopters help the study to apply econometric technics; probit and logit to estimate the parameters of the variables that influence adoption decision. The study report both the probit and logit result to show that results of the study were/are not influenced by choice of empirical estimation procedure. There was validation workshop with about 60 organizations and/or individuals. There was also community level dissemination of the findings and validation.

Study results

Farmers will adopt a technology if the perceived benefits exceeds the cost. As such, farmers were asked to indicate the benefits or advantages associated with technology adoption (Figure 1)



About 73.1% of the respondents believe that the adoption of technologies ultimately leads to improvement in income. On productivity, 87.2% reported adopting the technologies help to improve productivity. Productivity increase are also linked to good farm management practices. As the result of SIPs adoption almost two-thirds (65.8%) of farmers reported improved farm operations such as weed, pest, disease controls and harvesting. For instance, the use of animal manure can have a long-lasting effect on the soil texture and fertility than chemical fertilizer. However, 70% reported no improvement in social cohesion or gender equity (Figure 1). The factors that influence adoption are discussed below.

Financial Services/Credit: Financial services/credit, for example small loans are observed to be very important in SIPs adoptions. Access to financial services increase adoption to 10.8%. This means that the possibility of adopting SIPs increases if the farmer has access to small loans, farm inputs like fertilizer. Most of the technologies deployed requires monetary resources to implement. For example farmers are required to use specified quantities of fertilizer and prescribed seed varieties, and these are externally supplied. The farmer therefore needs to purchase these inputs if he/she is to implement the technologies. *Access to financial service increases adoption of SIPs by 10.8%*

Market Services

Access to output market for agricultural products has been observed to influence adoption decisions of smallholder farmers, positively. This is so because access to market serve as a motivation to increase production since there are outlets through which the farmer can sell or dispose the products. In many cases, these farm products are highly perishable (vegetables), and there are no storage facilities, especially at the production centres. It is observed in this study that access to market increase the probability of adoption of SIPs by 42%. This means that if the farmer has a market outlet near the production centre or availability of buyers, then he/she is motivated to adopt sustainable intensification practices since adopting this technology tend to increase farm output. Without accessible market infrastructures, products will perish, leading to loss of income and labour expended. Despite the significance of access to markets for the product only 43.5% of farmers have access to it. It is therefore important to complement SIPs deployment with access to market infrastructure. *Access to market service increases SIPs adoption by 40%*

Agricultural Extension Services: Agricultural extension agent to farmer ratio in Ghana is very low. The extension agent-farmer ratio is estimated at 1:1850 (MOFA, 2019). This means that the number of extension agents are inadequate, thereby reducing the quality and quantity of the extension service delivery. In many rural communities, farmers rarely have access to extension agents. It is observed in this study that the average extension visit per season per farmer is less than twice. Access to extension service, as has been found by this study increases adoption of SIPs by 12.3%/. There is therefore a need to improve agricultural extension services delivery in terms of quality and quantity. Retraining of farmers is important and necessary because of the challenges farmers encounter during the implementation of the technologies. However, because of low numbers of the AEAs, this is hardly done, leading to sustainability challenges. Farmers also need motivation from AEAs to sustain adoption since these technologies are different from farmers orthodox and used-to production practices. *Access to extension service improves SIPs adaption by 12.3%*

Farmer Based Organisation /Groups: FBOs provide platforms for peer learning, and also opportunity to collectively advocate for production resources. FBO membership significantly influence adoption of SIPs by 59.8%. The implication is that if farmers are in groups, the possibility of SIPs adoption improves remarkably. Group formation also comes with other benefits such as risk sharing, savings and loans, collective resource mobilization; labour. *FBO membership improves adoption by 60%*

Lack of Multipurpose Small Scale Production and Processing Machine: It was observed that some of the technologies, for example row planting, fertilizer placement, although are yield enhancing and ease farm operations, they are time consuming and labour demanding. These tend to inhibit adoption in the long run. It is therefore necessary to have access to small scale multipurpose machines, for example planters, to minimise the use of manpower in farm operations.

Policy implications or recommendations

1. Increase access to extension service

Regular visit of extension service providers, both private and state AEAs help to increase technology adoption among smallholder farms. Challenges do emerge in the implementation of technologies at farm level. Some of these challenges are technical which require the attention of the extension service providers to resolve. The study show that although majority of the farmer have access to extension service in one form or another, the number of extension visits per farmer per production cycle is very low, about 1.5 visit per farmer per season. This challenge is attributed to low AEAs-farmers ratio, and lack of transportation means for AEAs. Efforts should be made at the national level to improve AEAs-farmers ratio. This can done by recruiting more qualified AEAs, improving infrastructure and training of AEAs. State-private partnership in the delivery of extension could be promoted by creating the enabling environment for the private sector to participate. In addition, ICTs can be deployed to deliver extension services, in which case few AEAs can access more farmers, especially in the period of Covid-19 pandemic.

2. Improve access to financial service

Most of the technologies deployed require monetary or input resources to implement. For example, to use approved seed varieties, to apply the right quantity of fertilizer at the right time require not only the monetary resource to do so but also the availability of same. There are numerous instances where farmers have the means to purchase these inputs but they are not available, particularly at the community level. These inputs are stored and sold at the regional levels thereby increasing the cost of the inputs because of transportation cost. A state-private sector partnerships to make small loans and credit facilities is advocated. This could be implemented through the FBOs or Village Savings and Loans Associations (VSLAs) at the community level. This VSLSs are becoming

more common in small communities because of the inability of the orthodox financial systems to support smallholder (because of high cost, and poor repayment rate). The VSLAs are common, and are able to effectively regulate themselves which promotes repayment of loans among the farmers. Technology can be deployed to speed up disbursements of loans because studies have shown that loans for agricultural activities have been misapplied on other household needs because of untimely disbursements of loans, thus the need for timely disbursement of loans.

3. Promote formation and regular training of FBO members

The opportunity of peer learning and risk sharing is documented to be one of the main reasons why smallholder farmers join groups or associations. Farmers in groups are able to share their experiences and challenges in the implementation of technologies on their farmers. Collectively, ideas and solutions can be generated to resolve these challenges especially when number of extension visits are limited. Group members also encourage and support each other in times of adversity. Groups could also become the platforms through which extension and financial services are delivered. There should be promotion of group formation at the community level through education and sensitization of the farmers. This could help farmers appreciate the importance and benefits of being associated to a group rather than operating at individual levels. Although, farmers may operate at individual level on their farms, access to financial service, extension advice are best served at group level. Groups also have stronger voice to advocate for their needs than individuals.

4. Small-scale farm machinery support

There is a need to begin to produce and assemble small-scale multipurpose machines to help reduce manpower use and the drudgery associated with the use of human labour. This can be done by the state in collaboration with the private sector or creating the enabling policy environment for the private sector to invest in such areas. Institutions like CSIR-IIR and GRATIS can be relied on for the fabrication of these machines.

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative. Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.	The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment. Prepared by: Emmanuel Tetteh Jumpah africa-rising.net

Agricultural Mechanisation Policy Gaps in Ghana

Literature related to the historical and current policy on mechanization was reviewed. Ideally, agricultural policies should support a progressive drive towards the full integration of mechanization into the country's agricultural sector; more especially among smallholder farmers. To have a deeper understanding of the extent to which current agricultural policies in Ghana provide the enabling environment for increased growth in mechanization, the team reviewed all the relevant national policy documents that related to agriculture and mechanization promotion in the country and assessed their level of implementation for the benefit of smallholder farmers.

It is the considered view of the Africa RISING Ghana project that with the right policies in place, mechanization services will be made available to farmers promptly for increased production, productivity, and incomes. Smallholder agriculture has largely remained at the subsistence level due to the absence of mechanization services which makes it difficult for farmers to increase the land size cultivated. As part of the overarching aim of the Africa RISING Ghana project, this brief provides insights on agricultural mechanization policy gaps at the formulation stage (from stated policy objectives and interventions of agriculture), and implementation (through the effectiveness of implementation of the formulated objectives). The insights are based on reviews of policy documents, data from personal interviews, focus group discussions and household semi-structured surveys. Table 1 provides details of agricultural mechanization policies and programs in Ghana that were reviewed:

Table 1: Agricultural mechanization policies and programmes in Ghana

Policies	**Programmes**
Food and Agricultural Sector Development Policy (FASDEP I & II)	Agricultural Engineering Services Directorate Plans Agricultural Mechanization Service Enterprise Centre (AMSEC)
Ghana Poverty Reduction Strategy (GPRS I & II)	Modernising Agriculture in Ghana (MAG) Programme
Ghana Shared Growth and Development Agenda (GSGDA I & II)	Ghana Beyond Aid

Medium Term Agricultural Sector Investment Plan (METASIP)	Various Study Reports on mechanisation
Coordinated Programme of Economic and Social Development Policies	Published articles

A review of the literature revealed that national policy strategies advocate for increased private sector investment in agriculture for the provision of essential production services such as labour-saving equipment, certified and improved seeds, effective veterinary services system, as well as efficient value chain linkages to provide markets for farm households. However, there are challenges with the implementation of these strategies: limited coordination among actors promoting agricultural mechanization; no holistic approach in promoting mechanization; too much focus on farm tractors at the expense of small equipment that smallholder farmers can afford and weak policy implementation of mechanization. As such access to mechanization services remains a challenge in terms of accessibility and affordability.

Results

The core issues gathered from the literature review suggest that several strengths have been recognized in the approach to promoting agricultural mechanization. The approach to mechanization focuses on selected commodities based on comparative and competitive advantage, which implies that the emphasis is on farming as a business. Agricultural mechanization in Ghana, even without a formal strategy having been adopted, is being carried out as an integral part of the national development process. Policies affecting mechanization stem from national policies and have been ingrained into the various work plans of national institutions. In addition, because the national policy is to stimulate agriculture-led growth, many complementing policies that enhance agricultural production and productivity were put in place simultaneously. As a result, growth in productivity has been steady and sustained. Ghana already has a relatively good infrastructure, numerous training institutions in agricultural engineering (four public universities, one private university and four polytechnics), good extension service and a fairly well-staffed Agricultural Engineering Services Directorate.

One identified problem was that mechanization did not follow a holistic approach with the involvement of the various stakeholders outside the agricultural sectors such as finance, economic planning, industry, education, science and technology, labour and employment, universities, and research institutes. The various sectors have made important contributions over the years in the development of agricultural mechanization but not in a coordinated fashion and hence the actions have not been very effective.

National economic and social development policies to drive growth and development in all sectors of the economy (agricultural in particular) have focussed on the narrow view of mechanisation: mechanising on farm activities by providing tractor services to reduce drudgery and increase production. As a result of this, exhaustive literature can be found on mechanization on farm activities but little can be found on post-production at the national, regional and local levels.

There are weaknesses with the implementation of agricultural mechanization policies in Ghana. A lack of a strategy has meant that some stakeholders have been omitted from the planning and implementation stages, especially farmers and private-sector equipment and service providers. A detailed diagnosis of the problems confronting farmers and private-sector equipment and service providers still needs to be carried out. The Ghanaian approach to agricultural mechanization, for now, is essentially top-down. Also, the Government is involved in the provision of some mechanization services. This should be the role of the private sector. One of the main constraints is the lack of data to determine the long-term impacts of mechanization. Data collection should, therefore, be an important aspect of the mechanization strategy and this calls for effective monitoring and evaluation of the implementation of the strategy. There is an agreement that agricultural mechanization is only profitable for financially viable crops. In Ghana, the conclusion by the Agricultural Engineering Services Directorate is that agricultural mechanization is not profitable without subsidies.

While an increasing need exists to nurture a policy environment that encourages private-sector-led development of agricultural mechanization in Ghana (Houssou et al., 2013), commitment from relevant government agencies is highly crucial towards the sustenance of any agricultural mechanization scheme. Given that the direct involvement of governments in the early agricultural mechanization schemes is widely regarded as one of the reasons for their failure, future schemes need to carefully structure the nature and extent of state involvement. To formulate an effective strategy, a holistic approach is required that includes private sector involvement, profitability considerations, and the creation of an enabling environment with clear roles for both public and private sectors (Fonteh, 2010).

Agricultural mechanization policy gaps

The reviews show that over the years, policies on agricultural mechanization in Ghana have failed to deliver in the following areas:

1. Collaboration with the private sector to build capacity, and companies to produce and/or assemble appropriate agricultural machinery, tools and equipment locally.

2. Promote small-scale multipurpose machinery along the value chain, including farm-level storage facilities, appropriate agro-processing machinery/equipment and intermediate means of transport.
3. Improve mechanization in animal husbandry especially, intensify the use of animal traction through the establishment of animal traction centres.
4. Facilitate the establishment of mechanization services provision centres and machinery hire purchase and lease schemes that have adequate backup of spare parts for all machinery and equipment.
5. Promote local assembly of tractors and encourage adaptation and local fabrication of processing equipment.
6. Develop human capacity in agricultural machinery management, operations and maintenance with the public and private sectors.
7. Little emphasis on postproduction mechanization of agriculture for smallholder farmers.

POLICY RECOMMENDATIONS

To address the agricultural mechanization policy gaps, the policy brief recommends the following:

1. Extend the policy net to include and address the expectations of smallholder farmers as the current policy frameworks are largely focused on tractor services leading to the structural exclusion of small farm implements.
2. Increase budget expenditure for post-production infrastructure given the limited attention it is currently receiving under existing policy initiatives/programs.
3. Focus on improving the implementation of target credit support schemes on mechanization

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Sustainable Extension Delivery Pathway

Introduction

The global change research community has recognized that new pathway and scenario concepts are needed to implement impact and vulnerability assessment that is logically consistent across local, regional and global scales (Valdivia et al., 2013).

In Ghana, the Africa Rising project in the Northern regions led by IITA in terms of sustainable intensification for the next generation is a key pathway towards better food security, improved livelihoods and a healthy environment. Therefore developing representative technological pathways cannot be over emphasized.

The International Institute of Tropical Agriculture in West Africa have developed technologies in Ghana which are validated (Ghana Country brief, 2019) but the compliments of pathways for these technologies are missing for future predictions. The following are some of the technologies which includes the following but not limited to:

Maize-cowpea intercrops: The effect of different growth levels of cowpea living mulch and level of maize maturity in both farmers' fields and community technology parks have demonstrated that planting early maturing maize (Omankwa) with cowpea as living mulch at 1 week after planting maize reduces weed infestation by 40% and increases maize yields by 36%. Reduced labor demands will allow for easier adoption and more time for alternative livelihood options.

Maize leaf stripping: The stripping of leaves of the medium maturity maize variety (Obatanpa) at 50% silking has been shown to increase livestock feed by 27% with no penalty or decrease in maize yield experienced. The increased feed yields provide diversified diets of animal protein while improving food security.

Soil and water management: The use of appropriate soil and water conservation measures, e.g. tied ridges and contour planting and ridging has demonstrated increased soil moisture storage by 20% and increased maize yields by 15%.

Cowpea living mulch reduced direct evaporation of soil moisture by 25%, reduced weed infestation by 65%, and reduced soil losses by 45% as a groundcover. The reduced labor demands from less weeding allow for easier adoption and more time for alternative livelihood options.

Fertilizers: Planting of early maturing maize (Omankwa) with nitrogen fertilizers administered at a rate of 90 kg/ha increased both maize and stover yields.

Maize – Cowpea Living Mulch Technology

The study used the TOA-MD (Trade off analysis – Minimum data model). The data comprised of farms in Northern, Upper East and Upper West Regions of Ghana. This research work analyzed the economic impacts of Maize – cowpea living mulch adaptation on smallholder farmers using two staple crops namely Maize and Cowpea. Three scenarios of cowpea living mulch and maize were used for the projections.

The analysis is also based on the assumption that farms are using a base technology in crop production under system 1 which represents farms cultivating maize as mono crop whiles the analysis of the study further explores smallholder farms under a new technology which is system 2. Whereas system 2 represents farms cultivating maize and cowpea living mulch.

These includes Cowpea mulch planted same day with Maize, Cowpea mulch planted 1 week after Maize or Cowpea mulch planted 2 weeks after Maize.

Firstly, the adoption rates differ with the introduction of the cowpea planted after the maize. In other words most farms would adopt the technology Maize – Cowpea living mulch on the same day (34%) followed by Maize – Cowpea living mulch after 1 week (33.4%). The least preferred would be Maize and Cowpea living much planted after 2 weeks with an adoption rate of 29.88%.

In addition, the mean net returns per farm is greater for farms in system 2 than in system 1 across the different scenario levels of the technology. More especially, farms would be better off with the adoption of Cowpea living mulch planted 1 week after maize cultivation with a mean net returns of 6227.81 Ghana cedi. This means that mean net farm returns are sensitive to the technology scenario levels.

A technical report by AFRICA RISING in 2018 is in agreement with the mean net returns findings. According to the report Farmers' preferences for the cowpea-living mulch system were: planting cowpea a week after planting the maize, followed by no cowpea-living mulch, planting cowpea-living mulch two weeks after maize, and planting cowpea-living mulch on the same day of planting the maize. Farmers attributed their low preference of planting cowpea the same day as maize to competition between maize and cowpea resulting in smaller yields. This would trickle down to affect the mean farm net returns.

Furthermore, the Per capita income of the farmers which was derived from on-farm source of income as well as non-farm sources of income. The results suggests that farmers without the adoption of the technology have higher per capita income as against farmers who would adopt the technology across the technology scenario levels. On the other hand, such farmers might be engaged in other off farm employment opportunities and this could be the cause for higher per capita income. This implies that farmers must

not only be dependent on farming source of income but must be engaged in other off farm employment opportunities. As per capita income increases, poverty rates is expected to decreases among farm.

Maize Leaf Stripping Technology

Feed shortages during the cropping season constrain ruminant production in small-scale crop-livestock production systems in northern Ghana. Leaves stripped from maize plants after tasselling or silking could provide feed during the cropping season.

The maize leaf stripping technology could be practiced either at 50% tasselling or at 50% silking. The stripped leaves are then fed to livestock as feed. In other words, maize leaf stripping to maximize food and feed yields from maize-based cropping systems.

The analysis is based on the assumption that farms are using a base technology in crop production under system 1 which represents farms cultivating maize crop without stripping whereas system 2 is a maize crop where maize leaf stripping is practiced.

From the simulation analyses, more farms would adopt the maize leaf stripping at 50% silking other than the maize leaf stripping at 50% tasselling, this is represented by 59.4% and 56.9% respectively.

The results agrees with a study conducted by IITA in 2018 which revealed that the majority of the farmers across the three regions of northern Ghana preferred maize leaf stripping at silking. Farmers attributed their choice for leaf stripping at 50% silking to the ease of identifying lower leaves below the maize cobs and abundant feed for livestock feeding during the rainy season.

Secondly, the poverty rate for farms adopting the technology maize leaf stripping at 50% silking is 18.2%. This poverty rate is lower compared to maize leaf stripping at 50% tasselling which is 20.5%.

lso, mean farm net returns for farms adopting the maize leaf stripping at 50% silking is 3648.3 Ghana cedi. This is higher than a mean farm net returns of 3093.9 Ghana cedi for farms adopting maize leaf stripping at 50% tasselling. In other words, there would be gains for farms adopting the maize leaf stripping at 50% silking and losses for farms adopting maize leaf stripping at 50% tasselling. The gains would amount to 554.4 Ghana cedi.

Moreover, per capita income for the population of farmers with regards to maize leaf stripping at 50% silking technology is higher than maize leaf stripping at 50% tasselling technology. The per capita incomes are 381.8 Ghana cedi and 311.1 Ghana cedi respectively. Measures that can help and sustain adoption of these practices need to be aggressively promoted.

The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative. Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.	The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment. Prepared by: Nana Yamoah Asafu-Adjaye africa-rising.net

Smallholder preferred input and output markets

Executive statement/summary

The development and dissemination of agricultural technology especially, Sustainable Intensification Practices (SIPs)/technologies are to ensure sustainable production, improve productivity and welfare of smallholder farmers. However, improved productivity will only improve livelihood with better access to market and market infrastructures. It is therefore important to complement sustainable technologies deployment with better access to markets or marketing infrastructures. This study, therefore, analysed smallholder farmers input and output markets preference. This policy brief is the result of a study under the Africa RISING Project, which analysed farmers market choice for their input purchase and output sales, and factors that affect such decisions. A field survey of quantitative data from smallholder farmers in Africa RISING Project communities was used, and analysed, applying econometric procedures-multinomial logit to ascertain the factors that inform farmers market preference. Farmers main market choice was found to be village market in favour of farm gate and private sales. Key policy related variables affecting farmers market choice were found to be knowledge in SIPs, bargaining skills, agricultural extension and financial services, guaranteed market, and distance to markets. Findings suggest that there is a need to incorporate SIPs at the national policy level, particularly national agricultural policy. Also, the state and private sector partnership to expand access to extension and financial services need to be aggressively promoted. In addition, there is an urgent need to improve post production infrastructures, for instance, investment in small-scale processing and storage facilities at the community level.

Introduction

About the study/project/analytical framework

There was review of previous studies related to smallholder market options and preferences in terms of findings, conclusions and recommendations. Research gaps were also identified to inform the study. Africa RISING Project develops and disseminate yield enhancing, climate resilient and sustainable practices or technologies to smallholder to improve productivity and livelihood. The data for the study was obtained from

smallholder farmers from 16 Africa RISING Project implementation and non-Africa RISING Project communities in northern Ghana. These communities are Zanko, Goli, Duosa, Nator and Jirapa communities in Upper West Region; Nyangua, Gia, Samoligo, Nantaga communities in the Upper East Region; Langa, Tingoli, Cheyohi, Moglaa, Kpachi, Kpendua communities in the Northern Region (now divided into three regions).
Farmers were randomly selected, most of whom are in groups for the interview and structured questionnaires were administered. There were also general, and Focus Group Meetings (FGMs) with the farmers and identified groups, particularly females and the youth. This was to obtain information that may not be captured in the structured questionnaire. This informed the research to appreciate the dynamics of market preferences in rural communities.
In addition, the team collected data through personal interviews from stakeholders involved in SI dissemination, and the institutional conditions (e.g. policies and local norms) to generate insights on enablers or constrainers of SI technologies /practices dissemination as well as existing initiatives or opportunities that could support the scaling of SI technologies/practices.
The study employed the Multinomial Logistic Regression (MLR) and probit respectively to analyse the factors influencing farmers choice of market and access to input market. The MLR was used because the dependent variable for the market preference had three categorical variables (farm gate, private sale and village market)

Study results

SI technologies/practices and delivery pathways

We found that several SI technologies/practices exist and are being explored by farmers in the regions. The SI practices well-known by stakeholders are: row planting, dry season irrigation, food fortification, use of improved seeds, cowpea living mulch under maize, provision of donkeys for women to cart manure, intercropping of maize and cowpea or millet, crop-livestock integration, maize leaf stripping and groundnut spacing. The application of these technologies is to increase productivity and improve livelihood of farmers.

Determinants of Output Market

It is observed that common market place available where most farmers sell off their produce is the village market as against farm gate and private sales. This could be due to volume of sales and better price at the village market. The results show that there are about 13 policy related factors or variables that could affect farmers' choice or preference of output market. The key factors influencing preference of farm gate and private sales rather than village market as observed are membership of processing or marketing group, processing and storage facilities, extension and financial services, guaranteed market/price, knowledge of SIPs, bargaining skills, and distance to village markets.

Farm gate Vs. Village Market: A farmer belonging to a **group (production or processing or marketing)** is associated with a 5.7 decrease in the relative log odds of using farm gate markets as a main market outlet. Meaning, if a farmer belongs to a producer or marketing group then chances of selling at farm gate rather than village market decrease by 70%. Access to **storage facilities** is associated with a 9.8 decrease in the relative log odds of using farm gate as a main market outlet rather than village market. Thus, if a farmer have access to storage facilities then s(he) is more likely to sell at village market. **Knowledge in SIPs** is associated with a 12.9 decrease in the relative log odds of using farm gate as the main market outlet. So, a farmer with knowledge in SIPs is more likely to sell at the village market. The preference of sale of farm produce at the farm gate as against village market will decrease by 10% if farmer-input/output market distance increases. As the average distance increases, a farmer is more likely to sell at the village market. **Sufficient bargaining skills** is associated with a 0.4 increase in the relative log odds of using farm gate as the main market outlet. Meaning, a farmer with sufficient bargaining skills is more likely to sell at the farm gate rather than village market. Other factors identified but with only marginal influence to market preference are access to **extension, and financial** services, **processing facility and guaranteed market/prices**

Private Sales Vs. Village Markets: In terms of private sale, it was observed that only membership of a processing or marketing association, extension services, financial services, bargaining skills, and guaranteed market prices are the important policy variables informing market preference decisions. **This means if** a farmer belongs to producer or marketing group in the community she or his preference to private sales rather than village market increases by 90.0%. A similar situation is observed for bargaining skills (43.0%). Guaranteed market/price promotes preference for village market and decrease private sales by 97.0%.

Factors Affecting Input Market

Without **access to extension services**, a farmer is less likely (28% probability) to have access to inputs all things been equal. Lack of access to extension services negatively affect farmers access to input market. This is because most often than not it is these extension agents that connect farmers to government subsidised inputs like fertilizer, and also provide information on the quality and quantity of the inputs to use. Also, a**ccess to financial services** is critical in enabling farmers to access input markets. The findings showed that without access to financial services, a farmer's access to input market is reduced 25%. Finally, **distance matters in farmers' access** to input markets in northern Ghana. An increase in distance means that a farmer is less likely to have access to input market by 10%

Policy implications or recommendations

1. Sustainable Intensification Practices (SIPs) adoption is observed to influence farmers' access to output market, positively. The Food and Agriculture Sector Development Policy II and its implementation action plan, the Medium-term Agriculture Sector Investment Plan II, are the core policy documents guiding the development of the agriculture sector. The Ministry of Food and Agriculture is also implementing a 'Planting for Food and Jobs' agenda as the main programme. An earlier analysis of the policy landscape indicated that SI is not a core policy agenda for agriculture development, but strategies peculiar to specific SI domains (Production, Economic, Environmental, Human and Social) are dotted in the formulated objectives of policies and programmes. However, due to ineffectiveness (inadequate resources, weak coordination) in policy implementation, the stated SI strategies are not reflected in farming systems and farm household decision-making on agriculture production. It is therefore crucial to incorporate SI practices at the national policy level
2. State-private partnership arrangement is encouraged to open up market opportunities for smallholder farmers since adoption of SI improve productivity and farm output. Markets need to be developed and promoted closer to production centres or means of transportation of farm outputs improved so that farmers can sell off their output at competitive market prices. Leaving smallholder farmers to market forces would negatively affect livelihoods because farm produce in Ghana are highly price elastic. In seasons where outputs are high minimum guaranteed prices can be offered to farmers to serve as motivation to produce.
3. Further, government agencies such as the Buffer Stock Company (BSC) can liaise with middlemen or assemblers to aggregate farmers output from rural communities for storage and onward future sales by the BSC. A formalized and incentivized value chain in which the operations of actors, particularly assemblers are regulated is advocated. In addition to guaranteed minimum price there is a need to enforce or adhere to contractual agreements between producers and buyers. To complement BFC, there is the need to promote small and medium size community storage facilities with support from stakeholders to extend the **shelf** life of some of the farm produce. This could help farmers to preserve the commodities for a while, particularly during the harvesting season when there is glut and prices of produce are at all-time low. Further, processing of farm produce; FBOs could be sensitized or trained to extend their operation to post production activities such as small scale processing of farm produce.
4. Strengthening institutional support to improve input distribution systems: bureaucratic bottlenecks surrounding, and political interference in the distribution of farm inputs especially government subsidised fertilizer should be minimised or removed while fair and transparent means of distribution are employed. For

example distribution of inputs through community level farmer groups with the support of apolitical actors or opinion leaders, and agricultural extension agents. A review of the current fertilizer coupon system is advocated.

5. Leveraging ICT to facilitate marketing of farm produce. This could achieved through strong linkage between AEAs and NGOs (who can provide market information) and farmers. Most smallholder farmers own phones which can help to connect them to markets outside of their communities with the help of AEAs and NGOs. The state can support such initiatives through policy and programmes, such as tax incentives, grants etc.

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Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.	Prepared by: Emmanuel Tetteh Jumpah africa-rising.net

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