

The Role of Climate-Resilient Crop Demonstration Plots in Improving Food Security in Low-Income Neighborhoods: A Case of South Sudan

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ABSTRACT

Despite South Sudan's potential for agriculture and cultivation, food insecurity has remained a source of concern, with the Global Hunger Index (GHI) 2024 report designating the state of hunger in South Sudan as alarming based on the population undernourished (19.6%) and the number of children dying before their fifth birthday (9.9%). In addition to this, the Global Integrated Food Security Phase Classification (IPC) Emergency Review Committee identifies 42% of South Sudan's population as those afflicted by the high levels of food insecurity. It is for this reason that European Union (EU) through Tearfund in partnership with Coalition for Humanity (CH) intervened with an objective of piloting climate-resilient agriculture in Rubkona County, Unity state in South Sudan through the establishment of disease resistant rice demo plots. The management theory of project management was used to achieve the objective. This led to increased awareness, greater participation and interest in adopting new agricultural practices. The participatory approach used fostered a sense of community and collaboration among farmers within the county thus making them to understand the practical benefits of the technologies demonstrated. To use this approach, Coalition for Humanity established 40 farmer groups, targeting 800 food insecure households (4,800 individuals). This was followed by the distribution of agricultural inputs to the households, and engagement of 10 extension workers to provide capacity building of farmers on basic agronomic practices and nutrition sensitive agriculture before the establishment of the demo-plots. The formation of these demo-plots led to increased awareness of farmers in Rubkona County thus resulting in improved engagement and interest in adopting new agricultural practices. Community Engagement with farmers by involving them in the selection of demo locations and management activities enhanced their participation and ownership of the projects. This participatory approach also fostered a sense of community and collaboration among farmers. In addition to this, farmers who participated in demo-plots were able to learn by doing, thus resulting to the practicability and adoption of new technologies. The recommendation includes provision of continuous training and support to farmers to ensure they can effectively adopt and maintain new practices. Community formation of partnerships with local organizations, government agencies, and businesses to leverage resources and expertise are also recommended. Fostering of collaborative projects between schools and local communities to foster real-world problem-solving skills is also a necessity by the education sector.

Keywords: Climate Resilient, Demonstration Plots, Food Security

I. INTRODUCTION

According to Food and Agriculture Organization (FAO, 2024) food insecurity is the lack of access to safe, nutritious, and sufficient food required for people to live a healthy and active life. FAO further cites food security as one of the threats to human security that have increasingly gained attention. The importance of ending hunger is recognized second in the 17 Sustainable Development Goals (SDGs) 2030.

The SDG report in 2024 indicates a rise in global hunger in terms of the prevalence of undernourishment to have risen from 7.5% in 2019 to 9.1% in 2023. One in five people in Africa and one in eleven people worldwide, or 713 to 757 million people, experienced hunger in 2023. In addition, 2.33 billion people, or 28.9% of the global population, were expected to be moderately or severely food insecure in 2023, which is 383 million more than in 2019 (FAO, 2024).

The Global Report on Food Crises 2024 affirms how challenging it is to achieve the goal of ending hunger by 2030. Additionally, according to the analysis, almost 282 million people, or 21.5% of the population analyzed, lived in 59 countries and territories in 2023 and had severe food insecurity, necessitating immediate help for food and livelihood (Global Network Against Food Crises [GNAFC], 2024).

Global Hunger Index (GHI) values vary substantially between countries and regions. South of the Sahara in Africa and South Asia have the highest Hunger Index scores. Though the ratings have decreased for these two

locations, the present levels remain in the serious to worrying category rather than the moderate category. The situation is deteriorating throughout the majority of African countries and South America. However, Africa continues to have the highest rate of malnutrition, with over 256 million people affected.

Malnutrition is one of the effects of food insecurity, and is associated with poor baby and child growth as well as an excess of illnesses and deaths in adults and children, with infants and women being the most susceptible. Undernourishment refers to three conditions: wasting, being underweight, stunting, and other conditions related with poor micronutrient consumption. Children from 6 to 59 months are often affected the most. In 2024, there were 148 million children worldwide with low height-for-age (International Food Policy Research Institute (IFPRI), 2024).

FAO (2024) opines that malnutrition among children under the age of five remains a major problem, providing additional hazards to their growth and development. In 2022, an estimated 22.3 percent of children under the age of five, or 148 million, were stunted, a decrease from 24.6 percent in 2015. According to present trends, one in every five children under the age of five (19.5%) would be stunted by 2030. 37 million children (5.6%) were overweight, and 45 million (6.8%) were malnourished, exceeding the worldwide target of 3% by 2030. From the proportion mentioned, three-quarters of stunted children under the age of five resided in Central and Southern Asia (36.7%) and Sub-Saharan Africa (38.3%). More than half of people afflicted by wasting resided in Central and Southern Asia (56.2%), with almost one-quarter in Sub-Saharan Africa (22.9%).

According to Olsen et al. (2021), natural conditions, economic instability, and violence all contribute to South Sudan's ongoing food insecurity. Given the number of undernourished people and the number of children who pass away before turning five, the GHI 2024 study tentatively designates the level of hunger in South Sudan to be alarming. In addition to this, the Global Integrated Food Security Phase Classification (IPC) Emergency Review Committee identifies 42% of South Sudan's population, or 4.9 million people as those afflicted by the high levels of food insecurity, which exacerbated the country's vicious cycle. According to Avis (2020), 82% of people in South Sudan fell into poverty as a result of food insecurity.

The catastrophic status of food security in South Sudan necessitates quick action. According to the SDG 2024 study, productive and sustainable agriculture is critical to meeting and maintaining human requirements for current and future generations. The analysis also shows that all governments throughout the world must take ongoing, concerted effort to increase productive and sustainable agriculture by 2030.

The Acute Food Insecurity and Malnutrition report of 2022 approximates 6.6 million people, or over half of South Sudan's population (54%) to be experiencing high levels of acute food insecurity, classified in Crisis (IPC Phase 3) or worse between October and November 2022. World Food Program (WFP) report further ranks Unity state the second most food insecure state, after Jonglei (68%), with 66% of the population classified in Crisis (IPC Phase 3) or worse food insecurity. The report further projects lean season period of April to July 2023, an estimated 7.8 million people (63% of the population) will likely face Crisis (IPC Phase 3) or worse acute food insecurity, with 43,000 people likely to be in Catastrophe (IPC Phase 5) acute food insecurity in Akobo, Canal/Pigi and Fangak counties of Jonglei State; and Leer and Mayendit counties of Unity State (International Food Policy Research Institute, 2024).

The question posed by majority of the scholars is whether South Sudan is able to produce enough food for its citizens or not. According to the FAO's 2013 report, South Sudan has the ability to feed not only itself but the whole African continent. The survey also showed that South Sudan has a lot of rich land and a climate that is ideal for agriculture and development. A strong indicator that further study is needed to address the country's high incidence of food insecurity.

NGOs in South Sudan have made substantial contributions to economic empowerment initiatives by providing effective microcredit, training, self-help groups, and cash transfers. As posited by Steenkamp et al., (2021); and SDG 2024 report, agriculture still remains the backbone to solving food insecurity in South Sudan. Thus necessitating European Union (EU) through Tearfund in partnership with CH to piloting of climate-resilient crops demo plot firm in Rubkona, South Sudan. A move aimed at ensuring agricultural sustainability and securing food production in the face of climate change impacts.

CH is a nationally registered NGO in South Sudan with over 12 years of experience in delivering impactful humanitarian and resilience-focused programs. Its core areas of expertise include Food Security and Livelihoods (FSL), Water, Sanitation, and Hygiene (WASH), Shelter and Non-Food Items (NFIs), Health and Nutrition, Education, and Women and Youth Empowerment. The organization address cross-cutting issues such as Protection and GBV, Housing, Land and Property Rights (HLP), Emergency Shelter and Non-Food Items (NFIs), conditional and unconditional cash distribution, peacebuilding, and conflict transformation to ensure holistic and sustainable interventions. Headquartered in Juba, South Sudan, CH has an operational presence in Central Equatoria, Unity State, Northern Bahr el Ghazal, Upper Nile State, Pibor Administrative Area, Ruweng Administrative Area, and Jonglei State, with plans for further expansion in line with emerging needs.

1.1 Statement of the Problem

Achieving zero hunger requires intensified efforts to transform food systems so as to be sustainable, resilient and equitable. Moreover, accelerating improvements in diets, nutrition, health and hygiene is crucial to meeting the target of halving the number of children suffering from chronic undernutrition (International Food Policy Research Institute., 2024). As posited by Doocy et al. (2023), food insecurity is still a major problem in South Sudan, impacting millions of people and making preexisting vulnerabilities worse. This is in spite of the continuous humanitarian efforts and interventions. Lokosang et al. (2016) provide more evidence of how the region's ongoing war has exacerbated food poverty by disrupting agricultural operations, uprooting communities, and straining already scarce resources.

According to WFP, in 2022, there is already a 36 percent increase in admissions to the treatment of acute malnutrition programs, and over one-third of the counties in southern Sudan have Global Acute Malnutrition (GAM) rates that exceed the emergency threshold of 15 percent. Currently in Rubkona County, the global acute malnutrition (GAM) and Severe Acute Malnutrition (SAM) rates of children 6-59 months has shown an increasing trend. The nutritional status of under-five population in Rubkona County has deteriorated significantly with the highest SAM cases found in the age group of 6-29 months (Wadi, 2022)

With different reports and empirical evidence recommending agriculture as a solution to food security especially in South Sudan. Information on climate-resilient crops that have proven resilient to past climate-related problems seems to be lacking at the household and community levels in South Sudan especially in Rubkona. Generating information to fill this gap is likely to increase the understanding and improve knowledge of different crops that can be of impact. Thus providing useful insights into the structure, drivers of resilience and useful lessons for ensuring sustainable livelihoods in the face of climate variability.

1.2 Research Objective

To pilot climate-resilient agriculture in Rubkona County, Unity state in South Sudan through the establishment of disease resistant rice demo plots.

II. LITERATURE REVIEW

2.1 Theoretical Review

In order to achieve the objective, Management Theory of Project Management was used. The management theory of project management as developed by Koskela and Howell (2002), asserts that management practices are divided into three sub-sections: planning theory, execution theory, and control theory. According to the planning theory, there are two parts to project planning: the managerial portion and the part that heavily emphasizes human activity as it is placed. Planning essentially serves as an organizing event that management employs as a tool to gather all the resources (inputs: labor, materials, time, and money) required to complete the project's specified job.

According to Koskela and Howell (2002), the theory of execution, which is also known as the classical communication theory, states that managerially, execution is about assigning tasks to work stations. However, the language/action viewpoint must be added to the classical communication theory in order for execution to be successful. The operators must be fully informed of the tasks that have been sent to their work stations. Feedback systems should be in place to demonstrate to the workers that they have understood the instructions and, as a result, allow jobs to be completed as planned.

The control theory is divided into two models: thermostat and scientific experimentation (Koskela & Howell, 2002). The thermostat model proposed that in the production process, there is a process to control, a unit for performance measurement, a standard of performance, and a controlling unit, whereas the scientific experimental model focuses on identifying causes of deviations and acting on those causes, rather than simply changing the performance level to achieve predetermined goals in the event of deviation.

To accomplish the objective, the three theories—planning theory, theory of execution, and control theory—were all applied. At the managerial level, demo-plot planning was accomplished by allocating resources such as labor, materials, time, and funds. By organizing farmers and including them in plot identification, the execution idea was applied. Finally, M&E is a performance control measure for any project since it manages all performance-oriented operations. The theory of control in this initiative took these factors into consideration.

2.2 Conceptual Review

2.2.1 Climate Resilient Agriculture

In the context of food security, FAO (2024) defines resilience as "the ability of a household to maintain a certain level of well-being (i.e., being food secure) by withstanding shocks and stresses." The availability of livelihood opportunities and the ability of households to manage risks determine this. Both (ex-ante) measures that lower the likelihood of food insecurity and (ex-post) measures that assist households in coping once a crisis occurs are implicitly taken into account by this definition.

Africa's smallholder crop production farmers are particularly vulnerable to climate change due to their high reliance on natural resources and rain-fed agriculture, socioeconomic pressures, and little capacity for adaptation (Intergovernmental Panel on Climate Change [IPCC], 2024). In African dry regions, high rainfall variability in quantity, timing, and location is typical (Khadim, 2021) and can jeopardize agricultural production (Steenkamp et al., 2021). The already unstable climatic conditions for agricultural production will be made worse by the anticipated rise in season failure rates, decrease in dependable growing days, and likely increase in rainfall variability for Africa's dry lands through 2050 (Lokosang et al., 2016).

The 2014 IPCC report states that climate-resilient agriculture is a sustainable strategy for ensuring food security that combines mitigation and adaptation strategies. A significant obstacle still exists, nevertheless, in raising agricultural output in a changing climate without endangering social and natural resources. climatic-smart agriculture (CSA) technologies are among the sustainable practices suggested by Lopez-Ridaura et al. (2018). These technologies seek to boost yields by reorienting and altering the current system to accommodate changing climatic conditions.

The United Nations Sustainable Development Goals (SDGs) pose an urgent and formidable challenge to scientists and society alike, emphasizing the critical need to transform agriculture and the food sector in order to achieve food and nutrition security, ecosystem sustainability, economic growth, and social equity over the next few decades.

2.2.2 Demonstration Plots

According to Khadim (2021), demonstration plot is a tool used to influence the behavior of the rural masses in a way that is desirable, set up the best conditions for learning, and create opportunities for constructive communication and interaction between extension workers and farmers using the idea that "Seeing is believing." Farmers and technicians can both get training on a demonstration plot. Whether on a large or small scale, this approach gives farmers a realistic understanding of what they are expected to perform on a personal basis.

2.2.3 Improving Food Security in Low-Income

Food security has been recognized as a significant public health concern by research. Numerous negative health outcomes have been linked to household food security status, such as chronic disease in general (Gregory & Coleman-Jensen, 2017; Laraia, 2013), diabetes (Seligman et al., 2007), difficulties managing diabetes (Seligman et al., 2012), hypoglycemia (Seligman et al., 2011), depression and mental health (Heflin et al., 2005), poor general health and medication underuse (Gundersen & Ziliak, 2015). Additionally, food insecurity is linked to poor health and unhealthy weight, as well as parental depression (Ryu & Bartfeld, 2012). Birth abnormalities, anemia, asthma, cognitive issues, difficulties with social adaptability, and cognitive function are among the health issues in children that are known to be associated with food insecurity.

Diabetes, hypoglycemia, hypertension, and dyslipidemia are a few of the health issues that are linked to food insecurity. It is evident that the quantity and quality of food consumed by households experiencing food poverty are related to these disorders. When food insecurity and undesirable weight outcomes (obesity and overweight) coexist, it suggests that there is another kind of nutritional insufficiency that is related to both the quantity of food available in the home and the nutritional makeup of the food (Hernandez et al., 2017). Therefore, the types of foods that are accessible to households experiencing food insecurity can significantly impact their health, even in situations where there is an adequate supply of food. The significance of proper nutrition for promoting the well-being of low-income households may be emphasized by comprehending the specifics of their inferior buying quality.

According to Tacoli (2020), access to food is mostly influenced by availability, affordability, or earnings, at the family level. However, the proximity of selling places, the amount of time available to buy and prepare food, and the space available to cook and keep food are equally significant. Furthermore, low income has a significant negative impact on people' health and, consequently, their capacity to work effectively. Their rights and their capacity to participate in programs that involve nutrition programs are also impacted. Lastly, it significantly raises exposure to environmental risks, which have an impact on nutrition and food security. To empower such households, investment in agricultural technology and support to local farmers is a necessity. The key reason for this initiative.

III. METHODOLOGY

Considering the 5 approaches outlined by Cornwall et al. (1993), DELTA (Development, Education and Leadership Teams in Action) method was preferred. The DELTA approach is a comprehensive strategy that can be used in enhancing food security and nutrition in low-income communities. It focuses on a few essential aspects, including: Developmental element that incorporates Investing in agricultural infrastructure, technology, and best practices to boost production and sustainability. Education which includes Educating and teaching farmers and communities in optimal practices, nutrition, and food preservation. Leadership entails fostering local leadership and community participation to ensure that efforts are adapted to the unique requirements and difficulties of the region.

This method stresses collaboration among multiple stakeholders, including governments, non-profit groups, and local communities, to provide a comprehensive and long-term solution to food insecurity.

To use this approach, the organization established 40 farmer groups, targeting 800 food insecure households (4,800 individuals). This was followed by the distribution of agricultural inputs to the households, and engagement of 10 extension workers to provide capacity building of farmers on basic agronomic practices and nutrition sensitive agriculture before the establishment of the demo-plots.

IV. FINDINGS & DISCUSSION

4.1 Land Preparation and Crop Piloting In Demo Plots

Each member of the household was involved in the preparation of the Demo- firm. After identification of the land, land tilling was done and water flooded on the land in preparation of the rice planting.



Plate 1
Identification, Preparation and Flooding of the Demo Plot

As recommended by Miah et al. (2011). Dykes were made, the community was involved in rice plantation and watering. Some of the household members were tasked to align the rope so as to give direction to those who were involved in planting of the rice.



Plate 2
Making of Dykes, Planting of Rice and Watering of Demo Plots

After three to four days of waiting, the rice sprouted as the household members continuously watered the plots and were actively involved in observing of their growth and weeding. The demo-plots were able to also give seedlings that were given to the households to continue with the same at their individual household level. This would ensure continuity in food production within Rubkona, a County that has never done such kind of agriculture.



Plate 3

Constant Watering, Weeding and Distribution of Seedlings to Farmers

As a result of the demo-plots, there has been increased awareness of farmers in Rubkona County. This increased awareness has led to greater participation and interest in adopting new agricultural practices. Community Engagement with farmers by involving farmers in the selection of demo locations and management activities increased their engagement and ownership of the projects. This participatory approach also fostered a sense of community and collaboration among farmers. In addition to this, farmers who participated in demo-plots were able to learn by doing, which improved the relevance and adoption of new technologies. This experiential approach helped farmers understand the practical benefits of the technologies being demonstrated.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusion

The rice demo-plot project aimed to alleviate food insecurity in Rubkona County in South Sudan through community engagement and involvement with farmers, provision of agricultural tools and seedlings from the demo plots and creation of awareness on the current agricultural technology in use. The plot demonstrates clear distinctions in yield performance across the various irrigation techniques tested.

The successful growth of rice in the demo-plots and distribution of seedlings to the already trained farmers to start their own agriculture on the same is a clear indication that the county has a greater potential of crop production that can sustain the entire households so as to reduce food insecurity in the region.

To build upon these findings, further initiative is recommended. This could involve expanding the demo-plots to multiple areas and piloting different varieties of crops, exploring their economic aspects and examining their environmental sustainability. Such comprehensive studies could provide deeper insights and inform more effective agricultural practices in South Sudan.

5.2 Recommendation

For South Sudan to alleviate hunger and improve food security and livelihood as outlined in the SDG 2024 report, the country, local government and partners must come together to Provide continuous training and support to farmers to ensure they can effectively adopt and maintain new practices. The community should form partnerships with local organizations, government agencies, and businesses to leverage resources and expertise. The education

sector should facilitate collaborative projects between schools and local communities to foster real-world problem-solving skills.

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