

## Summary

### Introduction:

The introductory part of this paper focuses on the background, purpose and significance of the study.

Firstly, the paper points out that the issues of gender inequality and food security are two closely related issues in Sub-Saharan Africa. However, the relationship between these two issues has not received sufficient attention and research. Therefore, this paper aims to explore the relationship between gender equality and food security and to propose strategies and recommendations to address these issues.

Next, the paper describes the purpose of the study and the research questions. The purpose of this paper is to explore the relationship between gender equality and food security by comparatively analysing case studies from four countries (Botswana, Ethiopia, Kenya and Uganda) and to propose strategies and recommendations to address these issues.

The research questions of this paper include: how does gender inequality affect food security? Are there differences in the impact of gender inequality on food security across countries and regions? How can gender equality and food security be promoted through policy and practice?

Finally, the paper presents the significance and contribution of the research. The findings of this paper will contribute to a deeper understanding of the relationship between gender equality and food security and provide valuable references and recommendations for policy makers and practitioners. In addition, the research methodology and analytical framework of this paper can also provide lessons and insights for similar studies

### Literature Review:

Sub-Saharan Africa is facing a severe global hunger crisis and its food security situation is particularly dire. Data from the Food and Agriculture Organisation of the United Nations (FAO) show that the region has a significantly higher incidence of food

insecurity than the global average, with a large increase in the number of hungry people particularly affected by COVID-19 in 2020. The main sources of food are maize, sorghum and millet, but it is also affected by urbanisation and imports, such as the demand for wheat. Although smallholder farmers are the main agricultural producers in the region, they face many obstacles such as climate change, poverty and resource constraints.

These smallholder farmers often experience threats to their agricultural production such as droughts, floods and climate change, resulting in low food production. In addition, issues such as access to markets, land and water management pose great challenges for them. In addition, the region faces a range of other agricultural challenges, such as economic stagnation, gender inequality, declining soil quality, population explosion, inadequate policy frameworks, infrastructure shortages and corruption, which pose serious constraints to food security in the region.

Poverty and food security in sub-Saharan Africa are a complex double challenge. Poverty not only limits people's ability to buy and produce food but also exposes households to greater risks of food insecurity. This interconnectedness makes the issue even more complex and requires in-depth exploration and analysis.

First, we must recognize that poverty is a root factor in food insecurity. Many households in sub-Saharan Africa are unable to secure a daily meal, mainly because they lack a stable source of income. For families that depend on agriculture for their livelihoods, they may lack the necessary agricultural resources, such as land, seeds, and fertilizers. Worse still, their agricultural productivity is low due to a lack of modern agricultural techniques and training. This leads to food shortages and higher prices, which further exacerbate the problem of poverty.

In addition, climate change is another threat to agriculture in sub-Saharan Africa. Extreme climatic events, such as droughts and floods, severely affect food production. For those households already living below the poverty line, such climate change shocks can be devastating, as they lack coping strategies and resources.

Fluctuations in food prices are also a serious problem. Rising prices mean that many households may not be able to buy enough food, leading to undernourishment and

hunger. Poor households may be forced to choose less expensive but less nutritious foods, such as maize and rice, when food prices rise, at the expense of more nutritious foods such as vegetables, meat, and dairy products.

Furthermore, the quality of food in sub-Saharan Africa is of even greater concern. In impoverished environments, food is preserved and handled in poor conditions, which can easily lead to food poisoning and the spread of disease. In many households, food spoils quickly because of the lack of proper storage facilities, resulting in a great deal of food waste. This waste not only adds to the problem of food shortages but also leads to further impoverishment for families.

Gender inequality is defined as the unequal status and opportunities for women and men in social, economic, cultural, and political contexts, resulting from gender roles, norms, or differences in gender. Globally, women tend to lag far behind men in terms of entitlements, opportunities, and economic resources. Countries such as Iceland and Norway are doing better in terms of gender equality, but in most countries, women still face numerous challenges.

Gender inequality is particularly acute in sub-Saharan Africa. Statistically, women in the region face enormous inequality pressures in the economic, educational, and political spheres. More worryingly, many of these women live in extreme poverty and are at risk of food insecurity.

Women in sub-Saharan Africa contribute significantly to agriculture and food production, but their productive capacity is limited by gender inequality. They often lack access to agricultural resources such as land, finance, and technology. At the same time, since they are responsible for most of the household chores and water collection, this further reduces the time and energy available to them for agricultural production.

In addition, due to their low economic status and lack of resources, women and girls are more vulnerable to malnutrition. They bear the primary responsibility for accessing and preparing food, but their efforts and contributions are often overlooked by society, resulting in their own nutritional needs not being met.

Women are grossly underrepresented at the policy and decision-making levels. Even in agriculture, they are often excluded from policy formulation and decision-making,

despite being the main producers. This gender inequality not only limits women's economic and social rights and interests but also has a negative impact on food security for the community as a whole.

Rural women play a vital role in the agricultural and food economies of sub-Saharan Africa. Not only are they involved in agricultural production, processing, and marketing, but they also have the experience and knowledge to adapt to a wide range of climatic and soil conditions, as well as make important contributions to environmental protection, education, and training. However, rural women face many challenges, such as lack of financial resources, difficulties in accessing markets, gender discrimination, lack of ownership of land and other productive resources, and the effects of climate change and natural disasters. In order to better support and empower them, in-depth research on their challenges is needed to promote more equitable and sustainable socio-economic development.

The role of women as microentrepreneurs in the food economy is gaining prominence. Microentrepreneurs usually operate small businesses with no more than 50 people but have a significant impact on rural economic and community development. Particularly in sub-Saharan Africa, women microentrepreneurs have a profound impact on food production, processing, transport, distribution, and consumption. In Niger, for example, women entrepreneurs have made outstanding contributions to environmental protection, increased value addition to agricultural products, logistics and distribution, and community education on healthy eating. More broadly, they provide food security for their communities, contribute to local economic development, provide employment opportunities, and contribute to the economic and social progress of their communities. Gender inequality, food security, and poverty form an interconnected and complex system in sub-Saharan Africa. Gender inequality exacerbates poverty, which in turn undermines food security and puts women at a disadvantage. Poverty and food insecurity lead to health and education problems, further reinforcing gender inequality. Breaking this vicious circle, which exists not only at the household level but also manifests itself at the social and political levels, requires strategic interventions at multiple levels. In order to bring about real change, we need not only to understand

these issues in depth but also to act courageously.

Scholars working on gender and food security have used a variety of methods that combine quantitative and qualitative approaches. Quantitative methods emphasize data and statistical analysis; for example, Dzanku explores the relationship between gender, geography, non-farm work, and food security through panel data; Ashagidigbi uses questionnaires and GIS techniques to gain insights into the intersections of gender and food security; Belwal employs descriptive statistics and regression modeling to study the food status of Tanzanian households; and Lecoutere and Chu used experimental design methods to examine the impact of household decisions on food security. Qualitative methods focused on in-depth human observation and insight: focus groups and in-depth interviews revealed women's challenges in agricultural production and household food security, and Kadiyala et al. used a case study approach and content analysis to explore the relationship between agriculture and gender across multiple countries. Together, these integrated approaches provide a comprehensive understanding of the intersection of gender equality and food security.

Female empowerment in sub-Saharan Africa is closely linked to regional food security. Although the region has made some progress in female advancement, education and health, it still faces challenges such as poverty, low levels of education and limited economic opportunities. Several countries have endeavoured to improve the status and well-being of women in society by providing measures such as education, political participation, health and economic opportunities. For example, Kenya encourages women to pursue STEM professions, and Rwanda and South Africa provide scholarships and financial incentives for women.

Studies have shown that women play a key role in the household and community, often being responsible for purchasing and cooking food, so empowering them with more decision-making power and resources can improve the nutritional needs of households and communities. In addition, women's economic empowerment contributes to the economic strength of the family, which in turn allows them to purchase a wider variety of healthy foods. Educated women are more inclined to adopt better child feeding practices, such as breastfeeding, further improving the nutritional status of children. In

addition, improving women's position in household decision-making benefits the nutritional health of every member of the family.

Research methodology:

This study explores the relationship between gender equality and food security in four countries in sub-Saharan Africa: Kenya, Ethiopia, Uganda, and Botswana. These countries represent the diversity of economies, gender equality, agriculture, and food security in the region. Our objective was to analyze how gender equality tools have enhanced food security in these countries, as well as to compare the effects of various projects. For this purpose, a research methodology combining qualitative and quantitative approaches was used.

All these countries have made efforts toward gender equality and agricultural production, although they differ in their economic and agricultural status. Kenya's economy is dominated by agriculture and services, but women's access to education and political participation, among other things, is still limited; Ethiopia is still dominated by agriculture despite its rapid economic growth, and the government has begun to encourage gender equality; Uganda is an agriculture-based economy, and the government is working to close the gender gap; and Botswana is a middle-income country where the government is encouraging gender equality and focusing on increasing agricultural productivity.

The core hypothesis of the study is that empowering women in the food system is key to improving food security and gender equality. To test this hypothesis, regression analysis was used to explore the relationship between gender inequality and food insecurity by analyzing multi-country data over a number of years. At the same time, literature analysis was used to examine specific cases in selected countries to gain insights into how governments and organizations have enhanced food security through the advancement of women.

This study focuses on food security and gender equality in sub-Saharan Africa, using data covering 21 countries for the period 2015–2020. The data cover various aspects

such as food insecurity rates, gender equality index, gender participation in the economy, education and politics, gross domestic product (GDP), and consumer food price index (CPI).

To ensure the reliability of the data, data from internationally recognized organizations was selected for this study. This includes the World Bank, the United Nations, the World Economic Forum, and the Food and Agriculture Organization of the United Nations, among others. These data sources not only ensured the accuracy of the study but also provided comprehensive information to support the in-depth analysis of this study.

By exploring the results of the regression analyses, we find that they do not quite match our expected results. There is a positive correlation between gender economic participation, gender political power, and food insecurity, while GDP per capita is negatively correlated with food insecurity. The relationship between gender education and food security did not reach a statistically significant level, although there was a trend. The analysis also shows some positive correlation between the consumer price index for food and food security, but again, it does not reach significance. Increased gender equality appears to be positively correlated with food insecurity.

These findings are a reminder that food security cannot be fully solved by increasing female economic participation or gender equality alone. Social, economic, cultural, and other complex factors combine to influence food security. And while quantitative research on the complex relationship between food security and gender equality can provide some insight, it still has limitations and cannot fully reveal the deeper social, cultural, and political dynamics.

In order to gain a deeper understanding of this complex relationship, we plan to conduct further qualitative research, particularly through case studies, to explore the impact of women's empowerment programs on food security. In this way, we hope not only to provide policymakers with more informed and targeted recommendations but also to understand the relationship between gender equality and food insecurity from a more comprehensive and multidimensional perspective.

Case studies:

This study focuses on the impact of gender equality and women's empowerment strategies on food security in four countries. Case studies were chosen as the main research methodology to capture more precisely the link between women's empowerment and food security. Within this framework, the policies and practices of the four countries are examined, specifically the planning of the policy or program, the implementation process, the problems encountered, and their resolution strategies. Attention is focused on assessing the effectiveness of the implementation of women's empowerment tools and how they directly or indirectly affect food security.

Once the four case studies were completed, a cross-case comparison and discussion were conducted. This comparison aims to identify key elements of success and failure that can provide useful references for relevant policies in other countries or regions. These key elements may include the planning and implementation methods of the policies, the allocation of resources, and the synergy and cooperation among the participating parties.

To ensure the accuracy and completeness of this study, we have made reference to the official policy documents and reports of each country, which not only provide data support for the study but also help us gain a deeper understanding of each country's policy context and actual operation in terms of gender equality and women's empowerment.

The results of the study show that women's empowerment strategies have significant positive effects on improving food security. Women's participation in agricultural production, the household economy, and decision-making processes directly or indirectly increases the efficiency of food production and distribution. This also implies that the critical role of gender equality and women's empowerment must be taken into account in policy and practice if food security is to be effectively improved.

Comparative analyses and results:

This paper focuses on the relationship between regression analyses and case studies on several key factors, such as gender, economy, and food security. It finds a positive correlation with food insecurity, despite greater female participation in economic



activities. The main reasons for this include women's generally lower incomes than men, a lack of stable jobs and social security, and limited economic decision-making power. These issues need to be addressed in order to improve food security. In addition, there is a negative correlation between gross domestic product per capita and food security, suggesting that economic growth improves the quality of life. However, gender education has a smaller direct impact on food security, although it does enhance women's roles in the household and society. Overall, the relationship between the size of a country's economy and food security is not significant, while the relationship between the food price index and food security is complex and influenced by a variety of factors, such as unemployment and income stability. Overall, improving household food security requires a combination of factors and policies.

Successful food security programs in sub-Saharan Africa have demonstrated several key elements. First, gender sensitivity and female empowerment are at its center. Recognizing the role of women in food security and promoting their participation and decision-making not only increased the effectiveness of the program but also advanced the sustainable development goal of gender equality.

Second, community participation and ownership are seen as cornerstones of food security. Local communities play an integral role in the design and implementation of programs. By ensuring their participation in decision-making, programs are better adapted to local cultures and needs, thereby increasing their likelihood of success.

Moreover, these programs are not limited to the agricultural sector. Multi-sectoral cooperation and coordination ensure comprehensive coverage from economics to health to infrastructure, providing holistic solutions to complex food safety issues. The introduction of innovations and technologies, such as new drought-tolerant crop varieties, improved irrigation systems, mobile communication technologies, etc., has revolutionized agriculture, making it more efficient and sustainable.

However, in addition to the success stories, there are also programs that are not as successful as they could be. An example is the National Gender and Development Policy in Botswana. This project did not adequately take into account the local social and political context, particularly issues related to gender norms and power structures,

resulting in a significant reduction in its effectiveness.

In order to better advance food security in this region, several recommendations are worth noting:

Recommendations for policymakers:

Gender sensitivity: recognize the role of women in food production and ensure that they have equal access to resources and opportunities.

Cross-sectoral cooperation: Promote cooperation between different sectors to comprehensively address the various issues related to food security.

Technology and innovation: Encourage research and application of new technologies and provide technical training and support to farmers.

Community participation: Ensure that communities play an important role in the decision-making process and give them appropriate resources and training.

Recommendations for stakeholders:

Collective bargaining: encourage farmers to organize cooperatives or other collective organizations to increase their bargaining power in the market.

Skills training: Provide ongoing skills and knowledge training for smallholder and female farmers.

Resource sharing and cooperation: Encourage cooperation between farmers to purchase and use resources together.

Responding to climate change: Provide training and strategies on how to respond to climate change, such as planting drought-tolerant crops and adopting conservation farming methods.

Conclusion:

The key to the issue of food security in sub-Saharan Africa is gender equality. This study provides insights into the interrelationship between gender and food security, centered around four countries: Botswana, Ethiopia, Kenya, and Uganda. After a literature review, case studies, and regression analyses, it was found that the link between gender equality and food security is more complex, with only gender equality in the area of education being negatively correlated with food security, implying that

empowering women with more educational opportunities improves food security. Gender equality in other areas was positively correlated with food insecurity, possibly because the research model omitted some key variables or because of other deep-rooted social and cultural factors.

Nonetheless, the findings emphasize the critical role of women's empowerment in improving food security and reducing poverty in sub-Saharan Africa. It is recommended to improve women's access to education, guarantee their equitable access to land and financial resources, and provide them with social security and public services.

This study not only reveals the importance of gender equality and female empowerment for achieving food security in sub-Saharan Africa but also provides practical recommendations for policymakers. However, there are limitations to this study due to the limited number of cases and the lack of in-depth research on the cultural and socio-political context.

Overall, in order to ensure food security in sub-Saharan Africa, it is important to empower women, who play a key role in the food system, and to address the underlying issues of gender inequality.



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Gender equality and food security in sub-Saharan Africa: the case of Botswana,  
Ethiopia, Kenya and Uganda

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## **Abstract**

Focusing on sub-Saharan Africa, this study explores how gender equality strategies can effectively enhance food and nutrition security in the region. It analyzes the linkages between gender inequality and food security and assesses the impact of policies and programs in Botswana, Ethiopia, Kenya, and Uganda. The results show that gender inequality poses a threat to food security in the region and that strengthening the rights of rural women is key to improving the situation. Expanding female education opportunities, optimizing access to resources, and strengthening social protection are recommended. The study highlights the central role of gender equality and women's empowerment in ensuring food security and promoting sustainable development.

**Keywords: gender equality, food security, women's empowerment, sub-Saharan Africa**

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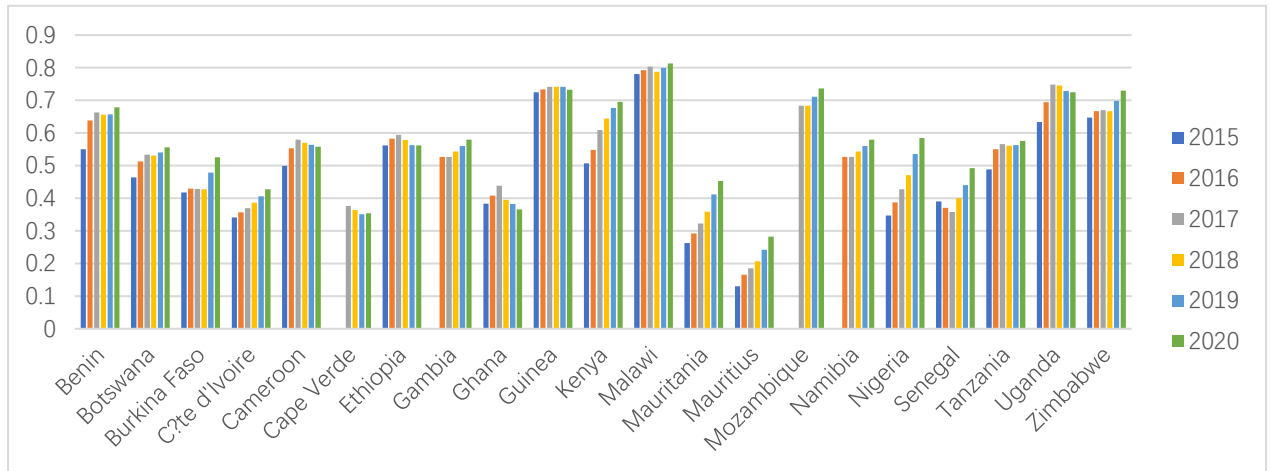
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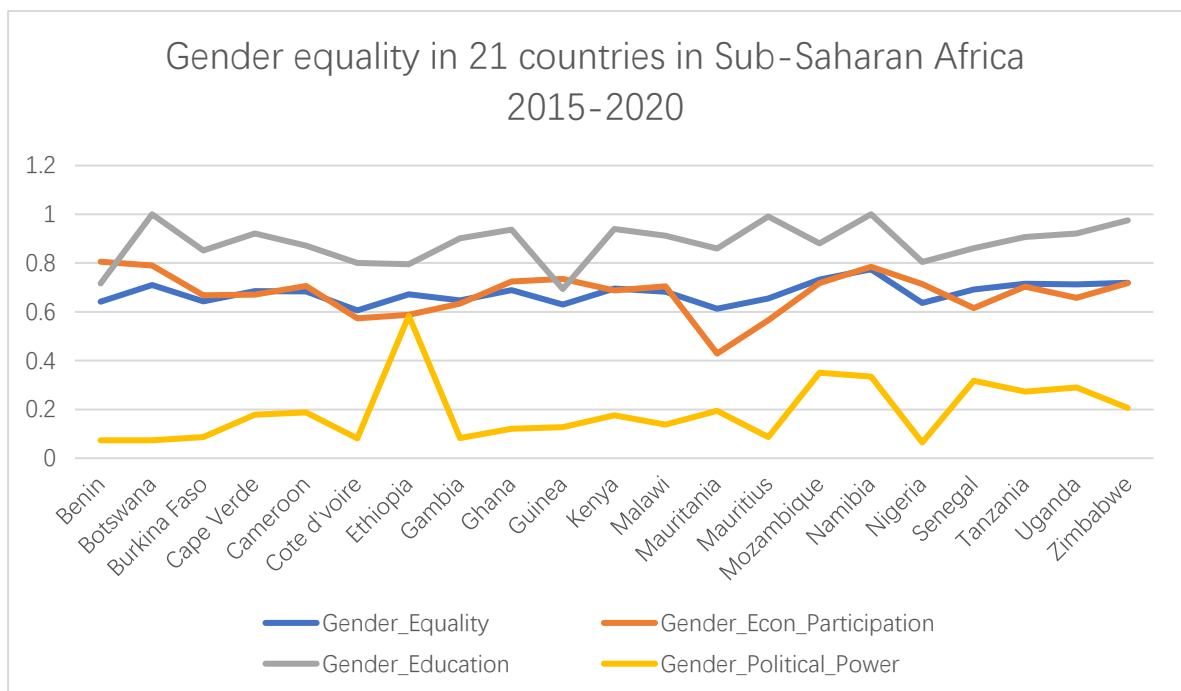
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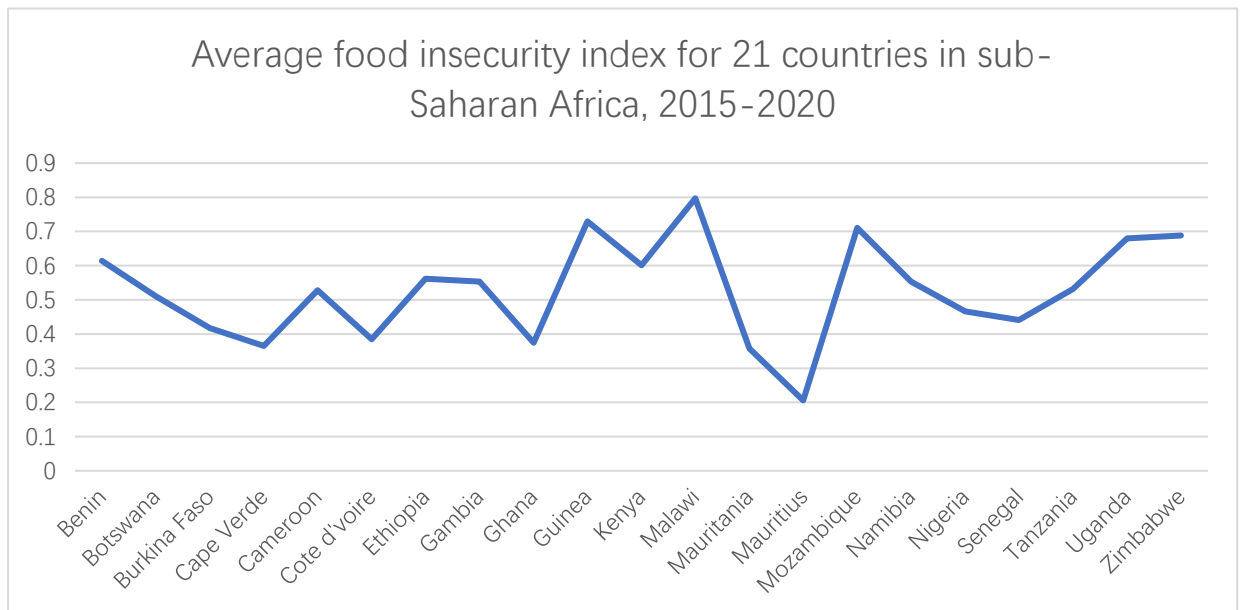
**Figure 1: Food Insecurity Index for 21 countries in Sub-Saharan Africa (2015-2020)**



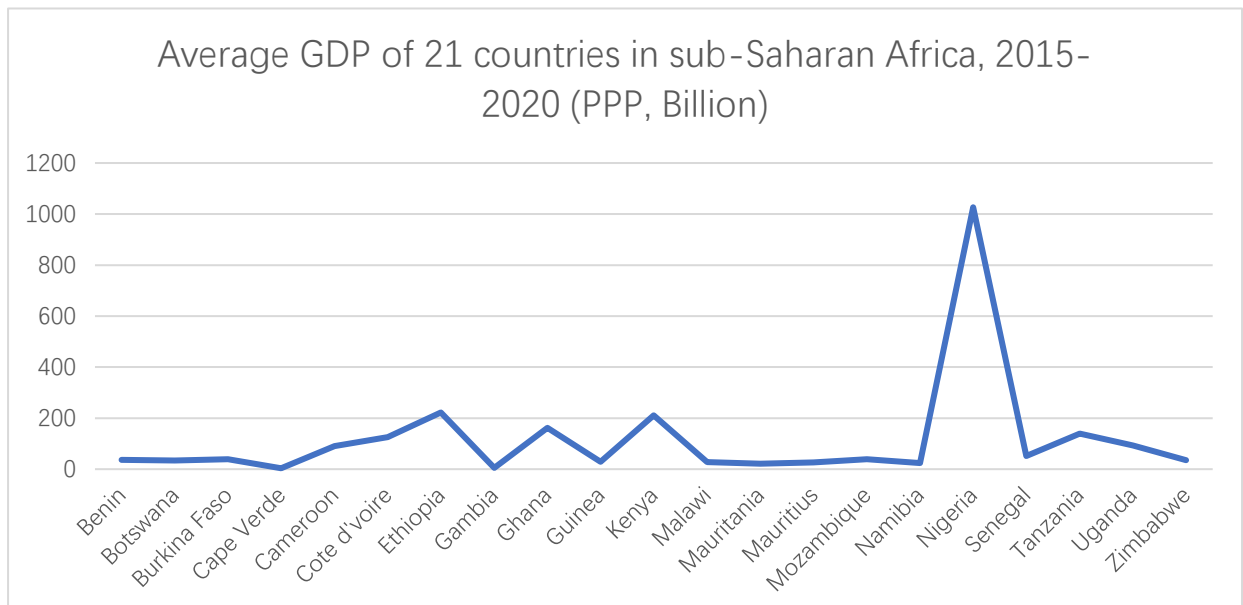
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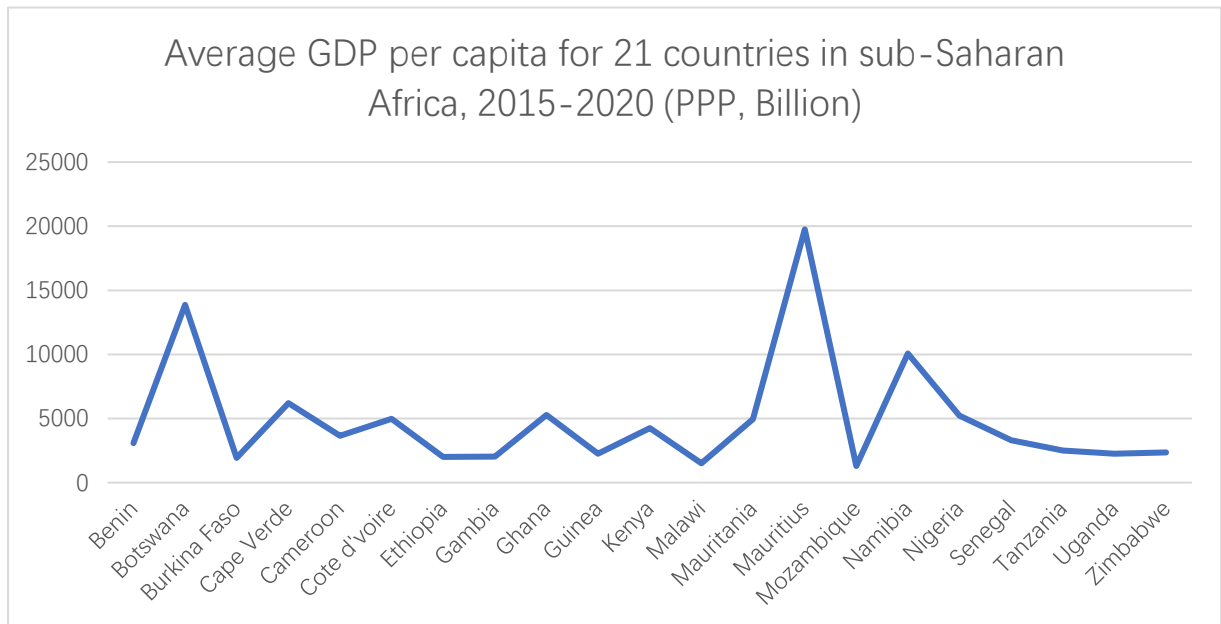
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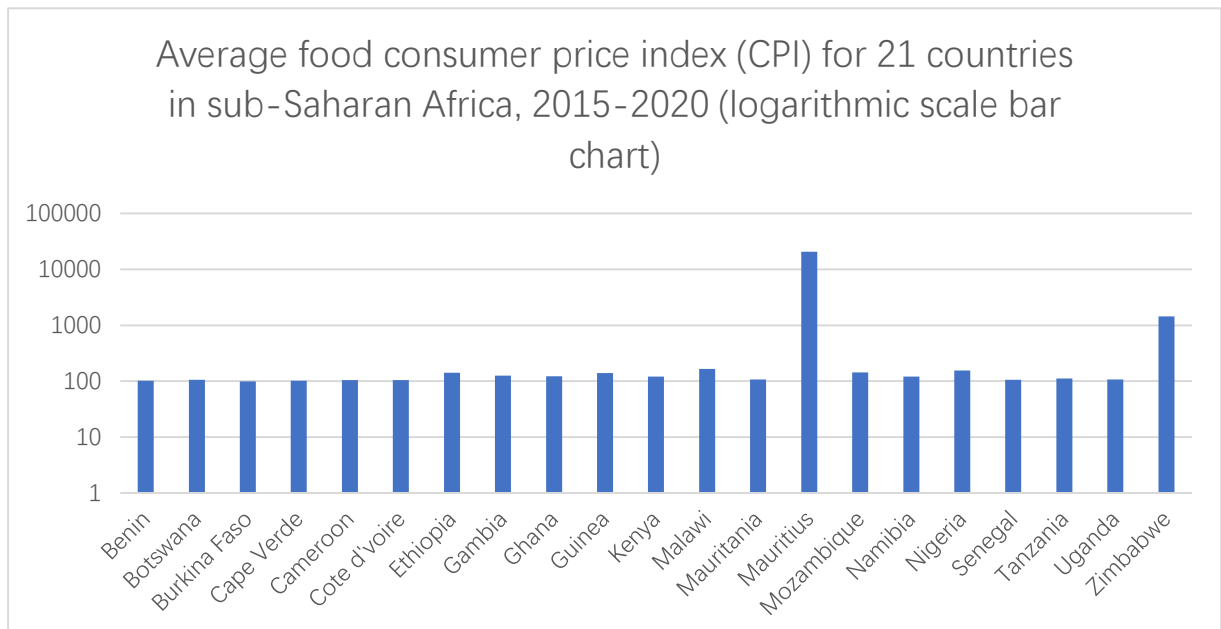
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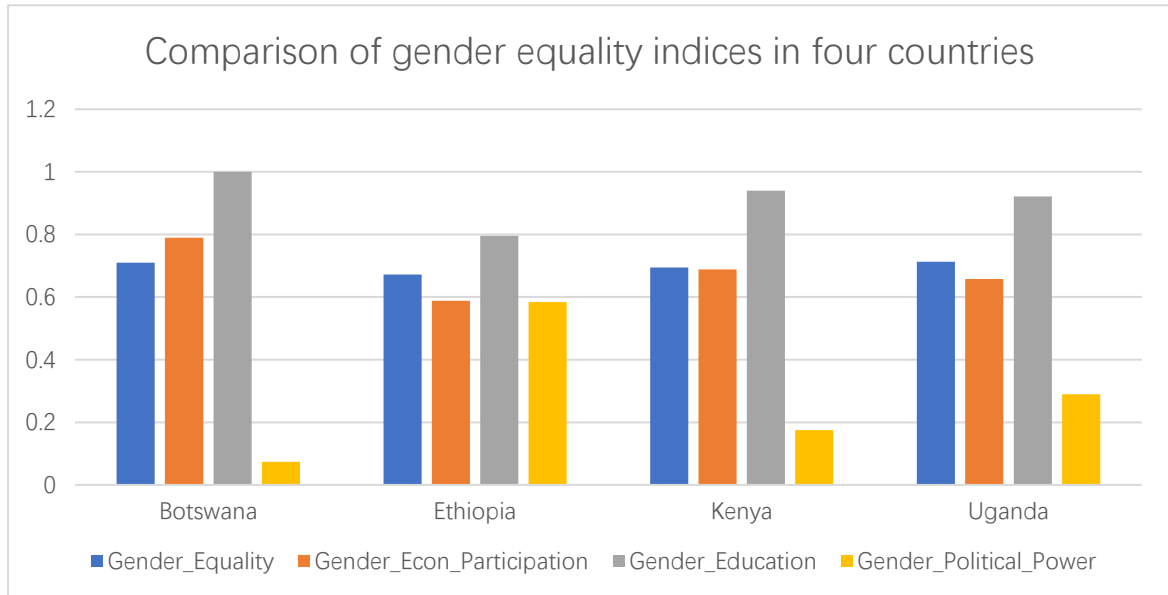
**Figure 5 Average GDP per capita for 21 countries in sub-Saharan Africa, 2015-2020 (PPP, Billion)**



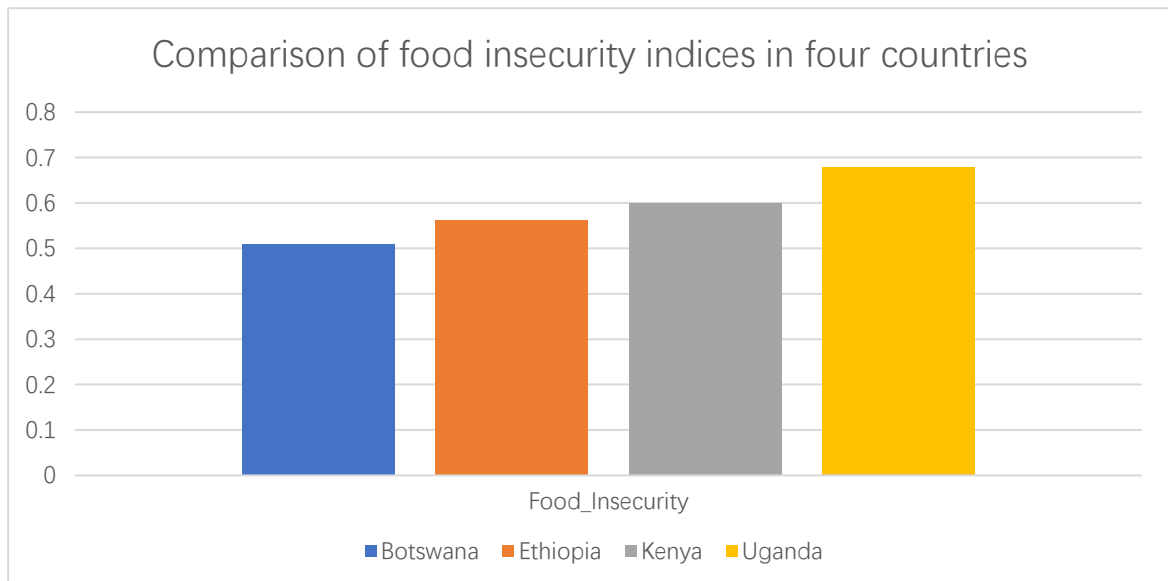
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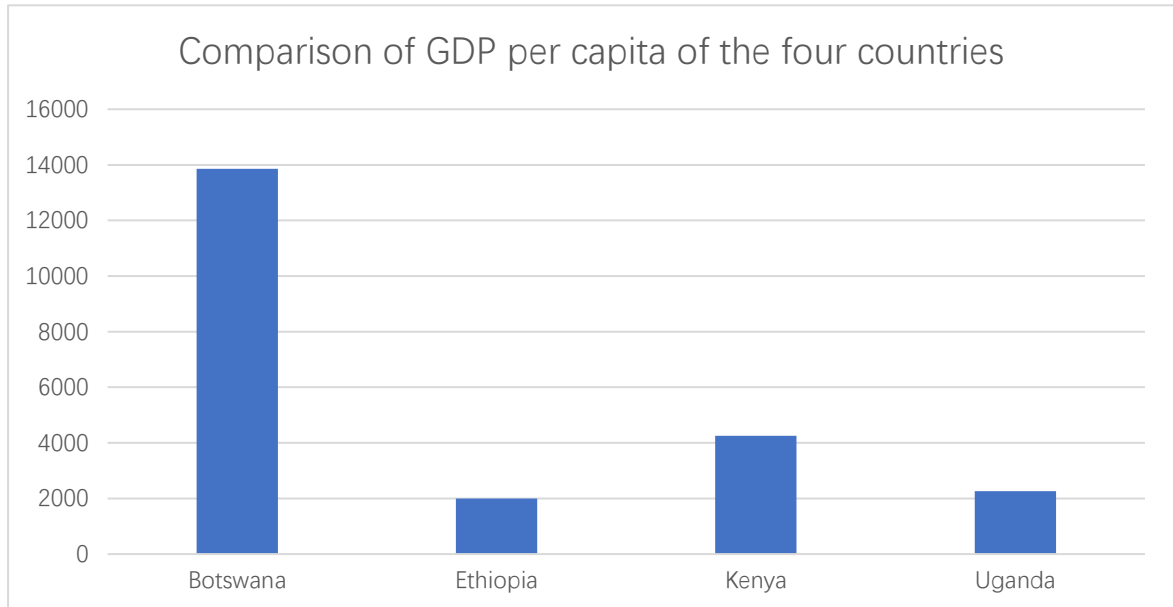
**Figure 7: Comparison of gender equality indices in four countries**



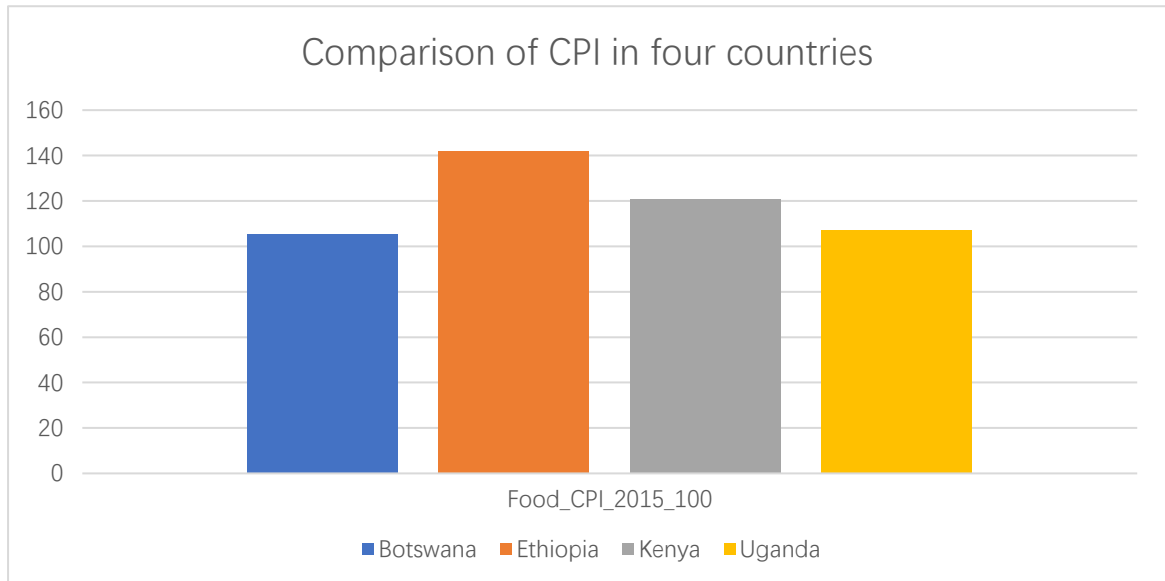
**Figure 8: Comparison of food insecurity indices in four countries**



**Figure 9: Comparison of GDP per capita of the four countries**



**Figure 10: Comparison of CPI in four countries**



**Figure 11: Results of regression analyses of gender equality and food security in**

**21 countries in sub-Saharan Africa**

Source	SS	df	MS	Number of obs	=	120
Model	<b>1.50350026</b>	<b>7</b>	<b>.214785752</b>	F(7, 112)	=	<b>18.49</b>
Residual	<b>1.30107178</b>	<b>112</b>	<b>.011616712</b>	Prob > F	=	<b>0.0000</b>
				R-squared	=	<b>0.5361</b>
				Adj R-squared	=	<b>0.5071</b>
Total	<b>2.80457205</b>	<b>119</b>	<b>.023567832</b>	Root MSE	=	<b>.10778</b>

food_insecurity	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
gender_equality	<b>.8749837</b>	<b>.5708027</b>	<b>1.53</b>	<b>0.128</b>	<b>-.2559887</b>	<b>2.005956</b>
gender_econ_participation	<b>.4208588</b>	<b>.156442</b>	<b>2.69</b>	<b>0.008</b>	<b>.1108891</b>	<b>.7308285</b>
gender_education	<b>-.2980402</b>	<b>.2207878</b>	<b>-1.35</b>	<b>0.180</b>	<b>-.735503</b>	<b>.1394226</b>
gender_political_power	<b>.0759841</b>	<b>.1038858</b>	<b>0.73</b>	<b>0.466</b>	<b>-.1298523</b>	<b>.2818205</b>
gdp_ppp_billion	<b>-.0000675</b>	<b>.0000475</b>	<b>-1.42</b>	<b>0.157</b>	<b>-.0001616</b>	<b>.0000265</b>
gdp_per_capita_ppp	<b>-.0000147</b>	<b>2.49e-06</b>	<b>-5.89</b>	<b>0.000</b>	<b>-.0000196</b>	<b>-9.73e-06</b>
food_cpi_2015_100	<b>.0000643</b>	<b>.0000404</b>	<b>1.59</b>	<b>0.115</b>	<b>-.0000159</b>	<b>.0001444</b>
_cons	<b>-.0231602</b>	<b>.1945993</b>	<b>-0.12</b>	<b>0.905</b>	<b>-.4087338</b>	<b>.3624134</b>

# **I Introduction**

## **Research Background and Problem Statement**

According to data from the Food and Agriculture Organization (FAO) of the United Nations' The State of Food Security and Nutrition in the World 2021 report, Sub-Saharan Africa's prevalence of moderate or severe food insecurity ranged from 53.0% to 66.2% from 2015 to 2020, which is higher than the African average (48.0% to 59.6%) and much higher than the global average (22.8% to 30.4%) for the same period (FAO, IFAD, UNICEF, WFP, & WHO, 2021, p. 17). As defined by FAO, food insecurity refers to "the lack of regular access to sufficient safe and nutritious food to ensure normal growth and development and an active and healthy life" (n.d.). FAO classifies food insecurity into four stages: uncertainty about the ability to access food, reduction in the quality and variety of food, reduction in the amount of food and skipping meals, and skipping meals for a day or more (n.d.). Where moderate food insecurity refers to the second or third of these stages, where a person is unable to obtain a healthy diet, and SEVERE FOOD INSECURITY refers to the fourth stage. Food security has become increasingly crucial in the context of globalization in the twenty-first century, particularly in Sub-Saharan Africa. Ensure zero hunger (Goal 2) is a major goal shared by all countries under the United Nations Sustainable Development Goals (SDGs). Furthermore, it is directly related to other UN humanitarian goals such as poverty eradication (Goal 1) and gender equality (Goal 5). Meeting these targets not only benefits local populations, but also has far-reaching ramifications for global food security and sustainability. However, global food security has been highlighted in recent



years as a result of climate change, land degradation, wars, conflicts, and political instability, and chronic poverty and gender inequality in Sub-Saharan Africa have exacerbated food shortages in the region. On the one hand, poverty prevents households and individuals from purchasing enough food, prevents farmers from investing in essential agricultural resources such as modern farming tools, seeds, and fertilizers, and leads to a lack of educational resources, reducing people's agricultural productive capacity, on the other hand, poverty tends to limit economic and educational opportunities for women while reinforcing traditional gender roles, leaving them with insecure access to land, agricultural resources, finance, and technical training, despite the fact that in Sub-Saharan Africa, women account for more than half of agricultural production (more than 50%) (International Labour Organization, as cited in The World Bank, 2021), women outnumber men among smallholder farmers, particularly in rural areas. Furthermore, gender inequality frequently leads to women having less decision-making power in the home and society, affecting food production, income distribution, and investment in children, all of which are linked to food security and nutritional health.

## **Research Objectives and Questions**

### **1. Purpose of the study**

This study aims to explore in depth the relationship between food security and gender equality in sub-Saharan Africa. Through empirical research in four specific countries, Kenya, Ethiopia, Uganda, and Botswana, we hope to identify which gender equality strategies and instruments have performed well in promoting food security, and from

these, distill strategies with general applicability to provide effective recommendations for other countries in sub-Saharan Africa.

## **2. Research questions:**

Core question: What gender equality strategies are most effective in enhancing food and nutrition security in sub-Saharan Africa?

Other key research questions:

1. Which government, NGO, and international organization's gender equality projects in these four countries have achieved demonstrable results in improving food security?
2. Is there a statistically significant correlation between gender inequality and food insecurity?

In order to answer these questions, the paper will further explore the following sub-questions:

- a) How does gender inequality affect food security in sub-Saharan Africa?
- b) When advancing gender equality and women's empowerment, how can it be ensured that food security also improves in sub-Saharan Africa?
- c) What is the role of rural women smallholder farmers and micro-entrepreneurs in food security and gender equality in the food economy of sub-Saharan Africa?

## **Hypotheses**

Achieving gender equality and empowering women in the food system is a key strategy for increasing food security in sub-Saharan Africa, particularly in Kenya, Ethiopia,

Uganda, and Botswana.

## **Scope and limitations of the study**

This study focuses on gender equality and food security in sub-Saharan Africa, with a particular focus on four countries: Kenya, Ethiopia, Uganda, and Botswana. It should be noted, however, that only 21 sub-Saharan countries provided more complete data, making the sample slightly limited. These data cover food security, gender equality index (covering education, economy, politics, etc.), GDP, GDP per capita, and food consumption index for the period 2015–2020. Most of the data comes from the World Bank and the World Economic Forum, but some do not share the same data sources. I will specify the source of each piece of data in the text, but different sources may lead to subtle biases in the data. In addition, the selection of this particular time period provides valuable data for the study but may omit key trends before or after. And, because the study focuses on using existing data, certain micro-factors or specific socio-cultural contexts that are directly related to gender and food security may not have been adequately considered.

## **Research methodology and data sources**

Combining qualitative and quantitative methods of analysis, this study aims to provide insights into the relationship between gender equality and food security, particularly in four sub-Saharan African countries: Kenya, Ethiopia, Uganda, and Botswana. Firstly, I will use data for the period 2015–2020 covering food security, gender equality indices

(education, economic, and political), GDP, GDP per capita, and food consumption indices, mainly from the World Bank and the World Economic Forum but also involving other institutions. Specific data sources will be clearly labeled in subsequent sections. Next, I will explore the correlation between gender inequality and food insecurity using regression analysis. In the qualitative analysis section, the study will also explore the effectiveness of the implementation of the relevant programs in the four target countries through case studies.

## **Article structure**

**Literature Review:** This part will provide a detailed review of the relevant literature on gender inequality, the role of women in the food economy, and food security in sub-Saharan Africa. In addition, the theoretical links between the gender equality literature and food security will be explored.

**Research Methodology:** This section will describe in detail the research design, data collection methods, variable selection and operationalization, and regression analysis models used in this study. In particular, there will be a special focus on the relationship between women and poverty indices (e.g., GDP per capita).

**Regression analyses:** An in-depth statistical analysis of the relationship between gender inequality and food security based on data from 21 sub-Saharan African countries

**Case studies:** Four countries, Kenya, Ethiopia, Uganda, and Botswana, are selected to explore in detail the countries' women's empowerment strategies and their effectiveness.

**Comparative analyses and results:** Compares the results of the regression analyses with those of the case studies and identifies commonalities among the successful cases and lessons learned from the less effective cases, and provides recommendations for policymakers and stakeholders.

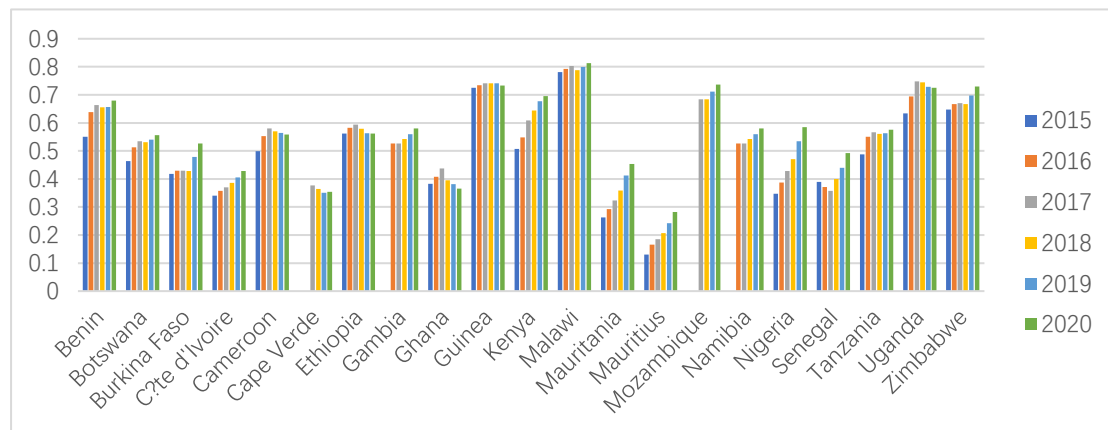
**Conclusion:** Summarise the key findings of the study.

## II Literature review

### 1. Status of food security in sub-Saharan Africa and its relationship to poverty

The world is currently facing an unprecedented global hunger crisis, and sub-Saharan African countries are particularly prominent in this problem. According to the Food and Agriculture Organization of the United Nations (FAO), the incidence of food insecurity in the region is much higher than the global average, highlighting the dire situation of food security in the region (FAO, 2021). As of 2020, as many as 724.4 million people in the region suffer from food insecurity, with 323.2 million suffering from severe food insecurity, and COVID-19 has caused the number of people in the region suffering from food insecurity to jump by 85.6 million in one year (FAO, 2021, p. 18).

**Figure 1: Food Insecurity Index for 21 countries in Sub-Saharan Africa (2015-2020)**



Data source: World Bank (2023). Retrieved March 2023, from

<https://data.worldbank.org/indicator/SN.ITK.MSFI.ZS>

Note: Due to data availability and harmonization, only 21 of these countries were selected for analysis.

As mentioned earlier, sub-Saharan Africa faces a complex set of challenges that undermine food security in the region. Against this background, this section will focus

on examining the current state of food security and its relationship to persistent poverty.

### **1.1 Causes and effects of food shortages**

Before delving more into the problem of food security, it is crucial to first understand the region's primary food sources and how food is generated. Maize is the most important staple food source in sub-Saharan Africa, followed by sorghum and millet. Rice is essential in some parts of the region, such as Madagascar and Tanzania, but wheat is also important in urban areas and in countries with import capacity. The region also consumes a lot of crops such as sweet potatoes, cassava, beans, and groundnuts, as well as bananas, which are a significant source of carbohydrates in many of the region's countries. Cattle, sheep, chicken, dairy products, and fish are the primary protein sources for the people.

Agriculture in the region is primarily reliant on smallholder farmers, who account for more than 70% of the farming population and produce the majority of food. According to the FAO report, there are 15 major farming systems, which include irrigated farming systems and other tree-based farming systems. Smallholder farmers often farm less than 2 hectares of land, use limited labor and money, and rely primarily on traditional and low-input agricultural techniques. According to Ubayeho and Kapari et al. (2023), these smallholder farmers face a variety of obstacles, including poverty, climate change, and resource limits, as well as a lack of capital, markets, and technology.

Despite their critical role, smallholder farmers face climate change challenges such as droughts, floods, and rising temperatures, in addition to poverty and malnutrition. The majority of them are poor and lack proper food and nutrition, which immediately

reduces their agricultural productivity. Market access concerns, as well as land and water management issues, compound their suffering. On the one hand, their lack of information, technology, and finance, as well as their lack of access to markets, limits the sale of their agricultural products and income, while on the other hand, issues such as land degradation, land ownership disputes, and water scarcity have had a serious impact on smallholder farmers' agricultural production and livelihoods.

However, the difficulties experienced by smallholder farmers are simply a subset of the region's agricultural issues. Other significant issues, according to Wudil et al. (2022), include:

1. A lack of economic progress, which has resulted in high levels of poverty and unemployment, making it difficult for individuals to obtain food. This is worsened by variables such as inflation and currency depreciation, which raise the cost of food.
2. Gender inequality, which restricts women's access to resources like land, credit, and education as well as their participation in decision-making, makes it difficult for them to engage in agricultural operations, affecting their food security position.
3. Low crop productivity, caused by poor soil quality and restricted resource inputs such as seeds, fertilizers, and insufficient irrigation systems, results in low crop productivity, which in turn causes reduced yields and insufficient food supplies.
4. Rapid population expansion, particularly in metropolitan areas, puts strain on the food system.
5. Inadequate policy frameworks that limit agricultural investment and efforts to improve food security, such as inadequate funding for agricultural research and



extension services and the implementation of policies that favor large-scale commercial agriculture at the expense of smallholder farmers.

6. Inadequate infrastructure, such as roads, storage facilities, and markets, might restrict farmers' ability to access inputs and market their produce. This can lead to poorer productivity and income, making it difficult for people to secure enough food.

7. Corruption, which diverts resources away from agricultural development and reduces the effectiveness of policies and programs, can lead to lower agricultural investment and limited access to resources for smallholder farmers, undermining the efficacy of efforts to improve food security.

## **1.2 Interaction between poverty and food security**

In sub-Saharan Africa, poverty and food security are closely interlinked. Despite the diversity of major food sources and agricultural practices in the region, widespread poverty continues to limit the ability of many households to access healthy and nutritionally adequate food. In addition, as mentioned earlier, this further limits the ability of poor farmers to increase their yields due to their lack of productive resources, information, technology, and finance.

Food insecurity, on the other hand, can lead to poverty. It may have an impact on people's health and productivity, lowering their income and economic chances. When people do not have enough food, they may have to spend more money on food, which can contribute to poverty. Furthermore, food insecurity may lead to an increase in food costs, putting an additional burden on low-income households and increasing the problem of poverty (Baptista et al., 2022).

Against this backdrop, we will delve into how poverty affects the ability of individuals and communities to access and use food, particularly in terms of both food availability and quality. We will also highlight how poverty exacerbates already existing food security problems, including by increasing people's vulnerability, affecting food prices, and leading to worse nutritional status.

### **1.2.1 The impact of poverty on food availability**

Poverty is a major contributor to food insecurity in sub-Saharan Africa. First, insufficient or inconsistent income owing to household poverty hinders many households from acquiring adequate food, resulting in malnutrition and health concerns. Furthermore, as Wudil et al. noted in their 2022 study, poor households frequently lack the resources needed to grow enough food, such as access to land, seeds, fertilizers, and modern agricultural technologies, preventing them from investing in improving their agricultural production capacity, purchasing the necessary agricultural tools, or obtaining productivity-enhancing training. This reduces their productive capacity and revenue, making them more subject to fluctuations in food prices. The lack of basic irrigation and storage facilities worsens the situation, prohibiting people from hoarding food in case of price swings or other calamities.

Furthermore, the majority of the population in Sub-Saharan Africa lives in rural areas and is primarily dependent on agriculture. However, due to climate change and other natural variables, agricultural production has grown more volatile, impacting farmers' incomes and, as a result, their capacity to purchase food. This situation is aggravated by a lack of funds as a result of poverty to deal with unforeseen occurrences such as

natural catastrophes or household emergencies, increasing the likelihood of food insecurity.

Poverty exacerbates food insecurity in a variety of ways, most notably by influencing food prices. Wudil and colleagues (2022) .On the one hand, poverty might result in an inability to invest in technology and infrastructure to boost food production, resulting in a lack of food supply and, as a result, higher costs. Poverty, on the other hand, causes many people to be unable to purchase enough food, which can lead to a variety of issues, including demand for food outstripping supply and driving up costs. Rising food prices further reduce impoverished households' purchasing power, causing them to reduce their food consumption or switch to less nutritious food. Such decisions not only increase the poor's condition, but can also contribute to health concerns, particularly malnutrition among groups with high nutritional demands, such as children and pregnant women. Poverty not only causes demand for food to exceed supply, causing prices to rise, but it also prohibits households from purchasing enough food when prices rise. Rising food prices force impoverished households to cut their food consumption or choose less nutritious foods, which can contribute to health problems, particularly among groups with high nutritional demands, such as children and pregnant women.

### **1.2.2 Food quality in poverty settings**

Food quality is a significant aspect contributing to food security challenges in the setting of poverty in Sub-Saharan Africa. Due to poverty and a lack of resources, many households do not have access to nutritious and varied meals. This results in malnutrition and health issues in many households. Low-quality food, for example, may

be deficient in vital elements such as proteins, vitamins, and minerals, resulting in malnutrition and health problems in poor homes. Furthermore, due to a lack of diverse food sources, many households rely on a single staple meal, such as maize or rice, which can lead to malnutrition and health concerns. These issues may worsen food insecurity by affecting people's productivity and economic prospects due to malnutrition and health issues. 2020 (Giller).

Food quality issues in the region have a number of consequences for food security:

To begin with, poverty has left many agricultural farmers without adequate food storage and processing facilities. Food products are more likely to decay, degrade, or become contaminated in this climate, raising the risk of food poisoning and other health concerns. Furthermore, food diversity suffers considerably, and a lack of different food sources and food cultures deprives many people of the nutrition and energy they require, increasing food security issues.

Furthermore, a lack of suitable storage and handling facilities permits a substantial amount of food to go to waste, which leads to food shortages and price hikes, affecting people's food security, health, and quality of life.

Finally, poor food quality might result in food poisoning and other health issues. Food poisoning and other health concerns in Sub-Saharan Africa can worsen food insecurity by keeping individuals from working or being productive, lowering their income and economic possibilities.

## **2 . Gender Inequality and Its Impact on Food Security**

### **2.1 Definition and Current Status of Gender Inequality**

According to the UNICEF Regional Office for South Asia's 2017 report, gender inequality is defined as unequal status and opportunities for men and women in social, economic, cultural, and political contexts due to gender roles, norms, or differences between genders. Gender inequality means that women and men, girls and boys, are constrained in realizing their own talents and making choices because of preconceptions and prejudices, and such inequality is a violation of human rights (p. 2).

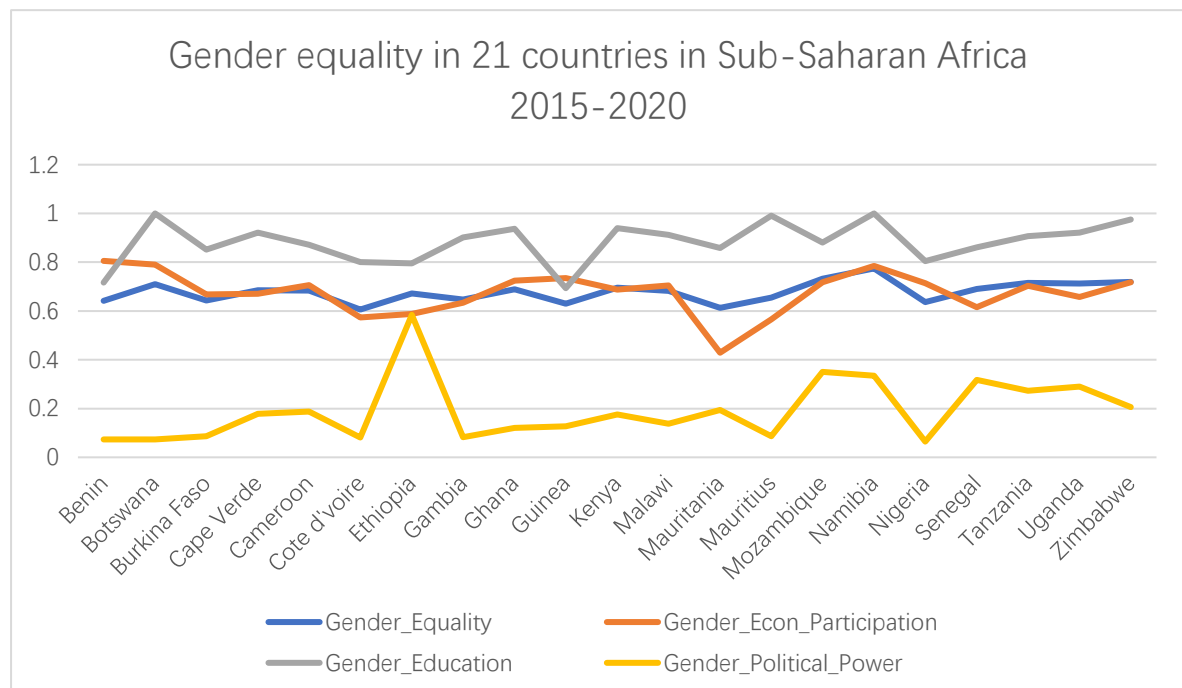
At the moment, no country in the world has achieved complete gender equality. Iceland, Norway, Finland, and Sweden are among the world's leaders in terms of closing the gender gap. The distribution of available income, resources, and opportunities for men and women in these countries is reasonably fair.

According to the Global Gender Gap Report 2020 (2019, p. 188), women have access to only 70% of the economic rights and opportunities that men have, and only 55% of women participate in the labor market, compared to 78% of males. Furthermore, women have lower employment and salary rates, as well as fewer chances in areas like entrepreneurship and executive roles. Furthermore, women are underrepresented in politics, with only 26% of legislative seats held by women.

In 2020, the gender equality gap in sub-Saharan Africa will be 32.7% (World Economic Forum, 2021). This includes a 33.9 percent discrepancy in economic participation chances, a 15.5% deficit in educational equality, and a 79.2% gap in political empowerment equality (the global average gap is 78.2%). The picture below depicts the gender equality index for 21 sub-Saharan African countries, which reveals that these countries have the weakest equality in political empowerment and the best equality in

education.

**Figure 2: Gender equality in 21 countries in Sub-Saharan Africa 2015-2020**



Note: Data derived from World Economic Forum Global Gender Gap Reports (2015–2021).

Gender disparity in Sub-Saharan Africa is evident in a variety of ways, according to UN Development Programme reports. Women aged 25–34 are more likely than men in this region to be living in extreme poverty, with every 100 men living in extreme poverty equaling 127 women in the same condition. At the same time, women are more likely than men to be food insecure in over two-thirds of the region's countries. Furthermore, Sub-Saharan Africa has the highest rate of food insecurity of any SDG region, with more than half of its female population experiencing moderate or severe food insecurity (UNDP, 2018).

According to this research, *Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development*, the following are the effects of gender inequality on agriculture and food security in the region (UNDP, 2018):

To begin, women play an essential role in agricultural output in Sub-Saharan Africa, but they frequently lack access to land, funding, and technical training, limiting their productive capacity. In terms of water management, 80% of homes in the region without access to water facilities rely on women and girls to gather water, which not only takes their time and energy but also limits their access to education and jobs.

Second, significant gender differences in health and nutrition exist. Women and girls are more prone to malnutrition and health problems since women are typically responsible for food acquisition and preparation for the household, and they are more likely to suffer from malnutrition due to low income and resources. Furthermore, women's contributions to agricultural output are frequently overlooked, limiting their access to nutrition.

Women are also underrepresented in the political and public arenas, as well as in decision-making and policy formation, restricting their voice in policy formulation and decision-making. For example, they rarely have decision-making authority in the domain of land ownership, which leads to them being ordinary laborers in agricultural production rather than decision-makers or land owners, restricting their potential in the agricultural sector even further.

Finally, the role of women in agricultural productivity is frequently undervalued. Despite a rise in female labor force participation in the region, women's job possibilities and incomes remain lower than men's. This is mostly because they frequently work in the informal economy and lack consistent income and job security. They are also frequently denied access to quality education and skill training, restricting their

employment opportunities and economic self-sufficiency.

## **2.2 Roles and challenges of rural women in agriculture and the food economy**

Women constitute an essential element of the agricultural labor force in Sub-Saharan Africa, but they also play a vital role as micro-entrepreneurs in the food economy, acting as the cornerstone of socioeconomic development in this region. However, these essential participants frequently confront hurdles, such as limited access to resources and gender discrimination, which severely limit their potential and development space. This article aims to provide insights into rural women's contributions to the agriculture and food economies in this region, as well as explore the challenges they face, in order to identify strategies that can better support and empower them to achieve more equitable and sustainable socioeconomic development.

### **2.2.1 Contributions and challenges of rural women in agriculture**

Rural women play an important role in agricultural production in Sub-Saharan Africa, including production (planting, harvesting), processing, and marketing of agricultural products (e.g., grains, vegetables, fruits, poultry, and livestock products), as well as management of household livestock and fisheries, as well as home horticulture and food processing, to ensure food security and economic income for the household. Their contribution is vital to household food security and economic development in communities, states, and countries. In numerous nations in the region, women outnumber men in terms of agricultural labor force participation.

Women are frequently the primary labor force in the industrial chain. Females dominate food crop cultivation, including maize and vegetables. For example, in Nigeria, females



account for more than 70% of the agricultural labor force and are primarily engaged in the cultivation of food crops and farming, such as maize, beans, poultry, and fish (UNDP, 2018). Furthermore, they have the experience and knowledge to adapt to a variety of climatic and soil conditions, as well as a great capacity for innovation and adaptation, embracing various agricultural technologies and practices to boost productivity and quality. They can also innovate to create new agricultural goods and markets, providing greater income and job opportunities for their homes and communities (UNDP, 2018). Women are often in charge of transforming agricultural products into value-added commodities during the processing stage. For example, in Tanzania, women are in charge of processing maize into maize flour, which not only increases the market value of the agricultural product but also innovatively develops new agricultural products and markets, resulting in more income and employment opportunities for households and communities.

They have exhibited outstanding marketing and negotiation abilities in the sales and marketability category and are frequently responsible for the sale of agricultural products in rural marketplaces, considerably contributing to the realization of economic benefits. In addition to their economic contribution, rural women play a crucial social and cultural role in preserving and passing on their families' and communities' culture and customs. They can also improve their social standing and economic income, as well as their self-confidence and self-esteem, by engaging in agricultural production and marketing.

They frequently have strong environmental knowledge and awareness and are able to

adopt environmentally friendly agricultural technologies and methods to protect and improve land, water resources, and ecosystems, thus contributing to the sustainable development of their communities and countries.

Education and training are also important components of their contribution, as they pass on their agricultural knowledge and skills to young people in their families and communities, creating more chances and options for development.

Despite their enormous contribution, they face a number of challenges, including a lack of financial resources, difficulty accessing markets, gender discrimination, a lack of ownership and control over land and other productive resources, a lack of access to modern agricultural technology and market information, a high level of domestic labor and caregiving responsibilities, and the impact of climate change and natural disasters on agricultural productivity.

First and foremost, there are economic concerns and market access challenges, particularly a lack of financial resources. Due to their lack of control over land and other major economic resources in Sub-Saharan Africa, many women have found it incredibly difficult to acquire financial help and loans, especially since land and productive resources in the region are primarily dominated by men (FAO, 2023).

Second, women in the region face numerous barriers to contemporary farming technology and market knowledge. It is difficult for them to boost agricultural output or obtain better market prices due to a lack of education and training possibilities, as well as inadequate internet and communication infrastructure.

There is also gender prejudice and cultural hurdles. These are not only impediments to

commercial activity, but they also increase the strain on women at home and limit their participation. Females in many communities are responsible for a significant amount of domestic labor and caring responsibilities, which limits their ability to participate in agricultural production and other income-generating activities (FAO, 2023).

Finally, women are affected by climate change and natural calamities. They have a significant negative impact on agricultural production, and women are disproportionately affected since they frequently lack the required insurance and risk management tools to deal with these calamities.

### **2.2.2 The role of women as micro-entrepreneurs in the food economy**

Before we get started, it's vital to define what a micro-entrepreneur is. Micro-entrepreneurs are often people or groups of individuals who own and operate micro and small businesses (also known as MSMEs). These companies are distinguished by their modest size, limited financial resources, and geographical location. Microenterprises often have fewer than ten employees, whereas MSMEs have between ten and fifty employees and typically serve only local or regional markets. They may be involved in all elements of agricultural and food production in the food economy, including production, processing, transportation, and distribution, as well as direct sales to consumers. They not only play an important role in guaranteeing their communities' food security and nutritional needs, but they also contribute to economic viability by providing employment possibilities. Despite having relatively small market shares, they play an important role in the development of rural economies and communities.

The food system, according to Oxford University, is a complex network of activities

involving production, processing, transportation, and consumption (Oxford University Future of Food Programme, n.d.). Farmers, processors, distributors, and consumers are among the many players and segments involved in the system. A subset of this is the food economy, which focuses on the economic elements of the food industry, such as market dynamics, price formation, supply and demand, and policy implications. It also encompasses various economic activities such as investment, trade, and employment. Women micro- entrepreneurs play a critical role in all elements of the food system in Sub-Saharan Africa, contributing not only to the production and processing of agricultural products but also to their transport, distribution, and consumption. Their individual contributions in each of these areas are demonstrated below with case studies of Niger women entrepreneurs:

a) Production: Women are typically in charge of managing family gardens and small farms, as well as implementing environmentally friendly agricultural practices. They are dedicated to providing high-quality agricultural products to their communities. In Niger, female entrepreneurs maintain agricultural product quality while also considering environmental conservation and sustainability, thereby protecting the local ecology (Johnson, 2014).

b) Process: Women entrepreneurs frequently use local resources to establish processing businesses, such as mills or modest storage facilities, which add value to agricultural products. In the case of Niger, women not only enhanced the value added to the product but also improved processing efficiency through innovation (Johnson, 2014).

c) Transportation and distribution: Women are active in the development of logistics

and distribution networks that ensure agricultural products reach the market or consumers. In Niger, female entrepreneurs are protecting agricultural product supply chains through effective distribution networks, bringing more dynamism and efficiency to the market (Johnson, 2014).

d) Consumption: women attend to the community's nutritional needs by operating small stores or restaurants, as well as educating the community on how to eat healthier. They are not only providing new food options in Niger, but they are also improving community understanding of good eating through education (Johnson, 2014).

Women entrepreneurs contribute to the food economy in ways other than those mentioned above. They serve their communities by managing family farms, starting small processing industries, or operating market booths. More importantly, they generate a huge number of jobs, contribute to the expansion of the local economy, and increase the level and quality of food processing, enhancing the community's overall economic and social development.

This advancement not only improves local food safety and hygiene, but it also increases firm competitiveness and market share. They contribute to more equal and inclusive social development, better living circumstances and social welfare for local residents, and the formation of a more peaceful and successful community (Kapinga & Suero Montero, 2019).

### **3. Gender inequality, food security and poverty: an interlinked framework**

We now have a better knowledge of the relationship between gender equality and food security, as well as the relationship between food security and poverty, as a result of the

in-depth talks in the previous two sections. We'll now look at the connections between these three to see how they interact and produce a varied and complex system.

Gender inequality, food security, and poverty interact and intertwine to form a complex system in sub-Saharan Africa. To begin, it is critical to recognize that gender inequality frequently leads to increasing poverty, which in turn undermines food security. For example, in societies with high levels of gender inequality, women are frequently denied the right to education and the right to own property, which not only limits their opportunities to escape poverty but also affects their ability to provide enough food for their families, exacerbating the problem of food insecurity.

Food insecurity can aggravate poverty and gender inequity. Poor households may be unable to afford adequate meals, resulting in health issues and decreased productivity.

When poverty and food insecurity become the norm in homes, women and girls may be pushed to forego education and job development in order to support their families' fundamental needs. The interaction of these three causes a vicious cycle, with poverty exacerbating the likelihood of food insecurity and food insecurity exacerbating poverty.

Gender inequality plays a dual role in this cycle, both as a source of the problem and as a conclusion, producing an unfavorable environment for women, which drives the community as a whole into a vicious spiral of poverty and food insecurity.

When investigating the interaction between these three, it is important to recognize that this complex interplay is represented not only in home decision-making but also in wider social and political systems. To break the vicious spiral and get to the heart of the problem, we need to dig deeper into these three dimensions and look for strategic sites

of intervention at numerous levels. To establish a more egalitarian, inclusive, and sustainable future, we must galvanize collaborative efforts from grassroots communities to global politicians. This will necessitate not only a deeper understanding but also the guts to take meaningful action in order to effect significant change.

#### **4. Research Methods: quantitative and qualitative research methods in gender equality and food security research**

Research methodologies are critical in delving into the complicated concerns of gender equality and food security. This chapter will examine how quantitative and qualitative research methods have been used in this field, first by delving into the definitions, strengths, and limitations of the two methods, and then by using specific case studies to show how they have been applied concretely to gender equality and food security research.

##### **4.1 Definition and differences between quantitative and qualitative research methods**

According to Bhandari (2020–2023), quantitative research is a research strategy that uses figures and statistical data to uncover patterns, test hypotheses, and make predictions. This method is classified as descriptive, correlational, or experimental research. Descriptive research summarizes the studied variables, whereas correlational and experimental research investigate correlations between variables and test causal linkages. To quantify abstract notions, researchers must develop quantitative indicators based on operational definitions.

Some of the benefits include reproducibility, the ability to compare results directly,

application to large samples, and support with formal hypothesis testing. Standardized data collection techniques and explicit conceptual definitions enable research to be replicated in diverse contexts or populations and statistical comparisons of results to be made.

It does, however, have certain restrictions. For starters, because it is based on narrow operational concepts, it may only be able to deal with complex issues superficially. Second, it may result in an unduly restricted study emphasis, ignoring other pertinent observations. Furthermore, structural biases such as missing data and poor measurements may exist. Furthermore, it may lack the historical and cultural context required to adequately comprehend the data.

In contrast to quantitative research, qualitative research focuses on non-numerical data and aims to get a deeper understanding of people's viewpoints, experiences, and conceptions. This style of research seeks deep information rather than surface-level facts.

There are numerous qualitative research approaches, but there is usually a trend to keep some flexibility so that deeper information can be captured in the data interpretation. Grounded theory, ethnographic, and phenomenological research are examples of regularly used methodologies that have characteristics but differ in focus and goal. Data can be gathered by researchers through observations, interviews, and focus group discussions.

Qualitative research has the advantage of being adaptable and able to be carried out in a natural context. It emphasizes the importance of preserving participants' voices and



perspectives, is adaptable to new research questions, and gives significant information.

This method can spark fresh research ideas and prospects.

However, it has some downsides, including the possibility of inaccuracy, a high degree of subjectivity, and limited generalizability. When analyzing and interpreting data, researchers must be cognizant of potential limits and biases. Furthermore, qualitative research is labor-intensive and requires a significant amount of time to analyze and evaluate the data (Bhadra, 2020–2023).

#### **4.2 Examples of the application of these methods in research on gender equality and food security**

Scholars have employed a number of research approaches to investigate the intersections and mutual influences of the two dimensions in their research on gender equality and food security. The use of quantitative and qualitative research approaches in tandem has revealed not just the direct relationship between gender disparity and food security but also how this relationship is modified by geographic, social, and economic factors. Following that, we will go deeper into the implementation of these two methodologies in practical research as well as particular study examples to show how they operate together to increase our understanding of the topic.

##### **1. Quantitative Techniques**

Researchers undertake in-depth profiling and data analysis using quantitative approaches. These strategies are typically data-driven, employing statistics and using math to analyze data and trends.

###### **a) Data from a panel**

In his study, Dzanku (2019) used panel data to examine how gender, geography, and non-farm work affect food security. He discovered that geographic location and non-farm employment had a considerable impact on household food security. He presented a more complete perspective to grasp the various causes of food security by diving into the influences of geography and employment.

#### b) Questionnaire

To gain a better understanding of gender equality and food security, Ashagidigbi et al. (2022) used a large-scale questionnaire survey, statistical analyses, and GIS techniques. This technique offers a broad and in-depth view of the nexus of gender equality and food security while also showcasing the particular benefits of GIS technology in presenting geographical distribution.

#### c) Statistical method

Belwal et al. (2012), on the other hand, investigated the association between gender and food security among Tanzanian rural families using descriptive statistics and regression models. Female households were shown to be more likely to be at risk of food poverty, underscoring the major influence of gender disparity on family food security.

#### d) Methodology for experimental design

In their study, Lecoutere and Chu (2021) employed an experimental design technique to investigate the impact on food security of a family decision-making intervention. Their research offers a fresh look at the multifaceted nature of this problem.

## 2. Qualitative Methodology

In contrast to quantitative approaches, which rely on data and statistical analysis,

qualitative methods rely on human observation and understanding, as well as in-depth interviews and discussions with communities and individuals. These strategies highlight women's essential role in agricultural production and sustaining household nutritional security, as well as the barriers they encounter in gaining access to resources.

a) Focus group talks and in-depth interviews

In-depth interviews and focus group discussions are critical components of qualitative research because they can help researchers shed light on the issues that women experience in agricultural productivity and family food security.

(b) Case studies

They used case study methods, as in Kadiyala et al.'s (2014) study, to get insights into agricultural and gender relations in several countries. To define the association between gender disparity and agricultural productivity, they employed content analysis to interpret data from qualitative interviews.

## **5. Female empowerment and food security in sub-Saharan Africa**

In this section, we will focus on female empowerment in sub-Saharan Africa and its relationship to regional food security. We will focus on the policies and implementation measures and how recent research has revealed the strong link between empowerment and food security.

### **5.1 Female Empowerment Policies and Measures**

Women's empowerment has long been at the forefront of challenges in Sub-Saharan Africa. Since the 1970s, the region has implemented a variety of policies and measures aimed at advancing women in all areas, with an early emphasis on providing basic

education and health services. Over time, such initiatives have deepened and broadened to include encouraging women's participation in political and decision-making processes, boosting employment possibilities, and eliminating gender-based violence in the home. Governments and non-governmental organizations (NGOs) have developed a variety of projects and initiatives in response to the necessity of women's empowerment for socioeconomic growth.

A variety of programs and regulations, including initiatives to promote women's educational levels and social status, have been implemented in the region in recent years. These initiatives have yielded some remarkable results, but many obstacles persist, including high rates of poverty, low levels of education, and restricted economic prospects, to name a few.

The governments of Kenya, Rwanda, and South Africa have all taken steps to boost female education. Women in STEM professions now have more chances and assistance in Kenya. Rwanda and South Africa have also focused on promoting female involvement in higher education by offering scholarships and financial incentives to encourage female academic interests (Asaolu et al., 2018).

Rwanda is a shining example of female political empowerment (Asaolu et al., 2018). Since the genocide in 1994, the government has greatly boosted female participation in political and economic decision-making, including ensuring that women hold at least 30% of parliamentary seats. South Africa has taken similar initiatives to strengthen women's political and economic voices.

Ethiopia, Tanzania, and South Africa have introduced a variety of measures to improve

women's health and well-being, including free or low-cost health-care services and increased protection for women and girls.

In terms of economic empowerment, the governments of Kenya, Nigeria, and South Africa have all worked to improve employment and entrepreneurial opportunities for women, including through the provision of microfinance and training, as well as encouraging women's participation in a variety of industries, with South African women in particular encouraged to study and explore the possibilities of STEM fields.

To summarize, governments in Sub-Saharan Africa have achieved significant progress toward women's empowerment by enacting a variety of policies and measures to promote women's position and well-being in education, politics, health, and the economy. To achieve true gender equality and female empowerment, however, ongoing efforts are required to overcome existing barriers and limits.

## **5.2 Study on the linkages between women's empowerment and food security**

This section investigates the impact of women's empowerment on food security and nutrition levels.

First, consider the relationship between female empowerment and improved food security and nutrition. Women play an important role in the household and community, and they are frequently in charge of purchasing and cooking food. As a result, giving them more decision-making power and resources can help them better meet the nutritional needs of their households and communities, improving nutritional levels, as well as contribute to the sustainability of agricultural production and food supply chains, improving food security and nutritional levels (Lufuke et al., 2023).

Second, consider the relationship between food security, nutrition improvement, and female empowerment. There is a direct link between improved food security and nutrition and female empowerment. Female empowerment not only improves household and community food security and nutrition levels but also improves food security and nutritional status. Women will have more time and energy to dedicate to education and career development if their households and communities achieve food security and decent nutritional status.

Third, female empowerment and equity in food distribution in households (Lufuke et al., 2023; Kadiyala et al., 2014). Female empowerment increases not only equality in household food distribution but also household food security. Women have an important role in food procurement, preparation, and distribution in Sub-Saharan Africa, although they often have inferior status and influence within the home due to societal and cultural constraints. As a result, increased female empowerment can enable more equal food distribution and the fulfillment of nutritional demands in the household, so enhancing food security and nutrition for the entire household.

Fourth, female empowerment, dietary diversity, and nutritional improvement in the home (Smith & Haddad, 2015). Due to poverty and malnutrition, households in Sub-Saharan Africa frequently confront dietary homogeneity and undernutrition. Female empowerment is projected to remedy this condition by boosting female education and career prospects, which will increase household economic strength and the ability to purchase a larger variety of more healthy foods. Furthermore, female empowerment can boost household understanding and practice of nutritional knowledge and healthy

behaviors, contributing to an improvement in household nutritional status, including a greater emphasis on nursing and infant and young child nutrition.

Fifth, female empowerment is linked to children's nutrition (Na et al., 2015; Carlson et al., 2015; Yaya et al., 2020). Female empowerment is directly related to children's nutritional status in Sub-Saharan Africa. The following three points are critical to this relationship:

a) The role of education: better child feeding practices, such as breastfeeding and the timely inclusion of complementary foods, are more likely to be adopted by more educated women, hence enhancing children's nutritional status.

b) Impact of labor force participation: Increasing female labor force participation not only helps them overcome various difficulties, such as a lack of land and capital, but it also improves children's nutritional quality by improving the family's economic situation.

c) Greater decision-making power: Improving women's positions in family decision-making guarantees that their needs and opinions are considered in the home, which has a good impact on children's nutritional health.

### **III. Research Methodology**

#### **1. Research design**

The study concentrated on four sub-Saharan African countries: Kenya, Ethiopia, Uganda, and Botswana. These countries were chosen as example countries because they represent the region's economic diversity, gender equality, and the current situation of agriculture and food security. Furthermore, governments, as well as several NGOs and international organizations, have conducted a variety of projects on gender equality and food security in these nations, creating a fertile study environment.

The purpose of this study is to provide an in-depth analysis of how gender equality instruments in these four countries have helped to improve food security, as well as to compare the effectiveness of various projects so that the most effective ones can be chosen to provide feasible and useful recommendations for other countries and regions. We used a combination of qualitative and quantitative research methodologies to attain this goal.

#### **1.1 Background and rationale for sample country selection**

##### **The study's context**

Sub-Saharan Africa (SSA) has a wide range of economic, gender, agricultural, and food security situations. The purpose of this research is to look into the interrelationships and dependencies of gender equality and food security in four countries—Kenya, Ethiopia, Uganda, and Botswana—in order to propose solutions with broad applicability.

##### **Justification for sample nation selection**

The four countries were chosen as the study's sample because they represent the region's



diversity in terms of economic development, gender equality status, and the current state of agricultural and food security. The following information is supplied for each country:

### **Kenya**

Agriculture and services are critical to Kenya's economy. Although the country has made considerable progress toward gender equality, women continue to confront numerous challenges, including limited access to education and political involvement. Various projects have been launched by the government and non-governmental organizations (NGOs) to boost women's engagement in agriculture, thereby enhancing food security.

### **Ethiopia**

Ethiopia has witnessed remarkable economic growth, yet agriculture remains a significant component of the country's economy. The government has recognized the importance of gender equality and has begun to implement laws to provide more possibilities for women in education and the economy. Agricultural projects are working to promote food security by increasing the productivity of women farmers.

### **Uganda**

Uganda's economy was built on agriculture, but services and industry were expanding as well. The government is aiming to close gender gaps and boost women's economic position. Uganda has launched various female empowerment programs in order to promote agricultural output and education in order to improve food security.

### **Botswana**

Botswana is a middle-income country whose economy is mostly based on natural resources, but agriculture is also significant. The government is encouraging gender equality through a variety of means, including more female agricultural participation. Food security was also a government concern, with a number of programs focused on enhancing the productivity of women farmers.

## **1.2 Research methodology and underlying assumptions**

### **1.2.1 Fundamental assumptions**

This research is organized around the central idea that female empowerment in all elements of the food system, including production, processing, transportation, and consumption, is an effective and necessary path to improve food security and gender equality.

### **1.2.2 Methodology of Research**

To investigate the following hypotheses, I used a mixed research methodology that combines quantitative and qualitative research to acquire a better knowledge of the problem's varied elements. My research plan is as follows:

**Quantitative research:** I will use regression analysis to demonstrate the association between gender inequality and food insecurity by analyzing data from 2015 to 2020 in 21 countries. The data includes, but is not limited to, the Gender Equality Index, GDP, GDP per capita, and the Food Consumption Index, and is intended to provide reliable and intuitive data to support my hypothesis.

**Qualitative research:** The qualitative research will utilize documentary analysis to delve into specific cases in the selected countries. I will study various projects

implemented by the government, NGOs, and international organizations to understand how they enhance food security through the social and economic advancement of women.

**Strengths:**

**Comprehensiveness:** the mixed-methods approach allows me to explore and understand the relationship between gender equality and food security in depth from multiple perspectives, enabling me to capture the full picture of the issue.

**Depth and empirical support:** the quantitative component gave a solid data basis to back up my theory, while the qualitative component allowed me to go deeper and comprehend the mechanisms at work.

**Strategic Recommendations:** Through the analysis of unique examples, I am able to give instructive ideas and recommendations to enhance food security and gender equality.

In conclusion, my research methodology not only intends to test my underlying hypotheses but also to enhance our understanding of the relationship between gender equality and food security, resulting in informed suggestions and actions.

**2. Data collection and sources**

**2.1 Types and characteristics of data**

In this study, I will use a series of datasets covering 21 countries over the period 2015–2020 to provide insights into food security and gender equality in sub-Saharan Africa.

Below is a detailed description of these datasets:

1. Food Insecurity

- Type: continuous variable, expressed as a percentage.
- Characteristics: This data provides information on the prevalence of moderate or severe food insecurity in each country and can help me understand the extent of food security problems in a given country.

## 2. Gender Equality Index (GEI)

- Type: continuous variable, aggregated from several sub-indicators.
- Characteristics: This indicator aggregates the performance of countries in terms of gender equality and will provide me with an insight into the overall situation of gender equality in each country.

## 3. Gender Economic Participation and Opportunity

- Type: continuous variable consisting of three concepts: participation gap, pay gap and promotion gap.
- Characteristics:

Participation Gap: Captured by the difference between female and male labor force participation rates

Pay Gap: Captured by a hard data indicator (estimated earnings ratio of women to men) and a qualitative indicator (wage equality for equal work) from the World Economic Forum's annual Senior Executive Opinion Survey.

Promotion Gap: Captured through two hard data statistics (female to male ratio among legislators, senior officials, and managers, and female to male ratio among technical and professional workers).

## 4. Educational attainment

- Type: continuous variable capturing the current educational exposure gap through the ratio of females to males in primary, secondary, and tertiary education.

- Characteristics: Short-term perspective: Captures the current educational exposure gap based on the ratio of females to males in primary, secondary and tertiary education.

Long-term perspective: Captures a country's ability to educate females and males over a longer period of time, based on the ratio of female literacy rates to male literacy rates.

## 5. Political Empowerment

- Type: Continuous variable that measures the gap through the ratio of women to men at the highest levels of political decision-making.

- Characteristics:

Ministerial and parliamentary levels: Based on the ratio of women to men in ministerial and parliamentary positions.

Executive positions: Includes the ratio of women to men in prime ministerial or presidential positions over the last 50 years.

Limitations: Current data does not include gender participation differences at the local government level, which will be considered for inclusion in the index if such globally comparable levels of data become available in the future.

## 6. Gross Domestic Product (GDP, PPP)

- Type: Continuous variable, including absolute GDP and GDP per capita.

- Characteristics: GDP and GDP per capita provide me with a macro view of a country's economic level and trends.

## 7. Food Consumer Price Index (Food CPI)

- Type: Time series data, based on 2015 benchmark to reflect the change in food prices.
- Characteristics: Changes in food prices allow me to understand how food affordability and purchasing power affect food security.

## **2.2 Data sources and collection process**

This study combines data from a number of internationally recognised organisations and government databases for in-depth analysis. The reliability and accuracy of these data sources have been confirmed, which helps to ensure the validity of the findings.

The multiple stages of data collection are detailed below:

### **Identification of data sources**

Firstly, I identified multiple reliable data sources which include:

- World Bank
- United Nations
- World Economic Forum (WEF)
- Food and Agriculture Organisation of the United Nations (FAO)

### **Data Extraction**

The following data relevant to the study were extracted from the above data sources:

#### 1. Food\_Insecurity

- Data source: World Bank
- Definition: prevalence of moderate or severe food insecurity (%)
- Definition: Prevalence of moderate or severe food insecurity (%) Timeframe: 2015-2020

#### 2. Gender\_Equality

- Source: World Economic Forum's Gender Gap Report.

- Definition: Gender equality index

- Definition: Gender Equality Index Timeframe: 2015-2020

### 3. Gender\_Econ\_Participation

- Source: Gender Gap Report of the World Economic Forum.

- Data source: Gender Gap Report of the World Economic Forum Definition: Gender Equality Index of Economic Participation and Opportunities

- Definition: Gender Equality Index of Economic Participation and Opportunities

### 4. Gender\_Education

- Source: World Economic Forum's Gender Gap Report Definition: Gender equality index of access to education

- Definition: Gender equality index for access to education

- Definition: Gender equality index of access to education Time frame: 2015-2020

### 5. Gender\_Political\_Power

- Source: Gender Gap Report of the World Economic Forum.

- Definition: Gender Equality Index for Political Empowerment

- Definition: Political Empowerment Gender Equality Index

### 6. GDP\_PPP\_Billion (GDP in purchasing power parity)

- Source: World Bank

- Definition: GDP (in billions of PPP)

- Timeframe: 2015-2020

### 7. GDP\_per\_capita\_PPP (GDP per capita in purchasing power parity)

- Source: World Bank

- Definition: GDP per capita (in PPP)

- Time frame: 2015-2020

8. food\_CPI\_2015\_100 (Food Price Index)

- Source: Food and Agriculture Organisation of the United Nations (FAO), except for Mozambique and Tanzania where the consumer price index (CPI) is used due to the absence of a food price index.

- Definition: Food price index based on 2015.

- Time frame: 2015-2020

### **Data integration and cleaning**

After extracting the necessary data, I integrated them into a complete dataset and performed data cleaning to ensure data accuracy and consistency.

In this way, I successfully constructed a dataset from 2015 to 2020 that will provide a solid basis for analysing the relationship between gender equality and food security.

Again, this study focuses on four countries, Kenya, Ethiopia, Uganda, and Botswana, but to ensure consistency in the availability of all variables, I chose 21 countries as the source of the data.

## **3. Quantitative analysis**

### **3.1 Regression methods**

#### **3.1.1 Description of the regression model**

In this study, I used a multiple linear regression model to explore and explain the relationship between the variables. This model can be described by the following



equation:

$$\text{Food\_Insecurity} = \beta_0 + \beta_1 \text{Gender\_Equality} + \beta_2 \text{Gender\_Econ\_Participation} + \beta_3 \text{Gender\_Education} + \beta_4 \text{Gender\_Political\_Power} + \beta_5 \text{GDP\_PPP\_Billion} + \beta_6 \text{GDP\_per\_capita\_PPP} + \beta_7 \text{Food\_CPI\_2015\_100} + \varepsilon.$$

Where:

Food\_Insecurity represents food insecurity

Gender\_Equality stands for Gender Equality Index

Gender\_Econ\_Participation stands for Gender Economic Participation Index.

Gender\_Education represents the Gender Education Index.

Gender\_Political\_Power represents the Gender Political Power Index.

GDP\_PPP\_Billion and GDP\_per\_capita\_PPP represent GDP and GDP per capita, respectively (both in purchasing power parity (PPP) terms).

Food\_CPI\_2015\_100 stands for Food Price Index.

$\beta_0, \beta_1, \dots, \beta_7$  are the model parameters

$\varepsilon$  is the error term.

### **3.1.2 Variable selection and intended relationship**

For my research, I chose the timeframe of 2015 to 2020 for my data analysis, aiming to capture important changes and trends over this period. This timeframe not only provides recent data but also builds on past theory and research to deepen my understanding of the relationship between gender equality and food security.

The choice of variables is a critical step, as it directly affects the quality and results of the study. In this study, I operationalized variables to achieve concrete and measurable

analysis in the following ways:

First, I quantify the abstract concept of "gender inequality" through various reliable data sources. Specifically, I use the World Economic Forum's Gender Gap Report to identify and define various gender equality indices, including "economic participation and opportunity," "educational achievement," and "political achievement. Economic Participation and Opportunity", "Educational Achievement" and "Political Empowerment". In this way, I was able to obtain a composite indicator that provides an in-depth analysis of gender inequality from multiple perspectives.

Secondly, I used data from the World Bank and FAO to quantify "food insecurity". The specific indicator I used is the "prevalence of moderate or severe food insecurity (%)", which provides a reliable measure of the level of food security.

Meanwhile, in order to more fully explore the impact of economic factors on food security, I have also included the variables Gross Domestic Product (GDP) and GDP per capita in my model. These are calculated based on purchasing power parity (PPP), which provides a more accurate portrayal of the state of the economy and avoids the misleading nature of relying solely on nominal GDP.

Finally, I introduce the Consumer Price Index for Food (CPI) to assess changes in food prices and their impact on food security. This is done by analyzing a food price index benchmarked for 2015.

Through the above methodology, I converted abstract concepts into quantifiable and comparable indicators to provide a solid foundation for my regression model to examine the relationship between gender equality and food security.

Each variable in the study is closely related to the research topic, providing a multidimensional perspective to parse and understand the complex relationship between gender equality and food security. By analyzing these variables in depth, I expect to be able to draw more comprehensive and insightful conclusions.

### **Expected Relationship:**

Based on the literature and theory, I expect to find the following relationships:

**Gender Equality and Food Security:** Higher gender equality may reduce food insecurity by increasing women's roles in food production and decision-making.

**Economic participation and food security:** Higher female economic participation may lead to better food security because it can increase household income and food purchasing power.

**Education and food security:** Higher levels of education may lead to better food security because it can provide better employment opportunities and decision-making capacity.

**Political power and food security:** more political power for women may lead to better food policies and strategies.

**GDP and food security:** Higher GDP and GDP per capita may reduce food insecurity because they increase the wealth of the country and the purchasing power of individuals.

**Food price index and food security:** High food prices may increase food insecurity because they reduce the affordability of food for people.

### **3.2 Regression analyses**

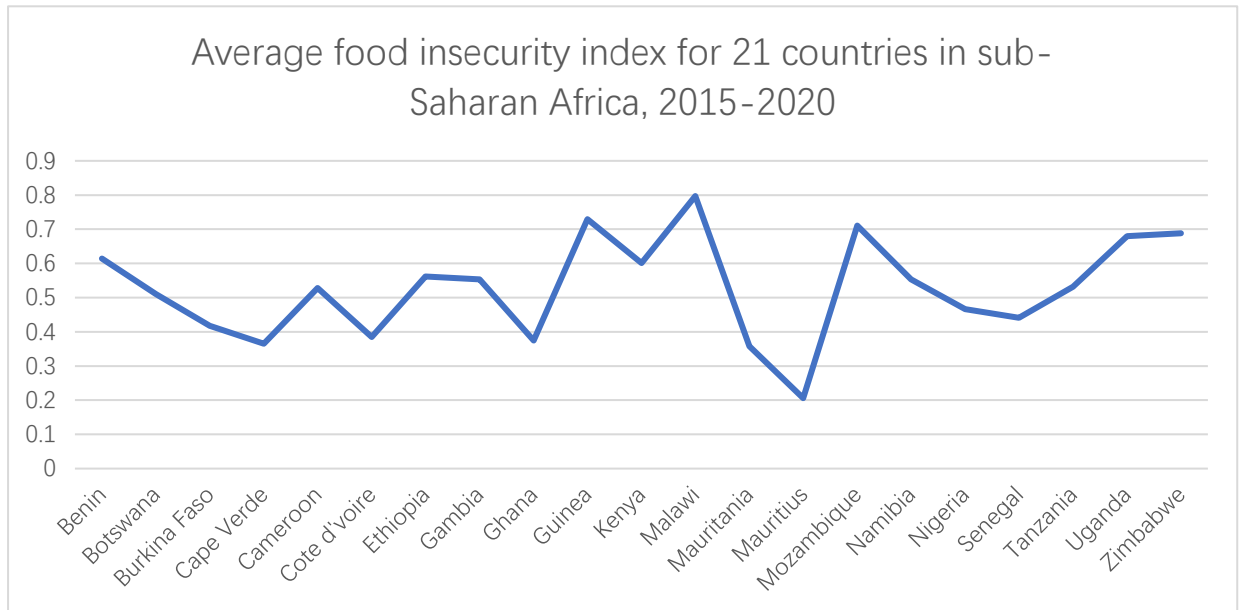
**(\*For the purpose of presenting the data, the charts and data that follow are based on averages from 2015-2020)**

### 3.2.1 Background Overview

For the period 2015–2020, we have conducted a comprehensive study of 21 sub-Saharan African countries, covering multifaceted indicators to shed light on gender inequality and food insecurity in these countries. According to the graphic below (data are averages from 2015–2020 for the corresponding indices), we can note that there are significant differences between the 21 countries in terms of food insecurity and economic performance. Food insecurity is prevalent, but to varying degrees across countries, with Guinea, Malawi, Mozambique, Kenya, Uganda, and Zimbabwe having higher indices. Whereas Mauritius and Zimbabwe have a relatively high Food Consumer Price Index (Food CPI), suggesting an increase in food prices in the region, Mauritius has a low food insecurity index due to its high GDP per capita, whereas Zimbabwe has a low GDP per capita among the 21 countries with a high CPI and therefore has a high level of food insecurity. On the economic front, Mauritius is a significant leader in terms of GDP per capita, suggesting that its inhabitants enjoy a higher standard of living compared to Botswana and Namibia, which have lower GDP per capita but are also among the leaders among the 21 countries, and Nigeria, which is a distant second among the 21 countries. Specifically for the four countries in focus, Uganda faces higher food insecurity and lower GDP per capita; Ethiopia, while slightly less food insecure, has a higher food CPI index, indicating a more pronounced rise in food prices; Kenya has a higher food insecurity index and lower GDP per capita; and Botswana is in the middle of the four.

**Figure 3 Average food insecurity index for 21 countries in sub-Saharan Africa,**

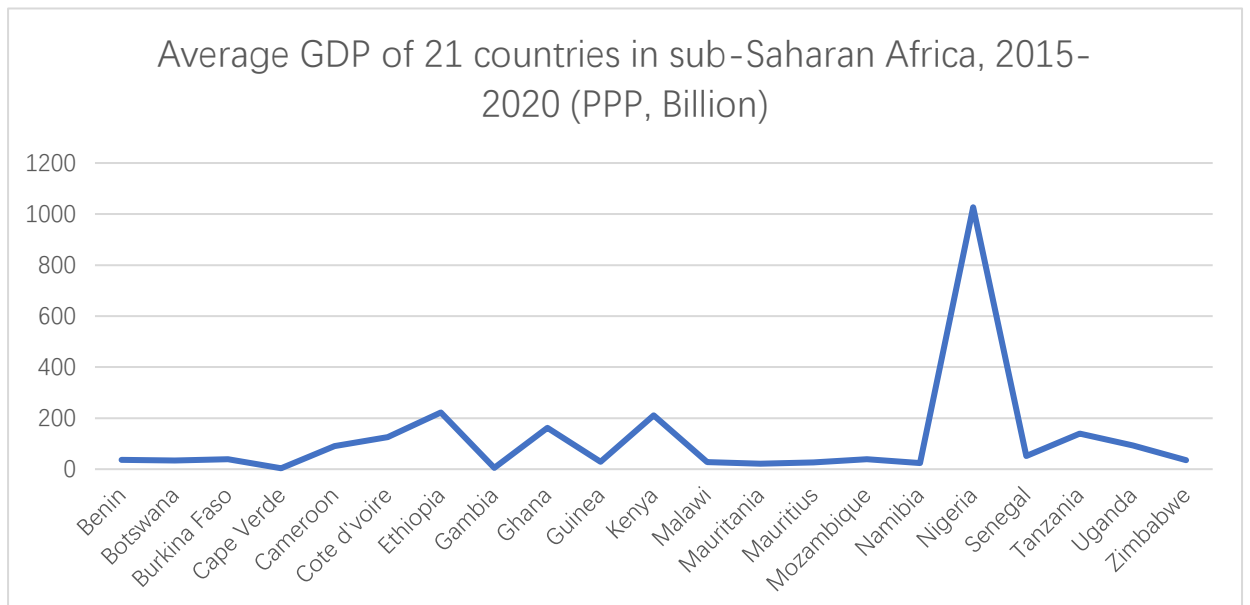
**2015-2020**



Note: World Bank (2023). Retrieved March 2023, from

<https://data.worldbank.org/indicator/SN.ITK.MSFI.ZS>

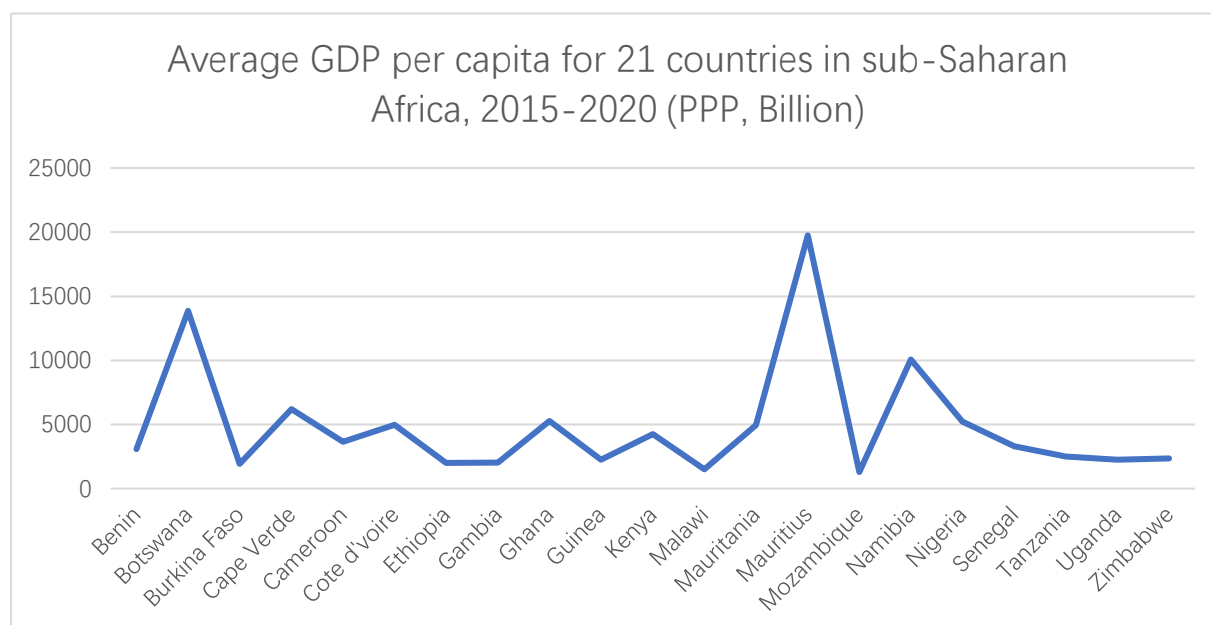
**Figure 4 Average GDP of 21 countries in sub-Saharan Africa, 2015-2020 (PPP, Billion)**



Note: World Bank (2023). Retrieved March 2023, from

<https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.CD&country>

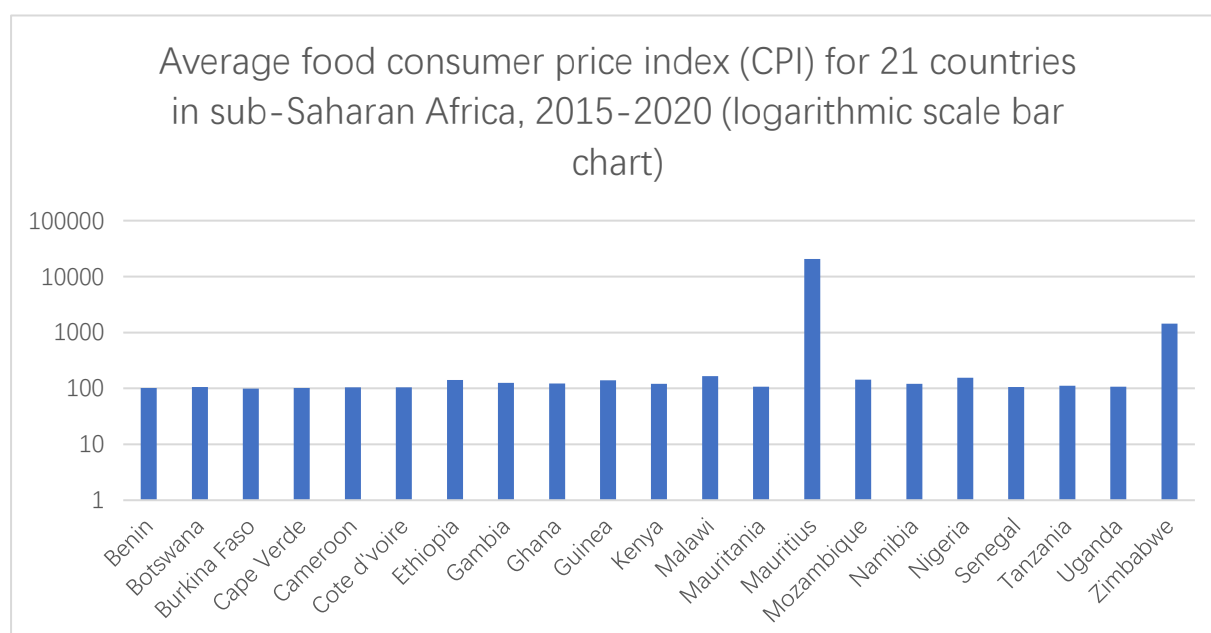
**Figure 5 Average GDP per capita for 21 countries in sub-Saharan Africa, 2015-2020 (PPP, Billion)**



Note: World Bank. (2023). Retrieved March, 2023, from

<https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

**Figure 6 Average food consumer price index (CPI) for 21 countries in sub-Saharan Africa, 2015-2020 (logarithmic scale bar chart)**



Note: 1. Food and Agriculture Organization of the United Nations, (n.d) Retrieved May, 2023, from

<https://www.fao.org/faostat/en/#search/food%20price%20index>

2. Data for all countries except Mozambique and Tanzania are food CPIs, while Mozambique and Tanzania are general CPIs.

### **3.2.1.1 Overview of the four country cases: location and characteristics**

#### **Botswana**

Located in the southern region of Africa, Botswana is a country that enjoys a relatively high degree of stability and economic prosperity, thanks in large part to its rich natural resources, particularly diamonds. Its economy is largely dependent on diamond mining, which makes it one of the most stable and richest countries in the region. The government's look at the economy does not stop at the exploitation of mineral resources; they are trying to diversify the economy, which includes the development of tourism and manufacturing. Tourism in the country is gradually becoming another driver of the economy, thanks to its magnificent natural beauty and abundant wildlife.

On the social front, Botswana demonstrates a largely harmonious social structure. Its social organization has remained stable despite some problems regarding land use and distribution. This stability is largely due to its relatively homogeneous ethnic structure, where the majority of the population belongs to the Setswana ethnic group. Such an ethnic structure has helped to maintain social harmony while at the same time providing favorable conditions for the preservation of traditional culture and language. Botswana's culture has been heavily influenced by the Setswana community, resulting in a society that combines traditional and modern elements, in which ancient rituals and modern lifestyles coexist in harmony.

In the political sphere, Botswana has also performed commendably. It has one of the most stable and democratic governments on the African continent, and its political environment is relatively peaceful and orderly. The government is committed to safeguarding the rights and freedoms of its citizens through the introduction of a series of democratic reforms. This political stability provides a favorable environment for the economy, helping to attract foreign investment and promote domestic businesses.

### **Kenya**

Located in eastern Africa, Kenya is a country of many contradictions and rich colors. Economically, Kenya's economy has shown a tendency to diversify despite high unemployment and poverty, with a number of industries, including tourism, coming together to drive the country's economic development. The agricultural sector stood out in particular, especially the coffee and tea industries, which not only provided a source of livelihood for the majority of the population but also gained a reputation on the international market. In addition, the country is endeavoring to expand its industrial and service sectors in order to achieve more comprehensive economic development.

At the societal level, Kenya has a multicultural background, which includes a wide range of ethnic and linguistic groups, making Kenyan society vibrant and diverse. Such diversity is both a valuable cultural asset and brings with it its own set of challenges that require fine-tuned management and guidance to maintain social harmony. Against this backdrop, Kenya's culture exhibits a rich diversity that is reflected in its distinctive artistic expressions, music, and literature, as well as displayed in various cultural celebrations.



Politically, Kenya is moving towards a more democratic and transparent system of government. While there has been a history of political instability and corruption, recent years have seen the implementation of a series of political reforms aimed at creating a more accountable and inclusive government structure. The new legislative framework places greater emphasis on citizens' rights, which can be seen as a positive sign that the country is moving towards a more open and liberal society.

At the cultural level, Kenya's cultural landscape is characterized by strong local and foreign influences, reflected in its rich literature, music, and art. National writers and artists such as Ngugi wa Siongo and Baraka Oluchi Oluchi have gained recognition on the international stage, which further strengthens Kenya's position in the global cultural scene.

## **Uganda**

Uganda's economic base is deeply rooted in agriculture, particularly coffee exports, which inject the country with significant foreign exchange earnings. In recent years, the government has endeavored to expand the industrial sector in order to diversify the economy and attract more foreign investment. This strategy has opened up new opportunities but has also raised concerns about the potential neglect of rural areas and environmental sustainability.

On the social front, Uganda is a multicultural and multi-ethnic country, a background that has endowed the country with a rich history and culture but has also brought with it a range of social conflicts and tensions. It is a multilingual, multi-ethnic society, and while this adds to cultural diversity and richness, it also generates significant socio-

economic divisions and inequalities in service delivery. Music and dance traditions take center stage in cultural expression, providing a window to portray history, beliefs, and values.

Politically, Uganda has a diverse but historically common background of regime change and political conflict. The current government is endeavoring to strengthen its democratic institutions and improve political transparency and fairness. Internationally, Uganda is also striving to project an image of responsibility and cooperation by actively participating in multilateral institutions and regional cooperation to strengthen its foreign relations.

## **Ethiopia**

Ethiopia is at a critical stage of economic transformation, and its economy is currently largely dependent on agriculture, particularly the production and export of coffee. However, in recent years, the government has embarked on a series of policies to promote industrialization and modernize the economy. While such efforts offered potential for economic growth, they also posed a number of challenges, including environmental concerns that had to be addressed and the uneven distribution of resources.

Socially, Ethiopia has a very diverse background, encompassing several ethnic groups and cultures. This has given the country a rich cultural heritage and a diverse social fabric. However, this plurality has also led to a number of social challenges, including how to maintain harmony among different groups and avoid social conflict.

Politically, Ethiopia is going through a period of instability, including serious internal

conflicts and ethnic divisions. The government is endeavoring to achieve more stability and harmony through political reforms, although this remains an ongoing challenge. Given Ethiopia's role in the African Union, its political stability would have far-reaching implications for the entire continent.

### **3.2.1.2 Focus of the study: rationale for country selection**

The four countries of Botswana, Kenya, Uganda, and Ethiopia were selected as focal areas for the study on the basis of their characteristics in the areas of gender equality and food security and the diversity of their respective economic situations.

Botswana is a country with a relatively robust economic base and a high GDP per capita, while gender parity has been achieved in the field of education. However, women's participation in the political arena in Botswana is still very low, highlighting a clear gender disparity that is deeply rooted in a traditionally male-dominated social structure. Nonetheless, its economic stability and high level of educational equality provide a relatively favorable environment for women to increase their participation in the social and political spheres.

Kenya is another country that has made some progress in the area of education, demonstrating a relatively high gender equality score in education. Its diversified economy and relatively high GDP per capita provide a rich context for exploring the interplay between gender and the economy. Despite this, Kenya's female participation in the political arena remains low, and the country's food security remains prominent.

Uganda presents a complex situation in terms of political participation and gender equality, demonstrating a combination of progress and challenges. The country has had

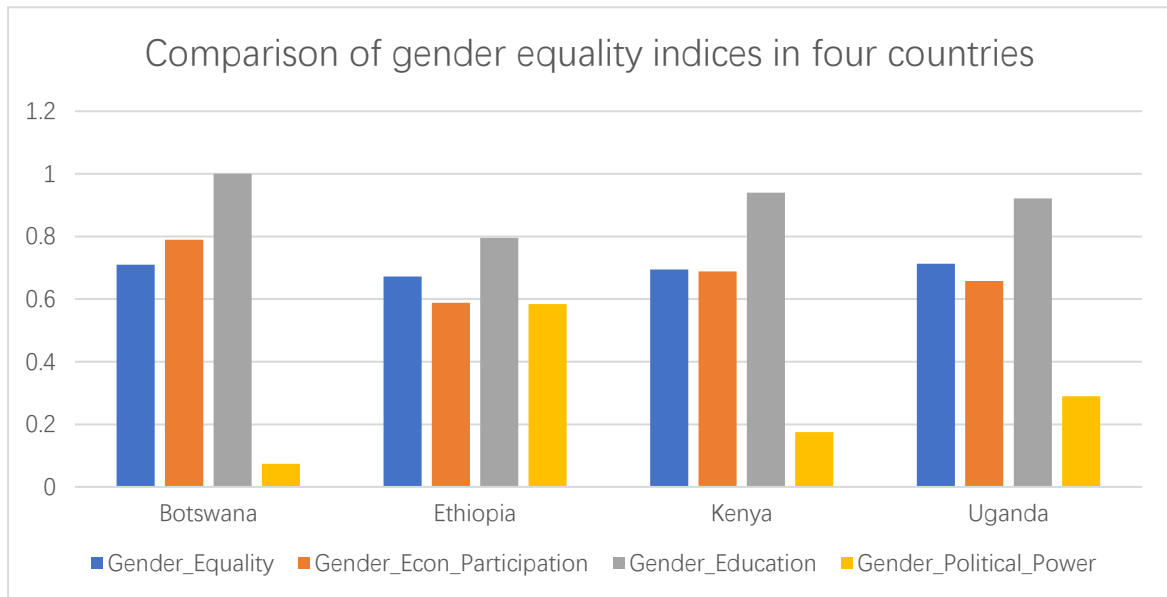
some success in promoting women's political participation and has implemented policies to increase women's representation in government institutions, but more needs to be done to ensure that women have greater influence in political decision-making processes. On the economic front, GDP per capita remains relatively low, suggesting that the country needs to further strengthen its economic base to provide more resources and opportunities for women to become more active in the economy. In the area of education, while some progress has been made, more needs to be done to ensure that all girls and women have access to quality education and to increase their social and economic participation. At the same time, Uganda is also facing a relatively high level of food insecurity, which not only highlights the urgency of addressing food security but may also affect the process of gender equality by requiring a reallocation of resources and attention to address the issue.

Ethiopia, on the other hand, offers a different perspective. In the political arena, the country has made significant progress, demonstrating a relatively high gender political empowerment score (0.584). This may be attributed to a series of efforts made by the Ethiopian government in recent years to increase female political participation, which includes enhancing female representation in government institutions. However, gender equality still has a long way to go in the economic and educational spheres. The GDP per capita is only \$2,527.18 (PPP), which hints at the country's relatively weak economic base, limiting its capacity and resources to implement gender equality policies. In addition, the CFI (Food Insecurity Index) of 0.562 suggests that food security is still a relatively serious problem in the country, which may further undermine

gender equality efforts as resources and attention may be reallocated to address food security. This situation suggests that even with efforts at the governmental level, achieving full gender equality is a multifaceted and multilayered challenge. The case of Ethiopia highlights the variety of challenges and obstacles that a country may encounter in its quest for gender equality, while at the same time underscoring the importance of an integrated approach in achieving gender equality and food security. Against this backdrop, the study of these four countries provides an ideal platform to delve into the interrelationship between gender equality and food security. By comparing and contrasting the performance of these countries across a range of areas, we can better understand how gender equality affects food security and how it interacts with broader socio-economic conditions. This includes exploring how government policies, education, cultural factors, and economic conditions affect women's rights and opportunities.

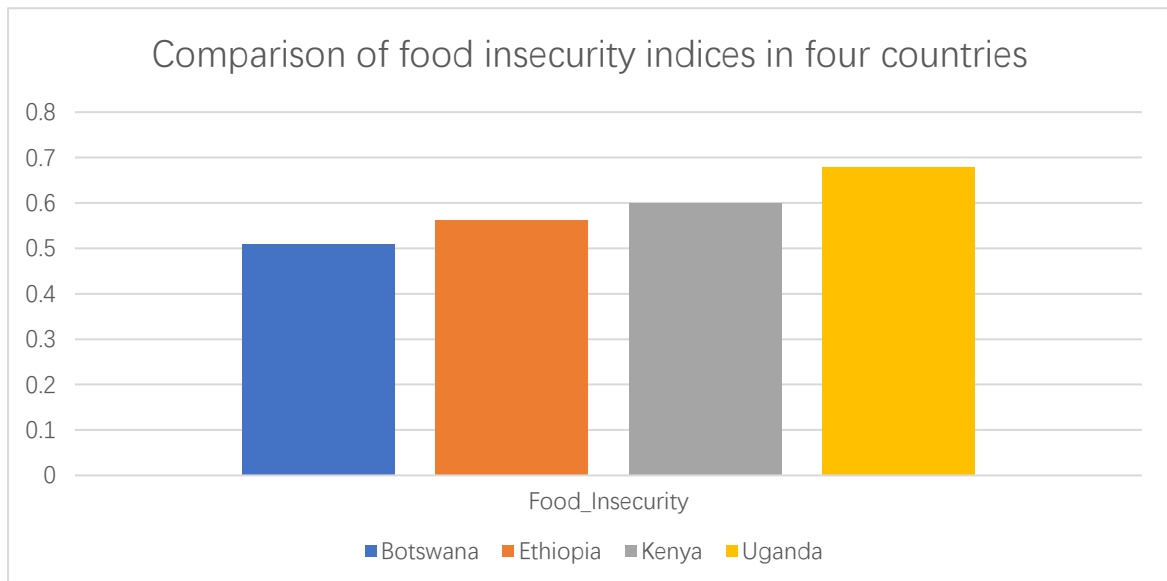
At the same time, the selection of these four countries reflects the diversity and complexity of the continent, thus providing a multi-dimensional and multi-layered framework for analysis. Each country has a unique historical context, political structure, and social conditions, which provide a rich backdrop for exploring the dynamic relationship between gender equality and food security.

**Figure 7: Comparison of gender equality indices in four countries**



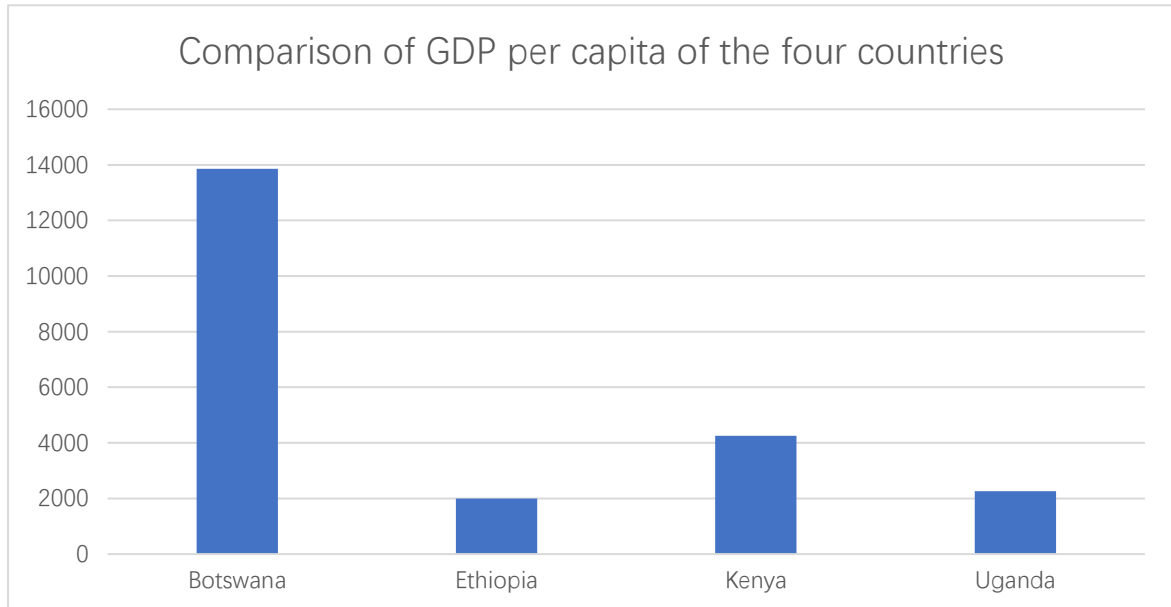
Note: Source, same as figure 2

**Figure 8: Comparison of food insecurity indices in four countries**



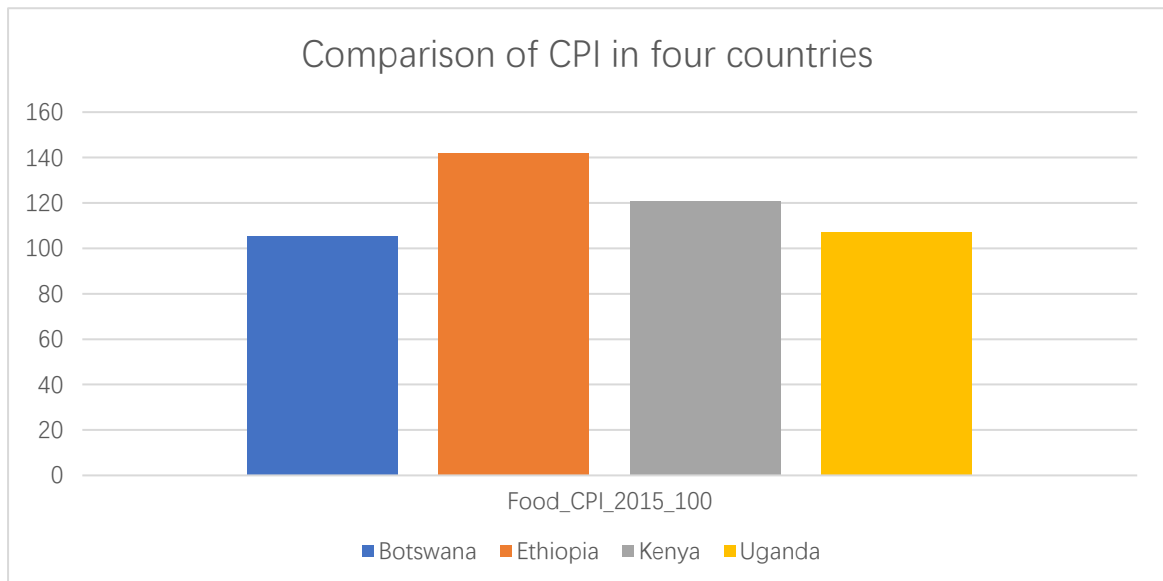
Note: Source, same as figure 1

**Figure 9: Comparison of GDP per capita of the four countries**



Note: Source, same as figure 5

**Figure 10: Comparison of CPI in four countries**



Note: Source, same as figure 6

### 3.2.1.3 Description of variables: correlation between gender equality, education and economic indicators

#### a) Gender equality

**Botswana:** In Botswana, we see a unique picture of a country that has achieved the highest level of equality in gender education, with a score of 1.0. This shows that the country has achieved full gender equality in education, which is a very commendable achievement. However, this is in stark contrast to its low score of 0.0735 on gender political power, which shows that female participation in the political arena is still very low. This raises the question of how to translate this progress into higher levels of female representation, despite the remarkable progress made in education.

**Ethiopia:** In contrast, Ethiopia shows high gender equality in political power, with a score of 0.584. This is a clear signal that the country has made significant progress in improving female representation in the political sphere. However, its score on economic participation is only 0.588, which hints that female participation in the economic sphere could be improved, especially considering its score of 0.7955 on education, which indicates a relatively well-educated female population.

**Kenya:** Kenya demonstrates a similar pattern, although its score on education is higher (0.94), its political power score is only 0.1755. This again highlights the gap that exists between education and political representation. It is worth noting that Kenya's gender economic participation score is 0.688, which could mean that women in the country have more opportunities to participate in economic activities.

**Uganda:** Uganda has a gender education score of 0.922, which is a very high score indicating that a high level of gender equality has been achieved in education. Its political empowerment score is 0.29, although this is higher than Botswana and Kenya, it is still indicative of a gender gap in the political arena. This could mean that although



education has been opened up to the majority of females, this has not fully translated into equality in political power.

#### **b) Economic indicators**

**Botswana:** Botswana leads with a GDP per capita (PPP) of \$13,862.2, which is more than just a numerical value that reveals the country's relatively strong and stable economy. Matching its high gender economic participation score of 0.7895, we can infer that the country has achieved some level of gender equality. Further analyses show that economic prosperity goes hand in hand with increased education and political power.

**Ethiopia:** In contrast, Ethiopia's economic performance lags a little behind, with a GDP per capita (PPP) of just \$2003.75. Its low gender economic participation score of 0.588 hints at the many obstacles women still face in the country's labor market. Despite this, the country boasts a relatively high gender political empowerment score of 0.584, indicating a significant female presence in the political arena. However, in order to achieve higher gender equality, there is still a need to include more females in economic activities, provide more employment opportunities, and improve working conditions.

**Kenya:** Kenya's economy is at a medium level, with a GDP per capita (PPP) of US\$4,254.25. Its Gender Economic Participation (GEP) score is 0.688, which indicates that women in the country have made some progress in the economy. Furthermore, Kenya's food CPI of 121.0555 is higher than that of Botswana and Ethiopia, which could indicate that the country is going through a period of rising food prices. To achieve greater gender equality, women's participation in the economy should be further

encouraged, while attention also needs to be paid to controlling prices and ensuring that basic necessities are affordable for all.

**Uganda:** Finally, there is Uganda, whose GDP per capita (PPP) of \$2,267.2 places it between Ethiopia and Kenya. Although its economic base is not as strong as Botswana's, its gender economic participation score of 0.658 shows that women in the country have made some progress in the economy. However, food insecurity remains a serious problem in the country, with a food insecurity index of 0.6795, which is the highest among the four countries. Therefore, in addition to promoting greater gender equality, food safety needs to be addressed to create a more prosperous and egalitarian society.

### **c) Food Security Indicators**

**Botswana:** Botswana's Food Insecurity Index (FII) score of 0.51 is a relatively low score, indicating that the country has made significant achievements in ensuring food security. A low food insecurity index promotes a healthier and more equitable society because it means that more people have access to adequate and nutritionally balanced food.

In addition, a more stable food security environment reduces the risk of malnutrition among women and children, thereby increasing their social and economic participation. Considering Botswana's economic strength and relatively high gender economic participation scores, the country's ability to continue to maintain its level of food security and further promote gender equality can be foreseen.

**Ethiopia:** Ethiopia's Food Insecurity Index score of 0.562 implies that the country has some problems with food safety. Although the country is making efforts to improve the

situation, food insecurity remains a problem that needs to be addressed in the long term.

The high food insecurity index could mean that women and children in the country are more likely to suffer from malnutrition, which could affect their education and economic opportunities. In order to achieve greater gender equality, Ethiopia needs to invest and reform more in food security to ensure that all people have access to adequate and nutritionally balanced food.

**Kenya:** Kenya has a food insecurity index of 0.601, indicating that the country also faces significant challenges in food security. Food insecurity can lead to a range of problems, including malnutrition and health issues, which can further exacerbate gender inequality.

To improve the situation, Kenya needs to take stronger measures to ensure food security, including improving agricultural production techniques and increasing the efficiency of food distribution. At the same time, increasing women's participation in agriculture and other food-producing industries can also be an effective strategy to improve food security and promote gender equality.

**Uganda:** Uganda has the highest food insecurity score of the four countries at 0.6795, which shows that the country is facing very serious problems in terms of food security. This not only affects people's daily lives but also has the potential to further exacerbate gender inequality.

In order to address this issue, Uganda needs to adopt a comprehensive strategy to improve its food security situation, which includes investing in more sustainable and efficient agricultural technologies as well as providing more education and training

opportunities, especially for women.

#### **d) The intersection of food price indices and gender equality**

**Botswana:** Although Botswana has the highest GDP per capita of the four countries, its food CPI indicates that its food prices have still increased. And price fluctuations directly affect women, as in many households they are responsible for buying ingredients and preparing meals. This role for women forces them to make difficult choices in budget management and food purchases. Additionally, a large portion of Botswana's agricultural industry is sustained by women, so the CPI also has a direct impact on their income and quality of life.

**Ethiopia:** The economic situation in Ethiopia is more complex. The low GDP per capita means that the people are more responsive to the CPI. In addition, high food prices not only exacerbate the economic pressure on households, but also affect women's social and economic rights to some extent. For example, educational and employment opportunities may be limited, as households may not have sufficient resources to support the personal development and professional careers of female members.

**Kenya:** Kenya's mid-level GDP per capita means that it is in a delicate position of needing to balance economic growth and price stability. For women, this situation can lead to a big challenge, as they are usually expected to not only manage the household budget, but also provide as much nutritious food as possible. In addition, women in Kenya also have to deal with a variety of issues in the agricultural sector, including land rights and access to markets.

**Uganda:** The situation in Uganda is even more serious, as it not only has a low GDP

per capita, but also a relatively high food price index. This puts a great deal of pressure on women in the country as they have to find ways to ensure food security and nutrition for their families with limited resources. In addition, the high CPI may also lead to reduced educational and employment opportunities for women, as families may prioritise basic survival needs over long-term investments.

### **3.2.2 Analysis of descriptive statistics**

#### **3.2.2.1 Description of the main indicators: incidence of food insecurity, poverty rate and gender inequality indicator description**

In this section, we explore key social and economic indicators for four different African countries for the period 2015–2020. These indicators include gender equality and its related sub-indicators (economic participation, education, and political power), food insecurity, as well as economic data, including purchasing power parity (PPP) GDP and the consumer price index for food. We will analyze the means, medians, and standard deviations for these countries based on these six years of data.

#### **Descriptive Statistics of Key Indicators (2015-2020)**

##### **Mean**

The mean value gives us an idea of the average performance of each indicator over the six-year period.

<b>Country</b>	<b>Gender Equality</b>	<b>Gender Econ. Participation</b>	<b>Gender Education</b>	<b>Gender Political Power</b>	<b>Food Insecurity</b>	<b>GDP (PPP) in Billion</b>	<b>GDP per capita (PPP)</b>	<b>Food CPI (2015=100)</b>
Botswana	0.7095	0.7895	1.000	0.0735	0.510	33.66	13862.2	105.353
Ethiopia	0.6725	0.5880	0.7955	0.5840	0.562	222.82	2003.75	142.2125
Kenya	0.6950	0.6880	0.9400	0.1755	0.601	211.50	4254.25	121.0555
Uganda	0.7125	0.6580	0.9220	0.2900	0.6795	93.155	2267.2	106.978

### **Analysis:**

#### **Gender Equality and its Sub-Indicators**

Botswana scores perfectly on the education sub-indicator, signalling a very high level of gender equality in education. However, it scores only 0.0735 on political power, showing a great gender disparity.

Ethiopia scores low on all sub-indicators, with a score of only 0.584 on political power, indicating that its women's participation in the political arena could be improved.

Kenya has a high score of 0.94 on the education sub-indicator, but a score of 0.1755 on political power, suggesting significant gender inequality in the political arena.

Uganda has the highest score on the overall gender equality index at 0.7125, but there is some degree of gender inequality in all sub-indicators, especially in political power.

#### **Incidence of food insecurity**

Botswana has the lowest food insecurity incidence rate at 0.51, indicating a relatively

good food security situation.

Ethiopia has a slightly higher incidence of food insecurity at 0.562 than Botswana.

Kenya and Uganda have higher food insecurity rates of 0.601 and 0.6795, respectively.

## Median

The median can provide a "central" value, and median analysis can give us a "typical" picture for each country over the period of observation. The pattern we see here is very similar to that of the mean analysis, which suggests that most of the countries have not changed very much over the period.

Country	Gender Equality	Gender Econ. Participation	Gender Education	Gender Political Power	Food Insecurity	GDP (PPP) in Billion	GDP per capita (PPP)	Food CPI (2015=100)
Botswana	0.7095	0.7895	1.000	0.0735	0.510	33.66	13862.2	105.353
Ethiopia	0.6725	0.5880	0.7955	0.5840	0.562	222.82	2003.75	142.2125
Kenya	0.6950	0.6880	0.9400	0.1755	0.601	211.50	4254.25	121.0555
Uganda	0.7125	0.6580	0.9220	0.2900	0.6795	93.155	2267.2	106.978

## Standard Deviation

The standard deviation allows us to understand how volatile and stable the indicators have been over the period.

Country	Gender Equality	Gender Econ. Participation	Gender Education	Gender Political Power	Food Insecurity	GDP (PPP) in Billion	GDP per capita (PPP)	Food CPI (2015=100)
Botswana	0.0007	0.0148	0.0000	0.0078	0.0651	3.8467	624.6581	7.5576
Ethiopia	0.0460	0.0283	0.0771	0.2220	0.0000	78.7717	527.2895	64.5030
Kenya	0.0339	0.1273	0.0028	0.0092	0.1329	49.7237	693.6010	31.5165
Uganda	0.0064	0.0071	0.0113	0.0269	0.0643	16.6665	135.7645	12.1325

### Analysis:

#### Botswana

**Food Insecurity Incidence:** The standard deviation is 0.0651, which means that Botswana has shown a low level of stability in terms of food insecurity incidence with little fluctuation during the period 2015–2020.

**Gender Equality Indicator:** The standard deviation is 0.0007, which means that there is little fluctuation in gender equality in Botswana during this period, indicating a high degree of stability.

**Gender Economic Participation:** The standard deviation is 0.0148, which shows that there has been little change in gender economic participation in the country over the period.

**Gender Education:** The standard deviation is 0.0000, showing that the country has maintained a completely stable performance on this indicator.



**Gender Political Power:** The standard deviation of 0.0078 also shows the country's stability in this area over the period.

**GDP (PPP) (Billions):** The standard deviation of 3.8467 indicates that Botswana has had some fluctuations in GDP (PPP) over the period.

**GDP per capita (PPP):** The standard deviation is 624.6581, indicating that the country's GDP per capita has fluctuated quite a bit over the period.

**Consumer Price Index (CPI) for Food:** The standard deviation is 7.5576, which shows that there was some volatility in the price of food during the period.

## **Ethiopia**

**Incidence of Food Insecurity:** The standard deviation is 0.0000, indicating that the incidence of food insecurity will not fluctuate at all during the period 2015–2020.  
**Gender Equality Indicator:** The standard deviation is 0.0460, which shows that there are significant fluctuations in gender equality during this period.

**Gender Economic Participation:** The standard deviation is 0.0283, indicating that the country's gender economic participation has fluctuated less during this period.

**Gender Education:** The standard deviation is 0.0771, indicating significant fluctuations in gender education in the country during the time period.

**Gender Political Power:** The highest standard deviation of 0.2220 indicates that the country will have a very high level of variability in this indicator during the 2015–2020 period, rather than continued stability.

**GDP (PPP) (Billions):** The standard deviation of 78.7717 indicates that GDP (PPP) has fluctuated significantly over the period.

**GDP (PPP) per capita:** The standard deviation is 527.2895, which shows that GDP per capita fluctuated significantly during the period.

**Consumer Price Index for Food:** The standard deviation is 64.5030, which shows that food prices fluctuated significantly during the period.

## **Kenya**

**Incidence of Food Insecurity:** The highest standard deviation of 0.1329 indicates that the food security situation in the country has fluctuated over the period.

**Gender Equality Indicator:** The standard deviation is 0.0339, which indicates that Kenya has had relatively little fluctuation in gender equality over the period.

**Gender Economic Participation:** The standard deviation is 0.1273, which indicates that the country's gender economic participation will fluctuate relatively more during the period 2015–2020.  
**Gender Education:** The standard deviation is 0.0028, which indicates that the country has experienced little fluctuation in gender education during this period.

**Gender Political Empowerment:** The standard deviation is 0.0092, which indicates that there is relatively little fluctuation in gender political empowerment in the country during this period.

**GDP (PPP) (Billion):** The standard deviation is 49.7237, which shows that there has been some fluctuation in the GDP (PPP) of Kenya during the period of 2015–2020.

**GDP per capita (PPP):** The standard deviation is 693.6010, which shows that GDP per capita fluctuates a lot during this period.

**Consumer Price Index for Food:** The standard deviation is 31.5165, which shows that

the price of food has fluctuated a lot during the period.

**And here is a comparative analysis of the standard deviation of the indicators for the four countries.**

#### **Food Insecurity Incidence**

- **Botswana** and **Uganda** exhibit similar volatility in this metric, both showing less fluctuation compared to **Kenya**.
- **Ethiopia** has the smallest fluctuation, indicating the most stable food security situation over the period.

#### **Gender Equality Index**

- **Botswana** has the least fluctuation in this metric, signifying the most stable gender equality over the period.
- **Ethiopia** experiences the greatest fluctuation, indicating substantial changes in gender equality over the years.

#### **Gender Economic Participation**

- **Botswana** and **Uganda** share comparable fluctuations, while **Kenya** has the highest fluctuation in this category.
- **Ethiopia** showcases the smallest fluctuation, indicating a relative stability in gender economic participation over the years.

#### **Gender Education**

- **Botswana** has zero fluctuation, displaying a completely stable performance in gender education over the period.
- **Ethiopia** exhibits the highest fluctuation, suggesting the most significant

changes in gender education over the period.

### **Gender Political Power**

- **Ethiopia** has the highest fluctuation, indicating very substantial changes in this metric over 2015-2020.
- **Botswana** and **Kenya** exhibit relatively small fluctuations, portraying a more stable performance in this field over the period.

### **GDP (PPP) in Billion**

- **Ethiopia** experiences the greatest fluctuation, illustrating very notable changes in its GDP (PPP) over the period.
- **Botswana** showcases the smallest fluctuation, indicating a more stable GDP (PPP) over the period.

### **GDP per Capita (PPP)**

- **Kenya** has the highest fluctuation, depicting the most substantial changes in per capita GDP over the period.
- **Uganda** showcases the smallest fluctuation, portraying the most stable per capita GDP over the period.

### **Food Consumer Price Index**

- **Ethiopia** experiences the highest fluctuation, signifying the most substantial changes in the food prices over the period.
- **Botswana** has the smallest fluctuation, showcasing more stable food prices over the period.

### **3.2.2.2 Initial trends and linkages between poverty, gender inequality and food**

## **insecurity**

A preliminary look at the data shows a possible correlation between gender inequality and economic indicators such as GDP per capita. For example, Botswana, which has a significantly higher GDP per capita than the other countries in the study, demonstrates a stable gender equality index over the study period and has the highest gender economic participation rate. This hints at a possible positive correlation between economic prosperity and gender equality.

When investigating the interaction between gender inequality and food insecurity, we noted that countries with higher gender equality indices (e.g., Botswana and Uganda) tended to exhibit lower rates of food insecurity. This suggests that improving gender equality may reduce food insecurity. The detailed mechanisms of this association need to be further explored; they may be related to inclusive economic policies and educational opportunities promoted by more egalitarian societies.

A brief analysis of the data shows clear trends between economic indicators (GDP indicators) and food insecurity. For example, countries with higher per capita GDP (PPP) (e.g., Botswana) tend to have lower rates of food insecurity, suggesting a possible inverse relationship between economic prosperity and food insecurity. There are notable exceptions; for example, Kenya exhibits a relatively high incidence of food insecurity despite having a moderate GDP per capita.

Analyzing deeper into the intersectionality of poverty, gender inequality, and food insecurity, we find that countries that exhibit better gender-related indicators also tend to exhibit better economic performance and lower rates of food insecurity. This hints at

a multifaceted relationship where improvements in one area may facilitate improvements in others, creating a virtuous cycle of development.

### **3.2.3 Regression analysis results, interpretation and comparative analyses with expected results**

In this section, we focus on using regression analysis to deepen our understanding of the relationship between poverty, gender inequality, and food insecurity. We have applied a multiple linear regression model to analyze how different variables affect food insecurity as a dependent variable. In this way, we are able to quantify the influence and importance of the various factors, as well as their interrelationships.

#### **Regression Analysis Formula**

$$\text{Food Insecurity} = \beta_0 + \beta_1(\text{Gender Equality}) + \beta_2(\text{Gender Economic Participation}) + \beta_3(\text{Gender Education}) + \beta_4(\text{Gender Political Power}) + \beta_5(\text{GDP (PPP in Billion)}) + \beta_6(\text{GDP per capita (PPP)}) + \beta_7(\text{Food CPI}) + \epsilon$$

Where:

- $\beta_0$  is the intercept
- $\beta_1, \beta_2, \dots, \beta_7$  are the coefficients for the respective variables
- $\epsilon$  is the error term

#### **Regression Analysis Results**

**Figure 11: Results of regression analyses of gender equality and food security in 21 countries in sub-Saharan Africa**

Source	SS	df	MS	Number of obs	=	120
Model	1.50350026	7	.214785752	F(7, 112)	=	18.49
Residual	1.30107178	112	.011616712	Prob > F	=	0.0000
				R-squared	=	0.5361
				Adj R-squared	=	0.5071
Total	2.80457205	119	.023567832	Root MSE	=	.10778

food_insecurity	Coefficient	Std. err.	t	P> t	[95% conf. interval]
gender_equality	.8749837	.5708027	1.53	0.128	-.2559887 2.005956
gender_econ_participation	.4208588	.156442	2.69	0.008	.1108891 .7308285
gender_education	-.2980402	.2207878	-1.35	0.180	-.735503 .1394226
gender_political_power	.0759841	.1038858	0.73	0.466	-.1298523 .2818205
gdp_ppp_billion	-.0000675	.0000475	-1.42	0.157	-.0001616 .0000265
gdp_per_capita_ppp	-.0000147	2.49e-06	-5.89	0.000	-.0000196 -9.73e-06
food_cpi_2015_100	.0000643	.0000404	1.59	0.115	-.0000159 .0001444
_cons	-.0231602	.1945993	-0.12	0.905	-.4087338 .3624134

Note:

1. **SS (Sum of Squares):** Denotes the sum of squares of the model and residuals, giving an indication of the variability explained and unexplained by the model.
2. **df (Degrees of Freedom):** Represents the number of values in the final calculation of a statistic that are free to vary.
3. **MS (Mean Square Error):** Refers to the average of the squares of the errors, providing a measure of the quality of the estimator.
4. **F (F Statistic):** Utilized to test the hypothesis that at least one of the coefficients in the model is not zero, helping in determining the overall fitness of the model.
5. **Prob > F:** The p-value of the F-statistic, which is used to infer the overall significance of the model. A lower value (typically  $\leq 0.05$ ) indicates a good fit.
6. **R-squared:** Indicates the percentage of variation in the dependent variable that is explained by the independent variables included in the model.

7. **Adj R-squared (Adjusted R-squared):** Like R-squared but takes into account the number of variables, providing a more accurate representation of the fit.
8. **Root MSE (Root Mean Square Error):** Represents the standard error of the model, giving a measure of the differences between values predicted by the model and the actual values.
9. **Coefficient:** The regression coefficient of each variable, denoting the mean change in the dependent variable for one unit of change in the independent variable while holding other variables constant.
10. **Std. err. (Standard Error):** Indicates the standard error of each variable, giving a measure of the accuracy of predictions.
11. **t (t Statistic):** Used to test whether individual coefficients are significantly different from zero, it helps in understanding the importance of different variables.
12. **P>|t|:** The p-value of the t-statistic, used to determine the significance of each variable in the model, with a smaller p-value indicating a more significant variable.
13. **[95% Conf. Interval (Confidence Interval)]:** Shows the range within which we can expect the true population parameter to lie 95% of the time, giving an idea of the precision of the estimates.

### **Conclusion:**

A deeper analysis of the results of the regression analyses allows us to present the following important findings and insights:

Firstly, a positive correlation ( $p < 0.01$ ) was demonstrated between gender economic participation and food insecurity. This may be indicative of the fact that higher female participation in economic activities has not necessarily led to increased food security.



This phenomenon may be due to a combination of complex factors, including unequal wages, job insecurity, or a lack of social protection measures. This finding underscores the need for a deeper exploration of how gender economic participation affects food security and raises a possible caveat for socio-economic policy: simply increasing female economic participation may not be sufficient to address food security.

Second, we find a strong negative correlation between GDP per capita (adjusted for purchasing power parity) and food insecurity ( $p < 0.001$ ). This implies that the likelihood of food insecurity decreases as the country's economy prospers and per capita income increases. This may be due to the fact that higher economic levels increase the ability of people to access adequate and nutritious food, thereby increasing food security.

Third, we find a trend towards a negative correlation between gender education and food insecurity, but this relationship is not significant ( $p = 0.180$ ). We would have expected education to be able to act as a tool to alleviate food insecurity by providing greater access to economic opportunities and knowledge to improve health outcomes. This may suggest that education contributes to reducing food insecurity to some extent, but we need further research to confirm this.

Fourthly, we note that there is a negative correlation between total GDP (adjusted for PPP) and food insecurity, but this is not significant ( $P = 0.157$ ). This may indicate that although the country's total GDP has an impact, it is not as direct as GDP per capita.

Fifthly, food Consumer Price Index (2015 = 100) Our analyses also showed a trend toward a positive correlation between food CPI and food insecurity, but this did not reach the level of significance ( $P = 0.115$ ). This reminds us that food price volatility

may affect food security to some extent, but it may not be the only determinant.

Sixthly, In exploring the relationship between gender political power and food insecurity, we found a non-significant positive correlation trend ( $p = 0.466$ ). This suggests that although the data reveals a positive correlation trend, this trend is not sufficient to confirm a statistically significant relationship.

There may be several reasons for this: First, increased gender political power may mean that more women have access to politics and the public sector, which will undoubtedly have an impact on the way policies are formulated and implemented. In particular, it may affect policies related to food security. However, such impacts may take time to manifest themselves and may be influenced by a multitude of complex social and economic factors that make the relationship non-linear and ambiguous.

Second, we must consider that increased gender political power may be accompanied by other social changes, including shifts in social structures and cultural values. These more ambitious and deep-rooted changes may affect food security in a more complex and indirect way. Such impacts are complex, and our modeling may not have adequately captured these multifaceted impacts, leading to results that now show a positive correlation rather than the expected negative correlation.

Another way to look at this is that while we have seen an increase in gender equality in the political sphere, it may not have reached a point where it can significantly affect food security. This could indicate that the positive correlation trend we observe is temporary or influenced by other variables not included in our model.

Seventhly, among the results of the study, we find that food insecurity also shows a

positive trend in the presence of increased gender equality. Although the relationship between gender equality and food insecurity did not reach a statistically significant level ( $p = 0.128$ ), this phenomenon still raises our concern because it is contrary to our original expectation, which was that gender equality would reduce the likelihood of food insecurity. However, it provides us with a possible insight that suggests that higher gender equality may not always be associated with lower food insecurity.

There may be multiple reasons for this positive correlation. On the one hand, as societies move towards greater gender equality, they may trigger a range of social and economic changes, some of which may have a negative impact on food security in the short term. For example, as women become more involved in the labor market, their role in the household in terms of responsibility for providing food may diminish, which may have some impact on household food security.

On the other hand, this positive correlation may also reveal some limitations of our model. Although we have included multiple variables to explore factors that may contribute to food insecurity, there may still be other unconsidered factors or confounding variables that could better explain this relationship. This could be certain social or economic factors related to gender equality that are not included in the model.

#### **3.2.4 Limitations of quantitative analysis and the need for qualitative research**

In the previous study, we explored the association between the four core dimensions of gender equality (gender equality, gender economic participation, gender education, and gender political power) and food insecurity. While regression analyses demonstrated some positive and negative correlation trends, most did not meet the criteria for

statistical significance. This strongly suggests that there is a complex and diverse picture in the field, that current data may only scratch the surface of the problem, and that more in-depth research is needed to reveal the more subtle relationships behind the scenes.

We must point out that the reliance on quantitative data analysis is a limitation of our study. While it can provide some measurable and verifiable results, it fails to capture the deeper social, cultural, and political dynamics that may play a central role in the context of our problem.

Therefore, we plan to explore this issue further through a case study of qualitative research, which in particular will focus on the impact of female empowerment projects on food security. Qualitative research can provide insight into and explain some of the trends and patterns observed in the quantitative data. It can provide a more nuanced and insightful perspective, allowing us to dig deeper into how social structures, cultural beliefs, and values influence the behavior and decision-making of individuals and groups.

Through case studies, we can gain a fuller understanding of the complex relationship between gender equality and food security, thus better capturing and understanding variables and dynamics that may not be captured by quantitative models. This may not only provide insights into more subtle and complex relationships but also provide a platform to explore how social norms and expectations shape people's food choices and consumption patterns.

In summary, introducing qualitative research will be a necessary step to complement

quantitative analyses and provide a more holistic and multifaceted perspective to understand the relationship between gender equality and food insecurity. Through in-depth case studies, we expect to be able to provide a richer and more nuanced way of understanding this complex relationship and to offer more informed and targeted recommendations to policymakers.

## **IV Case studies**

### **1. Overview**

In this study, we focus on how gender equality and women's empowerment strategies have been effective in improving food security in four countries. Case studies were chosen as the leading methodology to gain deeper and more nuanced insights into the phenomenon, rather than relying solely on quantitative data analysis. This approach allowed us to drill down into the details of specific contexts to reveal the subtle intersections and interactions between women's empowerment and food security. Rather than simply describing the phenomenon, this approach focuses on a deeper understanding of the phenomenon, providing us with a comprehensive and in-depth analytical perspective.

Based on the relationship between women's empowerment policies and food security in four countries, we have constructed unique case studies of four countries, focusing specifically on the following aspects:- Description of the case: An overview of the current state of women's empowerment and food security in each country and the challenges they face.- Implementation process: in-depth analysis of the policy or program from planning to implementation and the challenges and strategies to address them.- Results and Conclusions: Assess the effectiveness of the implementation of the women's empowerment tool, especially its direct and indirect impact on food security. After all the case studies were completed, cross-case comparisons and discussions were conducted with the aim of identifying key elements of successes and challenges from them and suggesting strategies with practical implications accordingly.

In order to ensure the quality and depth of this study, we have primarily adopted a case study approach combined with a literature review. In doing so, we refer to official policy documents and reports related to women's empowerment and food security from various countries, which not only provide a solid foundation for our study but also ensure the accuracy and relevance of the content presented.

In summary, this study provides an in-depth perspective through a case study approach that demonstrates how female empowerment tools affect food security in four countries. Through this analysis, we not only deepen our understanding of current policies and practices but also provide valuable strategic recommendations for the future to help countries promote food security more effectively.

## **2.The role of gender equality tools in food security: case studies and strategic analyses**

### **2.1 Context and background of agriculture and the economy**

#### **a) Botswana:**

In examining the agricultural and economic system of Botswana, we should first note the geographical and topographical features of the country. Botswana has a vast land area totaling 581,730 square kilometers, and about 45.63 percent of this has been zoned for agricultural production. Although agriculture contributes less than 2 percent of the gross domestic product (GDP), it is central to the livelihoods of many citizens who operate subsistence farms.

The production of cereal-based crops is constrained by a number of constraints, notably a lack of productivity, the unreliability of water supply, and soil conditions. Indeed, 70

percent of Botswana's land is desert and infertile, which poses significant challenges to agricultural production. However, it is worth noting that the country's total production of cereals in 2018 was 36,284 metric tons, a significant increase from 23,470 metric tons in 2017. Among the major cereal types are sorghum, maize, and millet. In addition, the 2017 data also shows that Botswana also managed to produce 2,348 metric tons of beans, 145 metric tons of groundnuts, and 78 metric tons of sunflower (World Bank, 2023). The aquaculture industry also presents a clear gap between supply and demand in Botswana. Although about 4,000 metric tons of fish are consumed annually, only 300 metric tons are produced locally, while the majority, about 3,700 metric tons, are imported from neighboring countries.

However, the challenges facing Botswana's agricultural production go far beyond this. Drought has become a major threat to agricultural production in Botswana, resulting in farmers facing great difficulties in growing crops and raising livestock (Mbulawa, 2017). Lack of stable water sources and irrigation facilities further reduces agricultural productivity, thereby affecting farmers' incomes and livelihoods. In addition, the relatively low level of mechanization in Botswana's agriculture and the lack of advanced agricultural equipment and infrastructure prevent farmers from realizing the full potential of modern technology. In addition, the homogeneity of agricultural production and markets creates market risks and uncertainty for farmers.

At the same time, despite its prudent macroeconomic policies, robust economic institutions, and relatively high GDP per capita, Botswana's level of inequality remains among the highest in the world. By the end of 2022, its unemployment rate stood at



25.4 percent, indicating a significant lag in job creation (World Bank, 2023).

## **b) Ethiopia**

The total area of Ethiopia is about 1.13 million square kilometers. Of this, about 65 percent of the land is used for agriculture. Despite its relatively low level of modernization, agriculture contributes up to 36 percent of the Gross Domestic Product (GDP), and about 85 percent of the population is directly engaged in agricultural activities. The country's main crops include cereals such as barley, maize, millet, and sorghum. Coffee, a major export product, generates significant foreign exchange earnings for the country. In addition to crops, there is extensive livestock farming, such as cattle, sheep, chickens, and camels, especially in some dry areas, which has become a major source of income. However, agricultural production is subject to a number of challenges, such as unpredictable monsoons, frequent droughts, soil degradation, pests and diseases, and the lack of modern agricultural equipment and irrigation facilities, which are serious constraints on productivity. Data for 2019 shows that Ethiopia's cereal production reached 27 million metric tons, but this figure is still affected by unstable climatic conditions (World Bank, 2019). Meanwhile, Ethiopia's economy, although it has grown over the past few years, still faces many challenges. Its economy is largely dependent on agriculture, which makes it vulnerable to price fluctuations in international markets and climate change. Despite the country's efforts to develop its manufacturing and service sectors in recent years, its economy remains fragile. Unemployment will remain high at 19 percent by 2022, especially among young people (World Bank, 2020). In addition, inadequate infrastructure, an unstable energy supply,

and rising levels of external debt are major challenges to Ethiopia's economic development.

### **c) Kenya**

In Kenya, the agricultural sector is the dominant force in its economic activities, contributing 33 percent and 27 percent of the gross domestic product (GDP) directly and indirectly, respectively (U.S. International Trade Administration, 2022). It is worth noting that more than 40 percent of the total population is employed in the agricultural sector, and when we turn our attention to the rural areas, the percentage is even as high as 70 percent (FAO, n.d.). These figures not only confirm the centrality of agriculture in the Kenyan economy but also reflect its critical importance in ensuring national employment and food security.

In the international arena, Kenya is widely recognized for its agricultural products. In particular, agricultural products such as tea, coffee, cut flowers, and vegetables have gained a solid foothold in the international market, with exports of tea, in particular, having increased in recent years. In addition, the horticulture and floriculture sectors have experienced significant expansion, attracting the attention of a large number of investors.

However, the development of agriculture has not been plain sailing. As most farmers rely on rain-fed irrigation, they are often affected by climate change and drought. At the same time, as the population grows and agriculture expands into drier areas, competition between livestock and natural resources intensifies, sometimes leading to regional conflicts. Lagging production technologies and scarcity of resources,

especially for smallholder farmers and agribusinesses, have become constraints to their further development.

Agriculture in Kenya complements the rest of the economy. It provides the necessary inputs and markets for manufacturing, construction, transport, and tourism. The sugar industry, despite its current challenges, is attempting to regain its former glory with government support and reforms.

Surprisingly, Kenya's high rainfall areas produced 70 percent of the country's agricultural products, despite the fact that they accounted for only 10 percent of the total arable land. Its semi-arid and arid regions, on the other hand, contributed 20 percent and 10 percent of agricultural products, respectively, which was further evidence of the resilience and diversity of Kenyan agriculture.

#### **d) Uganda**

Uganda, regarded as a country with great agricultural potential, is blessed with climatic and soil conditions. The country's stable temperatures, fertile soil, and two rainy seasons give it the ability to harvest multiple times a year. These advantages give Uganda enough farmland to feed a population of up to 200 million people. Nonetheless, there is still a large amount of land that is underutilized, with only 35% of the land under cultivation, even though 80% of the land is arable. Statistically, agriculture plays a key role in Uganda's economy, contributing about 24.1 percent of the country's GDP and accounting for a third of export earnings (U.S. International Trade Administration, 2022).

Despite Uganda's clear strengths in agriculture, the sector faces a number of challenges.

First, the country's farmers generally lack access to high-quality seeds and fertilizers, while the lack of irrigation infrastructure makes yields vulnerable to weather extremes and pests.

In addition, Uganda's agricultural output is also affected by a number of logistical and infrastructural challenges, such as a lack of efficient packaging technologies, storage facilities, post-harvest handling methods, and all-weather feeder roads. Another noteworthy issue is the complexity of land ownership, which limits the ability of farmers to increase production. And meeting stringent international requirements for food safety and quality is also a challenge for producers who wish to export abroad.

Tea is one of Uganda's key agricultural products. In 2021, Uganda produced 110,000 metric tons of tea, of which about 5% was used for the domestic market (U.S. International Trade Administration, 2022). Uganda is a major producer of tea.

In terms of economic development, Uganda has performed well in recent years. GDP growth is expected to reach 6.5 percent in 2023 and 6.7 percent in 2024, despite the pressure on financial markets from disruptions in the global supply chain and Russia's military action against Ukraine (African Economic Outlook, 2023).

## **2.2 Case studies on the implementation and effectiveness of gender equality tools**

### **a) Botswana**

#### **First case: The National Policy on Gender and Development (National Gender Policy)**

Botswana's National Gender Policy was developed in 1995 and launched in 2015. It is committed to the full participation and development of women, with the goal of

eradicating harmful practices and inappropriate laws in all economic and social cultures.

The formulation of the policy adheres to the country's core principles of democracy, unity, and self-determined development, combined with rapid economic growth, sustainable social progress, and just development strategies.

The birth of the policy was not an easy task, but a protracted and meticulous process involving multiple sectors and stakeholders. The process began with in-depth research and analysis aimed at gaining an in-depth understanding of the status of women and the challenges they face in Botswana society. Government departments, non-governmental organizations (NGOs), and academia all played an integral role in this phase. It was on the basis of the findings of these surveys and analyses that the sharpening of the objectives and strategic direction of the policy began.

The next step is the elaboration of the policy document, which covers the core principles of the policy, its objectives, strategies, and specific implementation programs. Each policy document has to undergo in-depth deliberation and approval by the government before it is widely disseminated and promoted to the public.

And the final implementation and monitoring of the policy is a concerted effort involving government departments, local communities, and all stakeholders. To ensure the successful promotion of the policy, the government needs to provide key resources and support, such as training, technical introduction, and financial assistance. In addition, a rigorous monitoring and evaluation mechanism is also key to ensuring the effectiveness of the policy, making sure that each step is taken in a sound and meaningful manner.

In the implementation of this policy, the Government of Botswana, in order to enhance women's participation and progress in agriculture, has adopted multiple effective strategies that are geared towards ensuring that women are more empowered in the four dimensions of production, processing, transport, and consumption of the food system.

1. In order to enhance women's effectiveness in agriculture, the government has implemented training and skills transfer measures. This covers not only farming techniques but also management and marketing skills. By providing women with these critical skills, their effectiveness in food production and processing has increased significantly, thereby enhancing the overall growth of the agricultural sector and the country's food security.

2. The Government of Botswana has also provided loans and other financial assistance to women to assist them in their agricultural endeavors and to break down the financial barriers to their entry into the agricultural sector. This financial support not only incentivizes women to play a greater role in food processing and marketing but also has a positive impact on food security and economic growth in the country as a whole.

3. Gender is mainstreamed as a core policy in Botswana to ensure the full participation of women in all aspects of agriculture. This means that women's perspectives and needs are valued and integrated into agricultural policy and decision-making. This strategy has not only advanced gender equality in agriculture but has also brought about substantial contributions to the progress of agriculture and the economy as a whole.

4. Further, the government is committed to ensuring that women's rights and interests in land and assets are adequately safeguarded, their influence in decision-making is

enhanced, and their leadership skills are strengthened. These efforts have ensured that women enjoy their rightful place and rights in food production, further solidifying food security.

5. The government has also strengthened rural infrastructure and public services, such as roads, water supply, and sanitation, with a view to further enhancing the efficiency of women's participation in agriculture and their quality of life. Such improvements have not only provided women with the productive resources they need but have further strengthened their role in the transport and consumption of food, playing a key role in the growth of the agricultural sector and the economy as a whole.

Overall, the Government of Botswana has adopted an all-encompassing strategy that includes skills training, financial assistance, gender policies, land rights protection, and infrastructure improvements to ensure the full participation and development of women in every critical aspect of the food system. These measures have not only contributed significantly to agricultural and economic development but have also had a profound impact on food security and gender equality.

**Participants:**

1. Government: As a central policymaker and implementer, the government has an important role in shaping and advancing policies on women and gender equality. In order to achieve sustainable agricultural development and ensure food security, the government has implemented a number of key measures aimed at promoting the greater participation and development of women in the agricultural sector.

2. Non-governmental organizations (NGOs): NGOs play an indispensable role in the

promotion of women and gender equality issues, whether by providing direct services, expanding publicity and education, monitoring government policies, or actively assisting the government in the formulation and implementation of relevant policies.

3. United Nations agencies: A number of United Nations agencies have also demonstrated their key role in helping the government shape and implement policies on women and gender equality, and the technical support, professional research and evaluation, and financial assistance they provide are all indispensable.

4. Other international organizations: In addition to the UN, many international organizations have also made active efforts towards women and gender equality, and they have provided strong support for this topic in terms of technical assistance, research and evaluation, and financial support.

In addition to the participants mentioned above, farmers themselves are key players in decision-making. As direct practitioners of agricultural production, their participation is key to ensuring agricultural sustainability and food security. In order to achieve this, governments and organizations need to provide training, technical support, and financial support to better facilitate farmers' participation and capacity development.

There are many challenges in advancing policies and programs for women and gender equality, especially when considering the critical role of women in the food system.

Below are some of the main difficulties and strategies to address them:

1. Cultural and social perceptions: Many communities and families still have stereotypical perceptions and prejudices against women. This often leads to the marginalization of women in the family and society and affects their participation in all



aspects of food production, processing, transport, and consumption. To overcome this dilemma, governments and organizations need to step up their advocacy and education efforts to emphasize women's key role in the food system and deepen the general public's understanding of gender equality.

2. Funding and resources: Empowering women in the food system and ensuring food security requires significant investment in funding and resources. In order to implement policies effectively, governments and organizations need to not only identify and secure stable sources of funding but also ensure that these funds are dedicated to women's empowerment, particularly in key parts of the food system.

3. Legal and policy frameworks: Having well-developed legal and policy frameworks is fundamental, but it is even more critical to ensure that these laws and policies truly support and safeguard women's rights and interests in the food system. To this end, strengthening the monitoring and evaluation of women's rights and interests and ensuring that the relevant laws and policies are substantively implemented and have a positive impact on the food system are crucial aspects.

In addition to measures in agriculture, the Government of Botswana has implemented other gender equality strategies that emphasize women's empowerment in order to promote overall gender equality in society. While these strategies may not directly target the agricultural sector, it is important to recognize that society is an organic whole, and progress in each part has a positive impact on the whole. However, this is beyond the focus of this paper, so we will only provide a brief overview here.

**Other projects implemented by this policy are:**

- Women's health
- Women's education and skills training
- Women's participation in political and public life
- Women's participation and development in the economic sphere
- Women's rights in social security and welfare
- Women's rights in law and justice
- Women's rights in media and information
- Women's rights in the environment and climate change

1. Measures for women's health The Government of Botswana recognizes that health is a fundamental right of every citizen. In order to promote women's health, the government not only provides primary health care services but also actively engages in health education. Through the gender mainstreaming policy, women's status in health care has been enhanced, especially in health decision-making, health literacy, and skills training. These measures aim to ensure that women are able to make informed choices for their own health and that of their families.

2. Education and skills training for women Education is the key to changing lives. The Government of Botswana is committed to providing women with a wide range of education and skills training opportunities, from basic to tertiary education. In agriculture, the government provides women with specialized skills training that covers modern farming techniques, agricultural management, and marketing skills. In addition, the government provides financial support, such as loans and scholarships, to women to help them become more successful in the agricultural sector.

3. Women's participation in political and public life Political participation is an important way of ensuring citizenship rights. The Government of Botswana has put in place a number of measures aimed at increasing women's representation and participation in political and public life. These measures include providing leadership skills training for women, increasing opportunities for their participation at the political decision-making level, and ensuring that public policies take into account the needs and perspectives of women.

4. Women's participation in the economic sphere Economic independence is crucial for women. The Government of Botswana ensures that women are given equal opportunities in the economic sphere through the provision of training, skills transfer, and financial support. The gender mainstreaming policy further ensures that women are included in economic decision-making so that their contributions are recognized and valued by society.

5. Social rights and welfare In a number of areas, such as social security, law, media, the environment, and climate change, the government of Botswana has put in place measures to ensure that women's rights are upheld. The objective of these measures is to ensure that women have equal access to social protection, access to information, participation in environmental decision-making, and justice in lawmaking and implementation.

6. Women's rights in law and justice The law is the cornerstone of social justice. The Government of Botswana has emphasized women's rights in the area of law and justice, including the provision of a gender-sensitive legal framework, guaranteeing women fair

access to the justice system, and enhancing women's legal literacy through various training and education.

7. Women's rights in media and information In the information age, the right to access and share information has become particularly important. The Government of Botswana has taken a number of measures to achieve this, including promoting gender-sensitive legal frameworks and policies, increasing women's access to justice, and improving women's legal literacy. The government has also implemented a gender mainstreaming policy to ensure that women's perspectives and needs are taken into account in all areas of law and justice.

8. Women's rights in the environment and climate change

The Government of Botswana is committed to promoting women's rights in relation to the environment and climate change. In order to achieve this, the government has taken various measures, including promoting women's participation in environmental decision-making, increasing women's access to natural resources, and improving women's environmental literacy. The government is also implementing a gender mainstreaming policy to ensure that women's perspectives and needs are taken into account in all areas of environmental policy and decision-making.

### **Second case: Female Horticulturist Empowerment Project**

The project aims to promote food security and poverty alleviation by improving the production skills and business linkages of women gardeners, improving water management and irrigation facilities, promoting the marketing and commercialization of women gardeners' produce, and enhancing the social status and participation of

women gardeners. The implementation steps of the project include the provision of training and technical support, the establishment of market channels and business linkages, the improvement of water management and irrigation facilities, policy advocacy, and community mobilization.

**The key elements of the project include the following:**

Firstly, the project focuses on empowering women in production. Through the provision of training and technical support, women gardeners have not only acquired better production skills and knowledge such as planting techniques, land management, fertilizer use, and pest control, but have also gained an understanding of market demand and business models through business skills training. This has enabled them to better market and commercialize their produce and connect directly with the consumer side of the food system.

Secondly, at the processing and marketing end of the chain, the project further strengthened women's empowerment by establishing market channels and business linkages. Connections to commercial organizations and market channels enable women gardeners to sell their produce to a wider market, thereby increasing the value added and profitability of their produce. Policy advocacy and community mobilization have ensured that women's status in the food system has been elevated, enhancing their self-identity and self-confidence and enabling them to become more active in business.

Thirdly, taking into account the sustainability of the production aspect, the project focused on improving water management and irrigation facilities. This not only increased the productivity and output of female gardeners but also ensured the

sustainable use of water resources, which are critical in food production, through water-saving techniques and training in water management.

Overall, the project achieved its goal of promoting food security and gender equality by empowering and positioning women in all four aspects of the food system: production, processing, marketing, and consumption. The various implementation steps of the project, including the provision of training, the establishment of market channels, improved water management, and policy and community advocacy, directly reflect the importance of greater female empowerment in ensuring food security and advancing gender equality.

**The various participants in the project and their roles include:**

1. Women gardeners: as the main beneficiaries and participants in the project, they have improved their economic status and social standing by acquiring better production skills and business contacts.
2. Government departments: responsible for formulating and implementing policies, providing technical support and financial backing, and facilitating the smooth implementation of the project.
3. NGOs and community-based organizations: promote the participation and social status of women gardeners through community mobilization and participation.
4. Business organizations and market channels: Provide sales channels and business contacts to facilitate the sale and commercialization of the products of women gardeners.

**Challenges experienced in the implementation of the project:**

**1. Inadequate financial and technical support:** Lack of financial and technical support limited the scale and potential impact of the project. When women have access to adequate financial and technical support for the production, processing, transport, and consumption of food systems, they will not only be able to improve food production and quality but also provide better food security for their families and communities. Providing more financial and technical support will be an important step in promoting women's participation and improving food security.

**2. Challenges of water resource management:** Inadequate water resources and irrigation facilities limit the productive capacity of women gardeners. Providing women with adequate water resources can increase their empowerment and efficiency in food production, thereby contributing to overall food security. Improving the efficiency of water resource management and irrigation facilities is key to ensuring a greater role for women in the food system.

**3. Market access issues:** Lack of market demand and business linkages limit business opportunities for women gardeners. By ensuring that women can easily access markets and connect with business partners, we can not only improve their economic status but also ensure that food is consumed in a wider area, thereby increasing food security.

**4. Social and cultural constraints:** Gender discrimination and social status constraints affect the project participation of women gardeners. When we support women at the social and cultural level and encourage them to play a greater role in the food system, we not only promote gender equality but also ensure a more robust and secure food system. Confronting gender discrimination and improving the social status of women

are core measures to promote food security and gender equality.

### **Results:**

The report reveals that although the project was initially designed to improve the livelihoods and food security of women gardeners by empowering them in the four dimensions of the food system: production, processing, transport, and consumption, the results have not been as significant as expected. This is mainly because the broader social and political contexts in which the project was implemented were not adequately addressed and taken into account. These contexts, particularly the deep-rooted issues related to gender norms and power structures, have a significant impact on women's participation and empowerment in all aspects of the food system. The importance of our hypothesis is confirmed by the extent to which gender norms and power relations shape women's lives and livelihoods in places such as Botswana. Therefore, any project aimed at strengthening women's rights and interests in agriculture should, in order to be truly effective, consider and address these structural issues in depth and adopt more refined and targeted strategies.

### **b) Ethiopia**

#### **First case: Integrated Basic Social Services with Social Cash Transfer (IN-SCT)**

##### **Pilot Programme**

This is a project that focuses on improving the livelihoods and food security of rural households in Ethiopia, and its implementation involves a combination of forces, from the government to NGOs, from community leaders to direct beneficiary households.

The project has a special focus on women's empowerment. In practice, it ensures that



women participate fully and enjoy the benefits. For example, women's workload on public works projects was reduced by 50 percent to enable them to focus more on their families and children. Moreover, women are encouraged to participate in the planning and decision-making of public works projects, which not only strengthens their voices in the family but also enhances their status in the community. This approach ensures women's rights and promotes equality and harmony within the family and the community.

The core project component is cash payments, whereby family members participate in public works to receive these payments. These projects, such as road construction, water management, and land conservation, not only provide employment opportunities for rural residents but also bring them better infrastructure and services, which directly improve their quality of life. These cash payments, in turn, further assist households in addressing livelihood challenges such as food shortages.

The project also provides livelihood support to families through specialized training and skills upgrading courses. From agricultural production to farming, from handicraft production to other specialized skills, these trainings are designed to help families increase their income and further strengthen their economic independence.

Basic social services are also included in the program, which include health care and education services. These services aim to improve the health status and education level of family members, thereby opening up more employment opportunities for them. To further support the participation of family members, the project also provides childcare services to ensure that families are able to fully engage in their livelihoods.

### Key Steps:

The IN-SCT pilot program has strongly supported women's rights and interests in all aspects of the production, processing, transport, and consumption of the food system through a series of practical measures. First, for women workers in public works, the program proposes to reduce their workload by 50 percent. This strategy is clearly designed to ensure that women can balance their family and professional responsibilities in the production chain, an arrangement that is particularly crucial for pregnant and breastfeeding women, who are better able to participate in the production and processing chain with shorter working hours and lighter tasks.

Secondly, encouraging women to play a leading role in public works projects is a positive recognition of their rights and interests in the transport and consumption chains. Women occupy half of the representative seats in the working groups and recommendation committees in the Kebele watershed, giving them a greater voice in strategic decisions on the transport, distribution, and consumption of food.

Going a step further, the program has set a target of encouraging women to take up leadership and supervisory positions in public works projects, which not only enhances women's positions in the production and processing chains but also promotes their ownership of the transport and consumption chains. Their leadership and exemplary behavior have undoubtedly encouraged and motivated other women.

In addition, the introduction of the "client card" tool ensures equal access to financial resources for couples at the household level and emphasizes the irreplaceability of women in household consumption decisions. Such measures give women greater

control and decision-making power in the consumption chain of the food system.

Participants:

The IN-SCT Pilot Program received active participation and support from multiple stakeholders in its implementation. First and foremost was the government agency as the main pillar of the program, which not only provided a critical injection of funds for this purpose but also a solid policy endorsement. The government is committed to crafting and promoting a long-term policy aimed at promoting gender equality and inclusive development. As part of this vision, the Ethiopian government introduced the Productive Safety Net Programme (PSNP) in 2005 to address chronic and temporary food shortages in the country, and the IN-SCT Pilot Programmes, as a further expansion of this set of strategies, were integrated into the fourth phase of the PSNP, PSNP4.

At the same time, non-governmental organizations (NGOs) and community leaders are an integral part of the process. These organizations and individuals acted as bridges and links throughout the program, reaching out to the grassroots and mobilizing and guiding community members to participate and become deeply integrated into the program. More importantly, they strive to enhance community understanding and recognition of the program and work hand in hand with beneficiary families to ensure that they receive genuine assistance, such as opportunities for public works projects, as well as cash transfers and other welfare services provided by the program, which have indeed improved their quality of life.

On the other hand, beneficiary families are not only direct beneficiaries of the program but also key participants in its successful implementation. They not only participate in

public works projects but also make more active use of the cash support and other services provided by the program to improve their living conditions. In addition, the program provides these families with a comprehensive range of training and courses covering nutrition, agricultural skills, gender awareness, health literacy, financial management, and so on. In order to ensure the comprehensive development of the families, the program also provides some basic social benefits, such as medical and educational services, and even takes into account the young children in the families by providing them with child care services.

Overall, the program is the result of a multi-stakeholder effort and synergy in which every stakeholder has played an irreplaceable role, and together they have contributed to the development and progress of Ethiopia.

#### Challenges:

One of the main challenges faced by the program is the entrenched gender norms and power dynamics within the household and community. Women often have limited decision-making power and face barriers to participation in public life. To address this challenge, the program has taken several measures to promote women's participation and decision-making power, such as providing childcare at public works sites and encouraging women to participate in the planning and decision-making process. The program also provides training and skills development opportunities to help women increase their income and improve their economic status.

Another challenge faced by the program is to ensure that the benefits are distributed fairly and equitably among all members of the beneficiary households. To address this

challenge, the program sets targets for women to take up leadership and supervisory positions at public works sites and encourages husbands and wives to have equal access to and control over the use of transferred funds. The program also provides training and support to help women develop confidence and assertiveness in public life.

#### Results:

Relying on this program has significantly strengthened women's agency and decision-making power in the family. Women's roles in all parts of the food system were strengthened through deeper ownership of household resources and active participation in decision-making and public life. Increased holdings of resources, such as livestock and home gardens, allow women to play a more critical role in the food production and processing chain, thereby advancing food security. In addition, their active voice in public gatherings reflects the strengthened position of women in the consumption and transport segments of the food system.

From an economic perspective, the program has already had a positive impact on women's economic status. Not only are women more likely to own and profit from livestock, but they are also more likely to run their own businesses or obtain loans, thus playing a greater role in the production and processing chain of the food system. However, with regard to certain economic indicators of income and expenditure, the program has not yet shown a statistically significant impact.

Moreover, the report notes that there is no significant difference between the two groups in terms of the proportion of women receiving antenatal care or giving birth in a health facility. This may be due to the fact that these two indicators were already quite high in

the two groups, at 94 percent and 92 percent, respectively.

Unexpectedly, the study also revealed an extra-intuitive finding. The comparison group was actually four percentage points ahead on the indicators "received iron supplements during pregnancy" and "visited a health center." Although the researchers examined whether this was due to a lack of health posts in the Kebele region, where some of the women were located, the facts do not support this hypothesis.

In conclusion, while the pilot project succeeded in empowering women more in some areas, it was less effective on other key indicators. Moreover, there are still areas where the program can be optimized. In order to advance women's empowerment more deeply, the program should further focus on and address the difficulties and constraints that women encounter when participating in public affairs and accessing resources.

### **Second case: Promoting Gender Equality for Food Security in Ethiopia**

"The Ethiopian Women's Empowerment for Food Security Project (EWEFSP) is a joint project of the Food and Agriculture Organization of the United Nations (FAO) and the Government of Ethiopia aimed at enhancing women's capacity and opportunities in agricultural production and market access to promote food security. The objective of the project is to improve household and community food security by enhancing women's agricultural production capacity and skills and increasing their participation in the agricultural value chain.

The main elements of the project are as follows:

1. Enhancement of women's agricultural production capacity and skills: The project helps women acquire modern agricultural technology and management skills through

the provision of technical assistance and training to enhance their agricultural production capacity and efficiency. Specific measures include:

providing training in agricultural technology and management, such as planting techniques, fertilizer and pesticide use, irrigation techniques, packaging, and processing of agricultural products.

providing agricultural production materials and equipment, such as seeds, fertilizers, pesticides, irrigation equipment, etc.

Support agricultural production organizations and farmers' cooperatives to increase the efficiency and scale of agricultural production.

2. Increasing women's participation in agricultural value chains: The project increases women's position in the market and their income by improving their access to the market. Specific measures include:

providing training in market access, such as market research, product pricing, and marketing skills.

supporting the processing and packaging of agricultural products to increase the added value of the products.

supporting sales and marketing of agricultural products, such as exploring new markets and establishing sales networks.

3. Improvement of rural infrastructure and services: The project improves women's quality of life and social status by improving infrastructure and services such as roads, water sources, and sanitation facilities. Specific measures include:

Improving rural roads and transport to enhance the efficiency of transporting

agricultural products and access to markets

Improving water sources and irrigation facilities to increase the efficiency and scale of agricultural production

Improving sanitation facilities, such as the provision of toilets and hand-washing facilities, to improve women's hygiene and quality of life

Provide financial services and technical assistance to help women start and develop their own agricultural businesses.

4. Improvement of women's social status and participation: The project enhances women's role and influence in agricultural production and community development by improving their social status and participation. Specific measures include:

supporting women's organizations and women farmers' cooperatives to increase women's social mobilization and participation.

providing gender equality training and education to enhance women's awareness and capacity.

formulating gender equality policies and regulations to safeguard women's rights and interests.

Overall, the project aims to enhance women's capacity and opportunities in agricultural production and market access, thereby contributing to food security and women's empowerment. Through a variety of measures, such as improving women's agricultural production capacity and skills, increasing their participation in agricultural value chains, improving rural infrastructure and services, and enhancing women's social status and participation, the project has contributed positively to promoting food security and



women's empowerment in Ethiopia.

#### Participants:

Various participants, including the Ethiopian government, local community-based organizations (CBOs), farmers' cooperatives, women's organizations, and international organizations (e.g., FAO), have played important roles in the implementation of the project.

1. Food and Agriculture Organization of the United Nations (FAO): As the main implementing agency of the project, FAO is responsible for planning, implementing, and monitoring the project, providing technical assistance and policy support, and coordinating the cooperation of all parties to facilitate the smooth implementation of the project.

2. the Government of Ethiopia: as the main partner of the project, the Government of Ethiopia is responsible for providing policy support and resources, coordinating the cooperation of all parties, and facilitating the smooth implementation of the project.

3. women's organizations and women farmers' cooperatives: as the main beneficiaries and participants of the project, women's organizations and women farmers' cooperatives are responsible for organizing and mobilizing women's participation in the project and providing feedback and suggestions to facilitate the smooth implementation of the project.

4. International partners: the project has received financial and technical support from international partners such as Belgium, the Netherlands, Sweden, and Switzerland, who are responsible for providing financial and technical assistance to assist FAO and the

Ethiopian government in implementing the project.

Challenges and strategies to address them:

1. Limited access to resources: Women often have limited access to land, credit, and other resources needed for agricultural production. Strategies to address this challenge include providing women with access to credit, land, and other resources and promoting gender-sensitive policies and legal frameworks.

2. Limited participation in decision-making: Women are often excluded from decision-making processes related to agriculture and climate change. Strategies to address this challenge include promoting women's participation in decision-making processes, providing gender-sensitive training and education, and promoting gender-sensitive policies and legal frameworks.

3. Limited access to markets: Women often have limited access to markets and face gender-specific barriers to participation. Strategies to address this challenge include promoting women's participation in value chains, providing gender-sensitive training and education, and promoting gender-sensitive policies and legal frameworks.

4. Limited access to technology and information: Women often have limited access to the technology and information needed for agricultural production and adaptation to climate change. Strategies to address this challenge include providing women with access to technology and information, promoting gender-sensitive training and education, and promoting gender-sensitive policies and legal frameworks.

Outcome Evaluation:

1. Increased access to resources: The project helped women gain access to land, credit,

and other resources needed for agricultural production. For example, the project provided training on land rights and helped women form cooperatives to access credit and other resources.

2. Increased agricultural productivity: The project helped women increase agricultural productivity through training on climate-smart agricultural practices such as soil conservation, water management, and crop diversification. As a result, women are able to increase crop yields and improve food security.

3. Income generation and economic empowerment: The project helped women increase their income and economic empowerment through training in value chain development and market access. For example, the project helped women form cooperatives to sell their products and access markets.

4. Improving gender equality and women's empowerment: The project contributes to improving gender equality and women's empowerment by promoting women's participation in decision-making processes and providing gender-sensitive training and education. For example, the project helped women form self-help groups to discuss and address issues of gender-based violence.

### **c) Kenya**

#### **First case: Women Economic Empowerment Strategy 2020-2025**

Issued by the Kenya Public Service and Gender Sector, the project is a policy document developed by the Government of Kenya to promote women's economic empowerment and achieve sustainable development. The strategy seeks to promote gender equality and economic growth by increasing women's participation in the economic, social, and

political spheres.

The components of the strategy include the following:

1. Policy framework: The strategy proposes a number of policy frameworks, including:

Promoting women's participation in the economy: Promote women's participation and empowerment in the economy through the provision of financial services, technical training, market access, entrepreneurship support, etc.

Increasing women's participation in decision-making: Increase women's participation in political, economic, and social decision-making by promoting women's leadership, strengthening the collection and analysis of gender statistics, and strengthening the fight against gender discrimination.

Strengthening the collection and analysis of gender statistics: Improve the monitoring and evaluation capacity of women's economic empowerment through the establishment of a mechanism for collecting and analyzing gender statistics.

Promote education on gender equality and anti-sex discrimination. Promote social change and ideological transformation by strengthening education on gender equality and anti-sex discrimination.

2. Economic empowerment: The strategy proposes a series of measures to promote female empowerment in the economic sphere. These measures include:

Provision of financial services: Provide financial services and financing support through the establishment of financial institutions and financial products to promote women's participation and empowerment in the economic sphere.

Technical training: To enhance women's capacity and competitiveness in the fields of

science, technology, and innovation through the provision of technical training and technical support.

Market Access: Promote women's participation and empowerment in the market economy by enhancing market access and market information delivery.

Entrepreneurship support: Promote women's entrepreneurship and innovation through the provision of entrepreneurship training, entrepreneurship guidance, and entrepreneurship support to enhance women's status and influence in the economy.

3. Social Empowerment: The strategy proposes a series of measures to promote women's empowerment in the social sphere. These measures include:

Enhancement of women's status in education, health, family, and community:

Enhancement of women's status and influence in the family and community by strengthening support for women's education and health

Strengthening the fight against gender-based violence and sexual harassment: protecting women's rights and safety by strengthening the fight against and prevention of gender-based violence and sexual harassment

Promoting women's leadership: Promote women's leadership and women's social influence by increasing women's participation and empowerment in leadership positions.

4. Political empowerment: The strategy proposes a series of measures to promote women's empowerment in the political arena. These measures include:

Increasing women's participation in political decision-making: To increase women's participation and empowerment in political decision-making by strengthening support

and encouragement for women's political participation.

Promoting women's leadership: Promoting women's leadership and women's political influence by increasing women's participation and empowerment in leadership positions

Strengthening the fight against gender discrimination: protecting women's rights, interests, and status in the political arena by strengthening the fight against and prevention of gender discrimination.

5. Monitoring and Evaluation: The strategy proposes a series of measures to monitor and evaluate the progress of women's economic empowerment. These measures include the establishment of a mechanism for collecting and analyzing gender statistics, the development of gender equality indicators, and the conduct of gender impact assessments. Among them, the establishment of a mechanism for collecting and analyzing gender statistics is to collect and analyze data on women's economic empowerment in order to better understand the status and needs of women in the economic sphere. The development of gender indicators is to ensure that the government takes into account gender equality considerations in the implementation of policies and programs. Gender Impact Assessments (GIAs) are conducted to assess the impact of policies and programs on women in order to better understand the effectiveness of policies and programs and to provide guidance for future policies and programs. By monitoring and evaluating the progress of women's economic empowerment, the government can make informed decisions and adjust policies and programs to better meet women's needs.

### Participants:

The implementation of the strategy requires the cooperation and support of all parties, including the government, civil society organizations, development partners, and the private sector, among others. Governments need to strengthen policy formulation and regulation and provide the necessary resources and services to promote gender equality and women's empowerment. Civil society organizations need to strengthen their support and services for women and promote social change and ideological transformation. Development partners need to provide financial and technical support to promote women's economic empowerment and sustainable development. The private sector needs to strengthen its support and cooperation with women to promote economic growth and social responsibility.

### Challenges and Solution Strategies:

The challenges faced by women in achieving economic empowerment are numerous and complex. Some of the key challenges identified in the strategy include:

1. Lack of financial and technical support: Many women do not have access to the financial and technical resources needed to start and grow their businesses. This can make it difficult for them to compete in the marketplace and achieve economic success.
2. Lack of policy and legal protection: Women may face discrimination and other barriers to economic success due to inadequate policy and legal protection. This can make it difficult for them to access resources and opportunities and limit their ability to participate fully in the economy.
3. Cultural and social constraints: Women may face cultural and social barriers that

limit their ability to participate in the economy. These constraints may include gender stereotypes, social norms, and other cultural factors that make it difficult for women to succeed.

4. Gender discrimination and violence: Women may face discrimination and violence in the workplace and other areas of life. This can make it difficult for them to succeed economically and limit their ability to participate fully in society.

To address these challenges, the Women's Economic Empowerment Strategy 2020-2025 proposes a range of solutions, including

1. Strengthening policy and regulatory frameworks: The strategy calls for policies and regulations that support women's economic empowerment and protect women's rights.

This includes measures to promote gender equality, eliminate discrimination, and provide legal protection for women.

2. Provide necessary resources and services: The strategy recommends the provision of financial and technical resources to support women's economic empowerment. This includes the provision of credit, training, and other resources to assist women's entrepreneurship and development.

3. Promote gender equality and women's empowerment: The strategy emphasizes the importance of promoting gender equality and women's empowerment in all areas of society. This includes measures to promote women's participation in decision-making, increase their access to education and training, and promote their rights and freedoms.

4. Support and services for women: The strategy calls for the provision of support and services for women, including counseling, legal aid, and other forms of support to help



women overcome the challenges they face.

5. **Strengthening Partnerships and Cooperation:** The strategy highlights the importance of partnerships and cooperation among various stakeholders, including government, civil society organizations, development partners, and the private sector. This includes measures to promote cooperation and coordination among these stakeholders to support women's economic empowerment.

### **Second case: Smallholder Horticulture Empowerment Project (SHEP)**

The Smallholder Horticulture Empowerment Project (SHEP) is a project implemented by the Japan International Cooperation Agency (JICA) to improve the management efficiency, productivity, and incomes of smallholder horticultural farmers' organizations in Kenya, thereby promoting gender mainstreaming.

The key components of the project include the following:

1. **Provision of technical training and support:** The SHEP project helps women farmers improve their agricultural productivity and management capacity by providing technical training and support. The training includes planting techniques, irrigation techniques, fertilizer use, pest control, and disease control. In addition, the project provides agricultural production materials and equipment, such as seeds, fertilizers, and agricultural tools, to help women farmers improve their productivity.

2. **Provision of financial and technical support:** The SHEP project helps women farmers obtain better land tenure and agricultural production materials by providing financial and technical support. The project provides loans and subsidies to female farmers to help them purchase land, seeds, fertilizers, and other means of agricultural production.

In addition, the project provides technical support, such as irrigation systems, greenhouses, etc., to help women farmers improve their productivity.

3. Improvement of social status and participation of women farmers: The SHEP project promotes gender equality and mainstreaming by improving the social status and participation of women farmers. Through training and support, the project helps women farmers improve their agricultural productivity and management capacity, thereby enhancing their status and influence in their families and communities. In addition, the project increases women farmers' participation and decision-making power by organizing women farmers' participation in decision-making and management, such as by organizing women farmers' associations and training women farmers to become agricultural technicians.

4. Promotion of gender mainstreaming: The SHEP project promotes sustainable agricultural production and socio-economic development through the promotion of gender mainstreaming. The project promotes gender equality and mainstreaming by conducting gender analyses, formulating gender policies, and promoting gender awareness. In addition, the project promotes the concept and practice of gender equality and mainstreaming through collaboration with the government, NGOs, and other stakeholders.

Participants:

1. Ministry of Agriculture, Livestock, and Fisheries (MoALF):

Kenya's Ministry of Agriculture, Livestock, and Fisheries (MoALF) developed a gender mainstreaming strategy and requested JICA implement the SHEP project. The

Ministry plays a crucial role in promoting gender-responsive policies and programs in agriculture.

2. Japan International Cooperation Agency (JICA):

JICA is the implementing agency for the SHEP project. They have been working closely with the Ministry of Agriculture and Rural Development (MoARD) to improve the management efficiency, productivity, and income of smallholder horticultural groups.

3. District Extension Workers:

The project aims to improve the institutional capacity of the Ministry of Agriculture, Livestock, and Fisheries (MALF) and District Extension Workers (DELWs) to utilize the Gender Mainstreaming Package (GMP) more effectively. Active human resource development efforts such as workshops and training programs have been undertaken to apply GMP to smallholder support projects.

4. the World Bank, the Food and Agriculture Organization of the United Nations (FAO), and other organizations:

In order to assess the effectiveness of GMPs, the SHEP project collaborated with other agricultural projects implemented by the World Bank, FAO, and other organizations.

Baseline and endline surveys were conducted to assess the quantitative effects of GMPs.

5. Smallholder horticultural farmers:

The SHEP project focused primarily on improving the capacity of smallholder horticultural farmers (both women and men). The project aims to improve their management efficiency, productivity, and income, thereby improving their livelihoods.

6 smallholder producers of other agricultural products:

The Ministry of Agriculture and Rural Development requested that JICA implement the SHEP project not only among horticultural smallholders but also among small producers of other agricultural products. The objective was to establish a gender mainstreaming approach within the Ministry and extend it to different agricultural sectors.

Challenges and solutions:

Challenges

1. Limited access to credit and financial services:

Smallholder farmers, especially women, face difficulties in accessing credit and financial services, which hampers their ability to invest in their farms and increase productivity.

2. Limited access to markets:

Smallholder farmers often face challenges in accessing markets due to poor infrastructure, a lack of market information, and limited bargaining power.

3. Limited technical knowledge and skills:

Smallholder farmers, especially women, often lack technical knowledge and skills in modern agricultural practices, which limits their productivity and income.

Solutions

1. Access to credit and financial services:

The SHEP project provides smallholder farmers with access to credit and financial services through the establishment of revolving funds, loans, and grants. The project also provides financial management and entrepreneurship training to help farmers

manage their finances effectively.

## 2. Improved access to markets:

The SHEP project works to improve smallholder farmers' access to markets by providing training in market information and linkages, establishing market information centers, and supporting the formation of farmers' groups and cooperatives.

## 3. Improving technical knowledge and skills:

The SHEP project provided training to smallholder farmers, especially women, on modern farming practices such as crop management, pest control, and post-harvest handling. The project also established demonstration plots to showcase best practices and provide technical assistance to farmers.

## Results:

### 1. Increased productivity and income:

The SHEP project helped to increase the productivity and incomes of horticultural smallholder groups. The project provided training on modern farming practices such as crop management, pest and disease control, and post-harvest handling, helping farmers improve yields and product quality. The project also provided access to credit and financial services, enabling farmers to invest in their farms and expand their businesses.

### 2. Improving gender equality and women's empowerment:

The SHEP project promotes gender equality and women's empowerment by improving the management efficiency and productivity of women-led farmer groups. The project provides training to women farmers in leadership, management, and entrepreneurship to help them take a more active role in decision-making and management. The project

has also established women-led farmers' groups and cooperatives, which provide a platform for women farmers to voice their concerns and needs.

### 3. Enhanced institutional capacity:

The SHEP project enhanced the institutional capacity of the Ministry of Agriculture, Livestock, and Fisheries (MoALF) and District Extension Workers (DEM) to use the Gender Mainstreaming Package (GMP) more effectively. The project provided training on GMP and gender-responsive agricultural extension services to help MoALF and county extension officers apply GMP to smallholder support programs. The project also established a GMP Resource Center to provide manuals, checklists, and training modules for gender mainstreaming in smallholder support projects.

### 4. Improved market access:

The SHEP project improved smallholder farmers' access to markets by providing training in market information and linkages, establishing market information centers, and supporting the formation of farmers' groups and cooperatives. The project also facilitated the establishment of market linkages between small farmers and buyers, helping farmers obtain better prices for their products.

## **d) Uganda**

### **First case: Feed the Future All-In Project for Women's Empowerment in Agriculture**

Feed the Future All-In Project for Women's Empowerment in Agriculture is an innovative initiative to empower women smallholder farmers in Uganda. Funded by the United States Agency for International Development (USAID), the project is

implemented by the Feed the Future All-Innovation Laboratory on Markets, Risks, and Resilience in partnership with Makerere University, the Ugandan Ministry of Agriculture, Livestock, and Fisheries, and the University of Florida. The main objective of the project is to improve the livelihoods of women smallholder farmers in Uganda by increasing their agricultural productivity, diversifying their incomes, and reducing their vulnerability to agricultural shocks. Women are vital to Uganda's agriculture, contributing about 90 per cent of the country's food. However, they face many challenges, including limited access to land, credit and markets, as well as gender-based discrimination and violence.

The specific implementation steps of the project are as follows:

1. Conduct qualitative research: The project team first conducted qualitative research to gain an understanding of local perceptions of female empowerment and agricultural shocks through in-depth interviews with local women and men farmers, community leaders, policymakers and technicians. This helped the project team to better understand the needs and challenges of the local community, which guided the subsequent interventions.
2. Measuring women's empowerment: The project team used the pro-WEAI tool developed by the International Food Policy Research Institute (IFPRI) to measure women's empowerment. WEI measures women's empowerment in decision-making, control of resources, and use of time, while SEWA measures women's perceptions of their empowerment. The tool can standardise research on female empowerment and provide flexibility to adapt to local contexts.

3. Provision of drought-tolerant, nutrient-rich crop varieties and fertilisers: The project team provides women farmers with drought-tolerant, nutrient-rich crop varieties and fertilisers to improve crop yields and quality. These varieties and fertilisers are provided through a revolving fund to improve sustainability.

4. Training in climate-smart agriculture technologies and practices, business skills and gender-transformative approaches: The project team provides training to women farmers in climate-smart agriculture technologies and practices, business skills and gender-transformative approaches. These trainings aim to improve the skills and knowledge of women farmers to help them better cope with agricultural shocks and improve their incomes.

5. Emphasis on Gender Equality and Community Participation: The project emphasises gender equality and community participation, and the team encourages women to participate in the decision-making and planning process and to work with local governments and communities to develop and implement projects.

6. Monitoring and Evaluation: The project team regularly monitors and evaluates the progress and outcomes of the project to ensure that the project is achieving the desired results. The project team uses the pro-WEAI tool to track changes in women's empowerment levels and other indicators to measure the impact of the project, such as agricultural production, food security and nutrition, income and asset diversification.

Participants:

1. Principal Investigator: Florence Kyoheirwe Muhanguzi from Makerere University.



2. project partners: Ministry of Agriculture, Livestock and Fisheries, Uganda and Florida University for Development and Innovation (FUDI).
3. Target population: Women smallholder farmers in Alebtong and Insingiro districts of Uganda.
4. Community Leaders: Local community leaders play a critical role in the project by providing insight into the local context, needs, and challenges faced by women farmers.
5. policy makers: engaging with policy makers helps to ensure that the project is aligned with national agricultural policies and strategies.
6. technical staff: technical experts in the fields of economics, agriculture, social anthropology and gender studies contribute their expertise to the design and implementation of the project.
7. Male and female farmers: The project conducted qualitative research with male and female farmers to understand their perceptions of women's empowerment and the agricultural shocks they face.
8. USAID: The project was funded by the United States Agency for International Development (USAID) with a budget of \$450,000 USD.

#### Challenges and Solution Strategies:

1. Limited access to financial resources: Women smallholder farmers in Uganda often do not have access to financial resources, which limits their ability to invest in their farms and increase productivity. To address this challenge, the project provides women farmers with access to financial resources by offering a revolving fund for seed and fertiliser inputs.

2. Limited access to information and training: Women farmers in Uganda often do not have access to information and training on modern agricultural practices, which limits their ability to increase productivity and adapt to changing conditions. To address this challenge, the project trains women farmers in climate-smart agricultural technologies and practices, business skills, and gender-transformative approaches.

3. Gender-based constraints: Women farmers in Uganda face gender-based constraints that limit their ability to fully participate in agricultural activities and decision-making processes. To address this challenge, the project has a strong gender focus and seeks to empower women by increasing access to financial resources, improving agricultural practices and reducing vulnerability to agricultural shocks.

4. Limited community participation: Community participation is critical to the success of the project, but it can be challenging to engage all members of the community, especially women. To address this challenge, the project worked closely with local community leaders and policy makers to ensure that the project was aligned with national agricultural policies and strategies. The project also endeavours to increase women's participation in decision-making processes and community activities.

5. External factors: External factors such as climate change, market volatility and political instability may limit the impact of the project. To address this challenge, the project seeks to increase the resilience of women farmers by providing them with the skills and resources they need to adapt to changing conditions and shocks.

Evaluation:

While the project has had some positive impacts, such as increasing women's access to

financial resources, improving their farming practices, and reducing their vulnerability to agricultural shocks. However, there were some need limitations of the project.

One of the limitations is that the project's interventions may not be suitable for all women farmers, and some women farmers may face barriers to participation due to cultural or social norms. For example, some women may not be able to attend training programmes because of family responsibilities or may not have control over their land or the proceeds from the sale of the crops they grow.

Another constraint is that the impact of projects may be limited by external factors such as climate change, market volatility and political instability. These factors may affect the productivity and profitability of women farmers and limit their ability to benefit from project interventions.

### **Second case: Rural Women's Climate Adapted Agriculture Empowerment Project in Uganda**

The project is aimed at empowering women to respond to climate change by increasing their participation at the decision-making level and their economic independence. The project is implemented by the Government of Uganda, the United Nations Development Programme, NGOs, local communities, and women-led associations.

Implementation steps:

1. Establishment of women-led groups The project has established more than 1,600 women-led associations that collect personal savings of at least \$1 per week to form a pool of funds. Women can borrow funds from this pool and invest them in income-generating activities that address climate change. These associations also provide

technical and training support to help women understand the importance of land planning, agriculture, forestry, and soil and water conservation practices. They also help women implement these practices. By establishing these women-led groups, the project aims to empower women economically and increase their participation in decision-making processes.

2. Promotion of land planning, agriculture, forestry, and soil and water conservation practices. The project provides training and technical support to help women understand the importance of these practices and how to implement them. These practices include growing drought-resistant crops, adopting water-saving irrigation techniques, and using organic fertilizers.

3. Increasing women's participation in decision-making processes. The project provides training and support to help women understand their rights and responsibilities in decision-making processes and to encourage their participation. These decisions include land planning, agriculture, forestry, soil and water conservation practices, and income-generating activities. By increasing women's participation in decision-making processes, the project aims to promote gender equality and ensure that women's voices are heard in matters that affect their lives and livelihoods.

4. Promoting the use of clean energy. The project promotes the use of clean energy devices, such as solar lamps and energy-efficient cookers, to help women reduce their dependence on traditional fuels, improve energy efficiency, and reduce carbon emissions. By promoting the use of clean energy, the project aims to reduce deforestation and improve the health of women and their families, who are often

affected by indoor air pollution caused by traditional fuels.

5. Strengthening climate change adaptation and mitigation measures. The project provides training and technical support to help women understand the impacts of climate change and provide adaptation and mitigation measures. These measures include the cultivation of drought-resistant crops, the adoption of water-saving irrigation techniques, and the use of organic fertilizers. By promoting these measures, the project aims to increase the adaptive capacity of rural communities to climate change and reduce their vulnerability to its impacts.

6. Increasing women's economic independence. The project provides technical and training support to help women engage in income-generating activities such as animal husbandry and crop cultivation and processing. In addition, the project has established a fund from which women can borrow and invest in these activities. By providing these opportunities, the project aims to increase women's economic independence and improve their access to productive resources, thereby strengthening their voice. The project has empowered more than 250,000 women, who are now economically independent and able to generate an income of at least \$300 per month.

7. Strengthening gender equality: The project aims to strengthen gender equality by increasing women's participation in decision-making and economic independence. The project provides training and support to help men understand women's rights and responsibilities and encourage them to support women's participation and economic independence. By promoting gender equality, the project aims to create a more inclusive and equitable society where both men and women have equal opportunities

to participate in the development process. All women involved in the project participate equally in decision-making processes, policy formulation, planning, and management. Women's participation in needs assessment, project design, implementation, and evaluation contributed to improved project management.

#### Participants:

Participants in the project were predominantly rural women in Uganda, who formed 1,642 female-led associations, representing over 250,000 women. In addition, the project established strategic partnerships with several organizations to facilitate knowledge transfer and shared values and missions. Some of these organizations include the International Union for Conservation of Nature (IUCN), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the Food and Agriculture Organization of the United Nations (FAO). These partnerships have helped to strengthen the capacity of agencies and community groups to partner, collaborate, and participate in the project since its inception. In addition, the project has received support from the Government of Uganda and NGOs, as well as financial and technical support from international organizations such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF).

#### Challenges and solution strategies:

1. Limited access to financial resources: Many women in rural Uganda do not have access to financial resources, which limits their ability to invest in income-generating activities. To address this challenge, the project has established a self-sustainable fund to provide women with access to financial resources to invest in innovative, scalable,

and replicable activities that will drive action towards a low-carbon and highly resilient future.

2. Inadequate infrastructure: Poor infrastructure, such as limited water supply and irrigation systems, can constrain women's economic activities. To address this challenge, the project works with local and national governments to improve infrastructure, such as water supply and irrigation systems, to support women's economic activities.

3. Limited technical capacity: Many women lack the technical skills and knowledge needed to engage in income-generating activities that address climate change. To address this challenge, the project provided training and support to women to improve their technical skills and access to markets.

4. Gender inequality: Women in Uganda often face gender-based discrimination and have limited opportunities to participate in decision-making processes. To address this challenge, the project involves women in decision-making processes, policy formulation, planning, and management. Women's participation in needs assessment, project design, implementation, and evaluation contributed to improved project management.

Results:

The project achieved several positive results, including

1. Empowerment of women: The project empowered more than 250,000 women, who are now economically independent and have greater access to productive resources, thereby strengthening their voices.

2. Improved access to resources: Some 182,000 women now own and control the land they use. Nearly a quarter of a million women own property and earn at least \$300 per month.

3. Increased resilience: Women were empowered through a variety of measures to increase their ability to withstand the impacts of climate change. For example, as a direct result of the project, 218,294 women now have access to clean water.

4. Increased incomes: 253,644 women farmers earned income from value-chain agricultural production and marketing. 198,640 women improved household nutrition. 135 women's groups utilized beehives for honey harvesting, earning \$540,000 per year from honey sales.

5. Institutional strengthening: Insights from local women and men formed the basis for climate change adaptation and mitigation activities, increasing self-reliance and a sense of ownership of the results and strengthening the capacity of institutions and community groups to partner, work together, and participate in the project from its inception.

However, the project faced a number of constraints, including

1. Limited coverage: The project reached only a small percentage of rural women in Uganda, many of whom still lack financial resources, infrastructure, and technical capacity.

2. Sustainability: The long-term sustainability of the project is uncertain due to its dependence on external funding and support.

3. Gender inequality: Although the project has made progress in empowering women,



gender-based discrimination and limited access to decision-making processes persist in Uganda.

## **V. Comparative analyses and results**

### **1. Regression analysis versus case study**

The aim of this section is to compare the results of the regression analyses with the findings of the case studies, to distil more in-depth insights from them, and to inform future decisions and research.

#### **1. Gender, economic participation, and food security**

Regression analyses provide us with a result that is not as expected: there is a positive correlation between gender economic participation and food insecurity. This finding is a preliminary indication that even an increase in female participation in economic activities may not directly increase food security, and similar observations were made in the case studies.

From the eight case studies in four countries, the following trends were observed:

- Pay inequality: In all countries examined, women generally earn less than men, even in the same positions and with the same skills and experience. This pay inequality limits the economic resources that women bring to the household, thus affecting the household's ability to procure food.
- Lack of permanent job opportunities: Women tend to be more engaged in informal or short-term contract work, which usually does not provide a stable income or social security. As a result, even if women's labor force participation increases, they are still at risk of income instability and disruption due to the precarious nature of their work.
- Lack of social security: Women often do not have access to adequate social security benefits such as health care, retirement, and unemployment benefits due to their

participation in the informal sector or a lack of formal employment relationships. This makes them more vulnerable to food insecurity in the face of economic crises or other emergencies.

- Cultural and social contexts: In some social and cultural contexts, women's economic decision-making power is limited despite their economic participation. Even if they earn income, they may not be able to fully decide how to allocate and use these resources, which further increases the risk of food insecurity.

These observations clearly demonstrate that simply increasing female economic participation does not directly translate into household food security. In order to achieve this, the multifaceted problems faced by women, such as job insecurity, unequal pay, and a lack of social security, need to be addressed. This requires comprehensive measures by states and policymakers at the economic, social, and cultural levels to ensure that women not only better participate in the economy but also derive real benefits from it, which in turn increases household food security.

## 2. GDP per capita and food security

Regression analyses show a strong negative correlation between GDP per capita and food insecurity. This implies that a country's economic growth is strongly correlated with people's quality of life. This is consistent with a number of case studies, such as those in countries with sustained economic growth, where people generally enjoy a better quality of life, higher levels of education, and a more stable food supply.

## 3. Gender education and food security

The negative correlation between gender education and food insecurity is not

statistically significant. This may imply that education has a limited effect on preventing food insecurity. However, when we dig deeper into the case studies, particularly the eight cases in four different countries, we find some interesting patterns. First, education has a profound effect on women's roles in the household and society. In these cases, educating women was shown to empower them to better understand and utilize health information. For example, educated females were able to recognize the nutritional value of foods and choose foods that were more beneficial to family members. This is in contrast to their uneducated peers, who are more likely to choose less expensive foods with less nutritional value.

In addition, educated women perform better at managing household resources. For example, by learning and applying budgeting and planning skills, educated women ensure that their households are well supplied even in times of food shortages. In contrast, women who are not educated may be at greater risk of food shortages during these times.

Further, educating women also enhances their economic opportunities. For example, educated women are able to use their skills to enter higher-paying, more stable jobs. This not only improves their economic status but also increases their ability to buy more and better food for their families.

Another important observation is that educating women also plays a key role in changing perceptions and attitudes in the family and society. In some cultures, women may traditionally be seen as secondary members of the family, but educated women are more likely to challenge these perceptions and increase decision-making power in the

household. This means that they are more likely to play a decision-making role in food choices and consumption, ensuring food security for their families.

#### 4. Gross GDP aggregates and food security

Regression analyses point to a non-significant relationship between gross domestic product and food insecurity. This may mean that the overall size of a country's economy does not directly affect food security as much as its per capita level. This is consistent with the case studies, such as those of small, rich countries, like Botswana, that may perform better in terms of food security than large, poor countries.

#### 5. Consumer price index for food and food security

The consumer price index (CPI) for food is often used as a measure of the purchasing power of households for food. The results of regression analyses show a positive trend between the CPI for food and food insecurity, but this relationship does not reach the level of statistical significance. This reveals that while price is an important factor, there are far more elements that determine household food security.

The combination of cases allows us to explore this relationship further. It is true that price volatility can have a short-term impact on some households, causing them to face food shortages at particular times. However, this does not mean that price changes are the main cause of long-term problems with food security.

For example, in the case of a sharp rise in food prices, there are households that can rely on community support and government subsidies to tide them over. These establishments provide a buffer for food, allowing households to maintain a relatively stable food supply during periods of high prices.

Moreover, even if food prices remain relatively stable, household food security can still be threatened by rising unemployment and other socio-economic factors. This suggests that employment, income stability, and other macroeconomic factors are also important variables affecting food security.

In addition, there are rural-urban differences in the relationship between the consumer price index for food and food security. In some rural areas, households cope with food price fluctuations through subsistence farming activities, while urban households are more dependent on purchasing power and markets. As a result, the same price movement may lead to different responses in different geographical and economic contexts.

## **2. Revealing differences in implementation strategies across countries**

### **a) Kenya: Supporting women smallholder farmers for food security**

Kenya faces diverse agro-ecologies and numerous challenges. Geographically, Kenya's highlands and lowlands constitute a variety of agro-ecological zones, which makes the country rich in biodiversity and crop varieties. However, this also means that farmers have to be flexible in adapting their agricultural practices to different ecological environments.

Seasonal droughts are the biggest threat to Kenyan agriculture. Especially in the lowlands, crops are often damaged due to a lack of water, leading to serious threats to farmers' livelihoods. This climatic instability, coupled with increasing global climate change, makes the future of Kenyan agriculture uncertain.

In light of these challenges, the Kenyan government has developed several strategies to

improve agricultural productivity and address the threat of climate change:

1. **Women Farmers' Support:** In Kenya, women play a key role in agricultural production. They are not only responsible for day-to-day farm management but also play a central role in harvesting and subsequent processing. However, for too long, women farmers have been neglected in resource allocation, decision-making, and training. In order to redress this inequality, the Kenyan government has put in place a series of measures to ensure that women have access to adequate resources and training to improve their productivity and adaptability.

2. **Technological innovation and application:** The Government of Kenya attaches great importance to the dissemination and application of modern agricultural technologies. To this end, they have collaborated with a number of international agencies and research institutions to introduce a wide range of drought-tolerant and pest- and disease-resistant crop varieties. These new varieties have not only increased crop yields but have also reduced farmers' dependence on chemical fertilizers and pesticides, thereby reducing production costs. In addition, the government has launched a series of training programs on agricultural technologies to teach farmers how to better apply these technologies and increase the efficiency of agricultural production.

#### **b) Botswana: Targeted Solutions and Climate-Smart Agricultural Practices**

In Botswana, the production of cereal crops provides the main source of income for smallholder farmers, especially women. However, climate change, credit constraints, and a lack of modern agricultural knowledge constitute major obstacles to their productivity and food security. Against this background, the Government of Botswana

has implemented a number of strategies and programs aimed at enhancing the productive capacity of smallholder farmers, especially women, and ensuring food security.

First, the government has introduced a "revolving fund" strategy that emphasizes community management and targeted financial support. This strategy is particularly important for women, as it provides a mechanism for women to access essential agricultural inputs such as seeds and fertilizers, thereby enhancing their position and role in agricultural production. In addition, the strategy's community management model provides women with greater opportunities for participation, thereby strengthening their influence in community decision-making.

Secondly, the Government of Botswana's Climate-Smart Agricultural Practices Strategy focuses on increasing the resilience of agricultural systems, especially in the face of the challenges of climate change. This includes the promotion of conservation agriculture and the cultivation of drought-tolerant and nutritious crops. These practices not only enhance food security but also place special emphasis on the critical role of women in improving the nutritional intake of families and communities.

### **c) Ethiopia: Collective strategies for women's empowerment and food security**

Ethiopia's agricultural production system is significantly characterized by smallholder farming. In this context, women play a key role in food production. However, women's productive potential and decision-making power are limited by constraints on land rights, access to credit, and educational opportunities, coupled with cultural and social norms.



### 1. Women's resource access challenges:

In Ethiopia, although women play a central role in household and agricultural production, they encounter barriers to accessing key resources such as land, agricultural credit, and educational services. Land entitlements, in particular, are an issue where women are often excluded from rights due to traditional patterns of inheritance and distribution.

### 2. Women's empowerment and agricultural production:

In order to overcome the above challenges and achieve increased efficiency in agricultural production, Ethiopia has adopted targeted strategies to promote women's participation and empowerment. In particular, women have been provided with opportunities to share experiences, access credit, obtain production inputs, and participate jointly in decision-making by encouraging the formation of women's groups and cooperatives. This organized approach strengthens women's rights and interests in agriculture and gives them a platform to have a voice in the decision-making process.

### 3. Gender-sensitive agricultural extension services:

In addition, Ethiopia has adopted a gender-sensitive agricultural extension strategy that provides women with the expertise and skills needed to improve agricultural practices. Such women-specific services not only emphasize agricultural production methods, but more importantly, they open up more market opportunities for women and enable them to better integrate into the agricultural value chain.

## **d) Uganda: The Strategic Role of Community Participation and Female Empowerment in Food Security**

Uganda, a country at the center of Africa, provides us with a strong case study of how community participation works in the area of food security. This participation, and the empowerment of women within it, is a central element of Uganda's strategy.

In Uganda, food security in rural areas has received particular attention. Community-based organizations (CBOs), often made up of smallholder farmers, women's groups, and other local groups, have become the cornerstone of this topic. Not only do they work to improve agricultural practices to increase productivity, but they also emphasize the importance of ensuring food security at the local level. However, it is worth noting that these organizations face challenges of access to resources, capacity building, and lack of official recognition.

To address these challenges, Uganda has developed a range of strategies to strengthen community participation and increase their ownership. Among these, practices such as the establishment of community seed banks, the development of community irrigation systems, and the promotion of agroforestry are seen as key means of increasing local capacity. These community-based approaches all emphasize community ownership and aim to ensure the sustainability of food security measures.

More importantly, Uganda has clarified the key role of women in this process. By providing training and support to community-based organizations, especially for women's groups, Uganda hopes to increase the capacity of these organizations in agricultural practices, financial management, and organizational development.

At the same time, women's empowerment is seen as a key driver for food security. The training and support strategy not only works to increase the capacity of community-

based organizations but also aims to ensure women's participation and empowerment in this process.

Overall, the Uganda case study provides an in-depth perspective on how to effectively integrate community participation and female empowerment into food security strategies. This unique approach highlights the differences in strategies between Uganda and other countries, such as Ethiopia, particularly in terms of female empowerment and community participation.

### **3. Commonalities and strategic recommendations of successful cases and lessons from cases of poor results**

Key elements of successful female empowerment for food security programs in sub-Saharan Africa:

1. Gender sensitivity and female empowerment: Successful food security programs in sub-Saharan Africa are fully gender sensitive. Recognizing the particular needs and challenges faced by women in relation to food security, the program advances gender equality and ensures women's access to resources and participation in decision-making processes. This not only increases the effectiveness of food security programs but also contributes to the achievement of sustainable development goals, such as reducing poverty and increasing economic growth.

2. Community participation and ownership: The participation of local communities is an important component in achieving food security. They play a key role in program design and implementation, ensuring that programs are culturally appropriate and sustainable. For sustained success, communities not only need to be involved in

implementation, but they also need to play a role in the decision-making process, which helps build trust and ensures the success of the program.

3. Multi-sectoral cooperation and coordination: Food security is not only an agricultural issue but also involves many complex factors such as economics, health, and infrastructure. Successful food security programs require multisectoral cooperation and coordination, encompassing government, civil society, and the private sector. This integrated approach develops comprehensive and sustainable solutions to challenges such as poverty and gender inequality.

4. Application of innovation and technology: Innovation and technology play a vital role in improving food security. The application of new technologies and methods, such as drought-tolerant crop varieties, improved irrigation systems, and mobile communication technologies, not only increases agricultural productivity but also helps communities adapt to climate change and other environmental challenges. In addition, the adoption of renewable energy technologies and climate-smart agricultural methods has made an important contribution to ensuring food security.

Taken together, successful food security programs in sub-Saharan Africa bring together multiple components, from gender equality and community participation to multisectoral cooperation to the application of innovation and technology. These components reinforce each other and together provide a solid guarantee of food security in the region.

However, as we have seen in the previous case studies, there are also cases of poor results or many limitations, such as the National Policy on Gender and Development in

Botswana, where the project was implemented without sufficient attention to the broader social and political context in which it was situated, in particular the deep-rooted issues related to gender norms and power structures, which led to some of the interventions not being very effective. Therefore, complex social and political dynamics, especially in the context of deep-rooted gender inequalities in sub-Saharan Africa, should be considered in depth and responded to in terms of cultural, political, and societal structural issues, and more refined and targeted strategies should be adopted.

#### **4. Recommendations for policymakers and stakeholders**

Based on the analyses of the previous successful and less effective cases, we have come up with the following recommendations for policymakers and stakeholders to better contribute to the development of women's empowerment projects in agriculture and progress in food security in the region.

##### **a) Recommendations for policymakers:**

###### **1. Gender sensitivity and agricultural production:**

In Sub-Saharan Africa, women play an important role in food production and supply chains. However, they are often denied access to land, credit, and agricultural education due to social and cultural factors. Policymakers should recognize and redress this inequality by ensuring that women have access to the same opportunities and resources as men. This is not only for reasons of equity but also because research has demonstrated that when women have access to adequate resources, they can significantly improve agricultural output and household nutrition.

## 2. Cross-sectoral synergy and policy integration:

Food security is not just about agriculture. Health, education, transport, and infrastructure are all closely linked to food production and distribution. Therefore, governments should promote cross-sectoral collaboration to ensure that individual policies and programs are consistent in their objectives and resource allocation. For example, improving transport infrastructure in rural areas could help farmers transport their produce to market more easily, thereby increasing their incomes.

## 3. Application of technology and innovation in agriculture:

With advances in science and technology, many new techniques and approaches are being applied in agriculture to help farmers increase productivity, reduce post-harvest losses, and combat climate change. Policymakers should consider how these technologies can be used to support smallholder farmers and ensure that they receive the necessary technical training and support.

## 4. Community participation and protection of rights:

Communities, especially rural communities, are critical to the success of food security programs. Policymakers should encourage community participation in decision-making processes, especially when it comes to the allocation of land, water, and other key resources. In addition, communities should receive adequate training and support to ensure that they can effectively manage and maintain agricultural programs.

## 5. Pay attention to the social context of the area where the project or policy is implemented.

Pay attention to the broader social and political context in which it is situated, especially

the deep-rooted issues related to gender norms and power structures. Consider and respond to cultural, political, and social structural issues in depth, and adopt refined and targeted strategies.

b) Recommendations for stakeholders:

1. Enhance collective bargaining power:

Smallholder and female farmers are often at a disadvantage in the marketplace and are unable to obtain fair prices. By establishing farmers' cooperatives or other collective organizations, they can increase their bargaining power and access better market conditions. Policymakers and NGOs should support the establishment and operation of these collective organizations.

2. Ongoing skills and knowledge training:

Agriculture is a continuously evolving field, with new technologies and methods emerging. Smallholder and female farmers should receive ongoing training to ensure that they can take full advantage of these new technologies and methods. This includes training on agricultural best practices, market strategies, and how to deal with climate change.

3. Resource sharing and cooperation:

Many smallholder farmers are unable to purchase modern agricultural equipment or apply new technologies due to a lack of capital and resources. Through resource sharing and cooperation, they can jointly purchase and use these resources, thereby reducing costs and increasing efficiency.

4. Strategies for coping with climate change:

Climate change poses a huge threat to agricultural production, especially in sub-Saharan Africa. Smallholder and female farmers should be aware of and apply climate change adaptation strategies, such as using drought-tolerant crops, improving irrigation systems, and adopting conservation tillage methods.



## **VI. Conclusion**

Food security in sub-Saharan Africa has attracted much global attention in recent years.

This study provides insights into the interrelationship between gender equality and food security in four countries: Botswana, Ethiopia, Kenya, and Uganda. Not only did we review the relevant literature and conduct case studies, but we also explored the specific linkages between gender equality and food security through regression analyses.

Surprisingly, the results of the regression analyses differed from our initial expectations.

With the exception of gender equality in education, gender equality in all other dimensions is positively associated with food insecurity. This implies both that our model may have missed some key variables and that the relationship between gender equality and food security is much more complex than we had assumed, and it requires further in-depth research.

Synthesizing the literature review, case studies, and regression analyses, the results suggest that empowering women in the food system in Sub-Saharan Africa is critical to improving food security and reducing poverty in the region. And this study makes the following recommendations: First, an all-encompassing strategy should be adopted, such as upgrading women's educational opportunities, ensuring that they have equitable access to land and financial resources, as well as access to necessary social security and public services. Secondly, we also need to recognize the critical importance of gender equality and female empowerment in achieving food security and sustainable development in sub-Saharan Africa.

The main contribution of this study is to argue the importance of gender equality and

women's empowerment in achieving food security and sustainable development in Sub-Saharan Africa and to suggest some commonalities of successful projects and policies through case studies, with recommendations for policymakers and stakeholders.

The limitations of this paper are clear. One of them is the relatively small number of case studies, which may limit the generalizability of the findings. Moreover, the study does not delve into the cultural, social, and political dynamics that may play a central role in the context of the problem, limiting the depth of the study. In addition, the study's reliance on quantitative data analysis is also a limitation, as it fails to capture deeper social, cultural, and political dynamics that may influence the relationship between gender equality and food security.

In addition, the study's regression analyses did not take into account all the variables that may have an impact on food security, which may limit the accuracy of the findings. The study's focus on Sub-Saharan Africa also limits its applicability to other regions and contexts.

In conclusion, this study provides new perspectives and strategic recommendations on the delicate relationship between gender equality and food security in Sub-Saharan Africa. We strongly believe that only by empowering women, who play a major role in the food system, and by digging deeper and addressing the root causes of gender inequality can we truly achieve food security and broader sustainable development goals in sub-Saharan Africa.

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