

## **EFFECT OF COOPERATIVE MEMBERSHIP ON THE FOOD SECURITY STATUS OF VEGETABLE FARMERS IN SOUTHERN BENIN REPUBLIC**

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### **ABSTRACT**

*Food insecurity remains a significant challenge across sub-Saharan Africa, particularly among smallholder farming households. In the Republic of Benin, vegetable farming plays a crucial role in food supply and income generation; however, many farmers continue to face food access constraints. This study investigates the effect of cooperative membership on the food security status of vegetable farmers in Southern Benin Republic. A 2-stage sampling approach was employed to select 120 vegetable farmers from three communes namely; Cotonou, Porto-Novo, and Seme-Podji. Data were collected using a structured electronic questionnaire and analyzed using descriptive statistics, budgetary analysis, and a linear regression model. Results indicate that 60% of the farmers were mildly food insecure, while 36.67% were food secure. Budgetary analysis revealed that vegetable farming is a profitable enterprise, with a positive gross margin and a profitability index of 0.131. The regression analysis identified cooperative membership and access to extension services as significant negative predictors of food insecurity, suggesting that these factors improve household food access. On the other hand, access to credit and larger farm size were associated with increased food insecurity, potentially due to poor utilization of credit and resource mismanagement. The study underscores the critical role of cooperative societies in enhancing food security through improved access to inputs, information, and support services. It recommends strengthening cooperative governance, expanding extension services, and promoting financial literacy among farmers. These findings provide actionable insights for policymakers and development practitioners aiming to improve smallholder welfare and contribute to the achievement of Sustainable Development Goal 2: Zero Hunger.*

**Keywords:** food security, cooperative membership, vegetable farmers, Benin Republic, HFIAS, profitability

## INTRODUCTION

Food security continues to pose a formidable challenge across sub-Saharan Africa, where the dual burden of poverty and undernourishment disproportionately affects rural populations, especially smallholder farmers (FAO, 2022; WFP, 2021). Despite agriculture being the main livelihood activity for a majority of these populations, paradoxically, many farmers remain food insecure (Alimoradi et al., 2022). In the Republic of Benin, vegetable farming is a vital source of income and nutrition, contributing significantly to both household food access and national food supply chains (Houngla et al., 2019). However, vegetable farmers still encounter substantial barriers such as limited access to credit, markets, extension services, and modern agricultural inputs, all of which can hinder their food security outcomes (Jatto et al., 2024; Mukaila et al., 2022; Ogunyemi & Adeoye, 2017; Azokpota et al., 2015). Food security, as defined by the World Food Summit (1996), encompasses the consistent physical, social, and economic access to sufficient, safe, and nutritious food that meets dietary needs and food preferences for an active and healthy life. According to USAID (2019), food insecurity is not only an issue of availability but is strongly rooted in poverty, structural inequality, and weak institutional support. Therefore, improving food security among vulnerable groups such as smallholder vegetable farmers requires multi-dimensional interventions that address both economic and social barriers.

One institutional mechanism that has gained considerable attention in recent years is the agricultural cooperative. Agricultural cooperatives are autonomous associations of farmers who voluntarily collaborate to meet their shared economic, social, and cultural needs through collectively owned and democratically controlled enterprises (International Cooperative Alliance [ICA], 2005). These organizations have been recognized for their potential to enhance access to critical resources such as credit, inputs, extension services, and market information that would otherwise be inaccessible to individual farmers (Baidu & Wang, 2018; Francesconi & Wouterse, 2017). Moreover, cooperative membership has been linked to improved bargaining power, increased productivity, and enhanced household welfare, all of which are crucial for achieving food security (Rodrigues et al., 2020; Johnson et al., 2019).

While the benefits of cooperatives are well documented globally, empirical studies that examine the specific effects of cooperative membership on food security outcomes in Southern Benin are limited. Existing literature suggests that farmers who participate in cooperatives are more likely to access credit, adopt modern technologies, and implement sustainable farming practices (Shumeta & D'Haese, 2018; Ma & Abdulai, 2017). However, these benefits are context-dependent and often influenced by the cooperative's internal governance, inclusivity, and external support. In Benin, where cooperatives are widespread yet heterogeneous in function and capacity, it is critical to assess whether and how

cooperative membership actually translates into improved food security for vegetable farmers.

Moreover, theoretical frameworks such as Social Capital Theory and Collective Action Theory provide insights into how cooperative networks promote trust, information exchange, and shared risk among members (DeMarrais & Earle, 2017; Häuberer, 2011). Through collective action, members can engage in joint input procurement, market access initiatives, and knowledge sharing which are activities that could significantly mitigate the risks of food insecurity. However, cooperative membership alone may not suffice. The quality of services rendered, members' level of participation, and the extent of support from government or NGOs also play crucial roles (Muyiwa, 2017; Boland & Kerr, 2014).

In light of these considerations, this study aims to assess the impact of cooperative membership on the food security status of vegetable farmers in Southern Benin Republic. It addresses a critical gap in the literature by focusing on vegetable farmers due to their importance in urban and peri-urban food systems (Dansi et al., 2015; Akinnifesi et al., 2004). The broad objective of this study is to evaluate the effect of cooperative membership on the food security status of vegetable farmers in the southern region of Benin Republic. Specifically, the study seeks to: assess the food security status of vegetable farmers using the Household Food Insecurity Access Scale (HFIAS); determine the profitability of vegetable production in the study area; and analyze the effect of cooperative membership on the food security outcomes of vegetable farmers, taking into account access to services, credit, and other socioeconomic factors.

This study employs a mixed-methods approach, integrating descriptive statistics, budgetary analysis, and regression modeling to provide a robust and multidimensional understanding of the linkages between cooperative membership and food security. The findings are expected to inform policymakers, development organizations, and farmer associations on how to strengthen cooperative institutions to better serve the food security needs of their members.

## **METHODOLOGY**

### **Study Area**

This study was conducted in the southern region of the Republic of Benin, a West African country bordered by Nigeria to the east, Togo to the west, and Burkina Faso and Niger to the north (Houngla et al., 2019; Adegbidi et al., 2018). The southern part of the country, which includes communes such as Cotonou, Seme-Podji, and Porto-Novo, is characterized by a tropical climate with two distinct rainy seasons from April to July and from September to November, and an average annual temperature of approximately 33°C. This region is a hub of horticultural activity, with vegetable farming being a predominant livelihood activity due to its proximity to urban markets and relatively fertile soils (Azokpota et al., 2015). The study focused specifically on vegetable farmers in peri-urban and rural communities within

these communes, where a large concentration of cooperative-based and individual vegetable farmers operates.

### **Sampling Procedure and Sample Size**

A 2-stage sampling procedure was employed to select respondents for the study. In the first stage, three communes (Cotonou, Seme-Podji, and Porto-Novo) were purposively selected due to their high concentration of vegetable farmers and active agricultural cooperatives. In the second stage, a simple random sampling technique was used to select 40 vegetable farmers from each commune, based on farmer lists obtained from the local Agricultural Development Programmes. This yielded a total sample size of 120 respondents. The sample comprised both cooperative members and non-members to allow for comparative analysis.

### **Data Collection**

Primary data were collected through the administration of a structured electronic questionnaire using the Kobo Toolbox platform. The questionnaire was designed to capture information on respondents' socio-economic characteristics, cooperative membership status, farm characteristics, food security status, input use, revenue, and access to services such as credit and extension. Data collection was carried out between August and October 2023 by trained enumerators fluent in local languages and French.

### **Analytical Techniques**

To achieve the objectives of the study, a combination of descriptive statistics, budgetary analysis, and linear regression model was employed.

#### ***Descriptive Statistics***

Descriptive statistics, including means, frequencies, and percentages, were used to summarize the socio-economic characteristics of the respondents and their level of cooperative participation. These statistics also provided insight into the demographic distribution, farming experience, household size, educational attainment, and access to extension services and credit.

#### ***Household Food Insecurity Access Scale (HFIAS)***

The Household Food Insecurity Access Scale, developed by the Food and Nutrition Technical Assistance (FANTA) project, was used to assess the food security status of vegetable farming households. The HFIAS comprises nine standardized questions that measure anxiety related to food supply, insufficient food quality, and insufficient food intake and its consequences over the previous 30 days. The responses were coded and aggregated to compute a food insecurity score ranging from 0 (completely food secure) to 27 (severely food insecure). Based on these scores, households were categorized into four food security groups: food secure, mildly food insecure, moderately food insecure, and severely food insecure (Coates, Swindale, & Bilinsky, 2007).

#### ***Budgetary Analysis***

Budgetary analysis was employed to evaluate the profitability of vegetable farming in the study area. Key financial indicators were computed, including:

*Gross Margin (GM):*

$$GM = TR - TVC$$

Where:  $TR$  = Total Revenue, and  $TVC$  = Total Variable Cost

*Profitability Index (PI):*

*Profitability Index (PI):*

$$PI = \frac{NR}{TR}$$

Where:  $NR$  = Net Return

*Operating Expense Ratio (OR):*

$$OR = \frac{TVC}{TR}$$

*Rate of Return on Variable Cost (RRVC):*

$$RRVC = \frac{TR - TVC}{TVC}$$

These indicators provided insight into the financial viability of vegetable farming and the extent to which cooperative membership might influence profitability.

### ***Linear Regression Model***

To analyze the effect of cooperative membership and other socio-economic factors on food security, a linear regression model was employed with the household food insecurity access score (HFIAS) as the dependent variable. The model specification is as follows:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + e_i$$

Where:

$Y$  = HFIAS score (proxy for food security)

$X_1$  = Farm size (hectares)

$X_2$  = Gender (1 = male, 0 = female)

$X_3$  = Access to extension services (1 = yes, 0 = no)

$X_4$  = Household size (number of persons)

$X_5$  = Age (years)

$X_6$  = Education level (categorical)

$X_7$  = Cooperative membership (1 = member, 0 = non-member)

$X_8$  = Access to credit (1 = yes, 0 = no)

$B_0$  = Constant term

$e_i$  = Error term

$B_1$  to  $B_8$  = Coefficients to be estimated

This model allowed the researchers to isolate the effect of cooperative membership while controlling for other potentially confounding socio-economic variables. All statistical analyses were conducted using Stata 15 software.

## RESULTS AND DISCUSSION

### Socio-Economic Characteristics of Respondents

The analysis of socio-economic characteristics reveals that vegetable farming in Southern Benin is predominantly practiced by men. As shown in Table 1, 72.5% of respondents were male, while 27.5% were female. The average age of farmers was 43 years, with 35.8% of respondents under 35 years, 40% between 36 and 50 years, and 24.2% over 50. This suggests that vegetable farming in the region is dominated by a relatively young and potentially more economically active population.

A majority (75%) of the farmers were married, indicating a high level of social responsibility and household dependency. Regarding educational attainment, 37.5% had completed primary education, 35% secondary, and 15.8% tertiary, while 11.7% had no formal education. The average household size was five persons, with 57.5% of households having fewer than five members.

In terms of farming experience, the average was 13 years, with nearly 86% of respondents having less than 20 years of experience. Notably, 95.8% of the respondents were members of cooperatives, while only 4.2% were non-members. Moreover, 91.7% reported having access to credit, and 70% had access to extension services. This high level of cooperative membership and service access suggests a well-organized farming community in the study area.

### Food Security Status of Vegetable Farmers

Food security was assessed using the Household Food Insecurity Access Scale (HFIAS). The results revealed that 36.67% of households were food secure, while 60% experienced mild food insecurity. Only 2.5% and 0.83% were moderately and severely food insecure, respectively (Table 2). The average HFIAS score was 3.43, indicating that most households were closer to being food secure than food insecure.

These findings align with the argument that smallholder farmers, despite being food producers, often experience some degree of food insecurity due to challenges in market access, price volatility, and input constraints (Alimoradi et al., 2022; Smith et al., 2000). However, the relatively low levels of severe food insecurity observed in this study suggest that interventions such as cooperative participation and access to credit and extension services may be mitigating some of these challenges.

### Profitability of Vegetable Farming

The profitability analysis, as shown in Table 3, indicates that vegetable farming is a viable economic activity in the study area. The average total revenue per farmer was 620,867.9 FCFA, while the total variable cost averaged 231,670.2 FCFA. This resulted in an average gross margin of 389,197.7 FCFA.

**Table 1: Socioeconomic Characteristics of Respondents (n= 120)**

<b>Variable(s)</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Mean</b>
<b>Gender</b>			
Male	87	72.5	
Female	33	27.5	
<b>Age</b>			
≤ 35	43	35.8	
36-50	48	40	43 years
Above 50	29	24.2	
<b>Marital status</b>			
Single	20	16.7	
Married	90	75	
Divorced	5	4.16	
Widowed	5	4.16	
<b>Household size</b>			
≤ 5	69	57.5	
6-10	47	39.17	
Above 10	4	3.33	5 members
<b>Level of Education</b>			
No formal education	14	11.7	
Primary education	45	37.5	
Secondary education	42	35	
Tertiary	19	15.8	
<b>Farming Experience</b>			
0-10	55	45.8	
11-20	48	40	
Above 20	17	14.2	13 years
<b>Cooperative Membership</b>			
Yes	115	95.8	
No	5	4.2	
<b>Extension Service</b>			
Yes	84	70	
No	36	30	
<b>Credit Access</b>			
Yes	110	91.7	
No	10	8.3	
<b>Farm Size</b>			
0.5 ha and below	111	92.5	
0.6 ha – 1 ha	3	2.5	
1.01 ha and above	6	5.0	

Source: Field survey, 2023

**Table 2: Food Insecurity Categories Among Respondents**

Food Insecurity Category	Frequency	Percentage
Food Secured	44	36.67
Mildly Food Insecure	72	60
Moderately Food Insecure	3	2.5
Severely Food Insecure	1	0.83

Source: Field survey, 2023

The profitability index (PI) was 0.131, implying that for every 1 FCFA invested, there was a return of 13.1%. The operating expense ratio was 1.33, and the rate of return on variable costs (RRVC) was 1066.25%, indicating highly efficient cost management. These figures confirm the economic relevance of vegetable farming, consistent with previous studies in Benin and sub-Saharan Africa (Adegbidi et al., 2018; Akinnifesi et al., 2004).

**Table 3: Budgetary Analysis of Vegetable Farming**

Items	Average value (FIFA)
<b>A. Total Revenue</b>	
Sales of vegetable	620867.9
<b>B. Variable Costs</b>	
Seed	21410.85
Fertilizer	39122.31
Pesticides	18421.42
Herbicides	3711.933
Labour	54586.65
Transportation	3934.067
Irrigation	78827.68
Loss	8511.117
Miscellaneous	3144.167
<b>Total Variable Cost</b>	<b>231670.2</b>
<b>C. Fixed Costs</b>	<b>50918.14</b>
<b>Total Fixed Costs</b>	<b>50918.14</b>
<b>D. Total Costs</b>	<b>282588.3</b>
<b>Gross Margin (TR-TVC)</b>	<b>389197.7</b>
<b>Profitability Index (PI)</b>	<b>.1312103</b>
<b>Operating expense ratio (OR)</b>	<b>1.328017</b>
<b>Rate of return on variable cost (RRVC)</b>	<b>1066.245</b>

Source: Field survey, 2023

### **Determinants of Food Security**

A linear regression model was used to examine the relationship between food security (measured by the HFIAS score) and selected explanatory variables. The results, presented in Table 4, show an R<sup>2</sup> value of 0.152, indicating that approximately 15.2% of the variation in food insecurity scores is explained by the independent variables included in the model.

Notably, cooperative membership had a statistically significant and negative relationship with food insecurity ( $p < 0.01$ ), suggesting that cooperative members were more likely to be food secure. This finding supports the hypothesis that cooperatives enhance food access by facilitating access to affordable inputs, information, and markets (Shumeta & D’Haese, 2018; Baidu & Wang, 2018).

Access to extension services also had a significant negative effect ( $p < 0.01$ ), implying that households receiving agricultural advisory support had lower food insecurity scores. This aligns with Brenya and Zhu (2023), who emphasized the critical role of agricultural extension in improving household resilience and food outcomes.

Interestingly, farm size showed a positive and significant relationship with food insecurity ( $p < 0.01$ ), indicating that larger farms were associated with higher food insecurity scores. This counterintuitive result may reflect inefficiencies in land use or the inability of farmers to manage larger plots effectively without adequate support.

Access to credit also exhibited a positive and statistically significant association with food insecurity ( $p < 0.05$ ), suggesting that credit access may not always translate into improved food security. One possible explanation is that farmers might be using credit for non-productive purposes, such as debt repayment, rather than investing in yield-improving activities (Kehinde & Kehinde, 2020; Bidisha et al., 2017).

Other variables, including gender, household size, age, and education level, were not statistically significant in explaining food security status in this model.

**Table 4: Determinants of Food Security (Linear regression analysis)**

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-value</b>	<b>P-value</b>
Farm size	0.001***	0.000	4.62	0.000
Gender	0.135	0.186	0.73	0.470
Extension service	-0.445***	0.168	-2.65	0.009
Household Size	0.018	0.037	0.49	0.625
Age	0.007	0.008	0.89	0.372
Education level	0.007	0.101	0.07	0.942
Cooperative membership	-0.998***	0.201	-4.97	0.000
Credit access	0.508**	0.226	2.25	0.026
Constant	1.097	0.718	1.53	0.129
R <sup>2</sup>	0.152			
Adjusted R <sup>2</sup>	0.090			
F-value	2.43			

Source: Field survey, 2023

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## **Discussion**

The findings underscore the importance of cooperative membership as a mechanism for improving food security among smallholder vegetable farmers. Cooperative societies serve not only as platforms for economic empowerment but also as channels for the dissemination of information and access to inputs and services. Their role is particularly critical in fragile food systems where smallholder farmers face structural barriers to productivity and market access.

The positive effects of extension services reinforce the need for public investment in agricultural knowledge systems. However, the unexpected relationship between credit access and food insecurity calls for a reassessment of rural financial inclusion strategies. Interventions must be accompanied by capacity-building efforts to ensure that farmers utilize loans productively.

Finally, while vegetable farming is shown to be economically viable, its ability to fully ensure household food security may depend on factors beyond profitability alone, such as intra-household food distribution, market volatility, and post-harvest losses. Thus, food security interventions should be holistic, targeting both economic and nutritional outcomes.

## **CONCLUSION AND RECOMMENDATIONS**

### **Conclusion**

This study investigated the effect of cooperative membership on the food security status of vegetable farmers in Southern Benin Republic, using a combination of descriptive statistics, profitability analysis, and econometric modeling. The results revealed that vegetable farming in the region is a male-dominated activity, carried out predominantly by relatively young and educated individuals. A significant proportion of farmers were members of cooperatives and had access to extension services and credit facilities, which are often considered critical enablers of agricultural productivity and food security.

The majority of respondents were either food secure or mildly food insecure, with only a negligible portion experiencing moderate to severe food insecurity. Profitability analysis confirmed that vegetable farming is a financially viable enterprise in the study area, suggesting that economic gains from the activity could contribute to household food access. However, food security outcomes varied significantly depending on individual and structural factors.

The linear regression analysis identified cooperative membership and access to extension services as statistically significant and negative predictors of household food insecurity. These findings imply that farmers who belong to cooperatives and receive regular extension support are more likely to experience improved food access and dietary outcomes. On the other hand, farm size and access to credit were positively associated with food insecurity, suggesting that the mere availability of resources does not guarantee improved welfare unless effectively managed and targeted.

Overall, the study supports the proposition that cooperative societies can serve as effective institutional mechanisms for enhancing food security among smallholder farmers. However, their effectiveness depends on active participation, strong governance, and integration with other support services such as agricultural extension and financial literacy programs.

### **Recommendations**

Based on the findings, the following policy and practice-oriented recommendations are proposed:

1. **Strengthen Cooperative Governance and Inclusiveness:** Government and development agencies should support the institutional capacity of agricultural cooperatives through training in financial management, democratic leadership, and conflict resolution. This will ensure that cooperatives remain transparent, inclusive, and responsive to the needs of all members, including women and marginalized groups.
2. **Scale Up Extension Services:** Given the significant role of extension in reducing food insecurity, more investment should be made in recruiting and training agricultural extension officers. Efforts should also be made to increase the frequency and quality of extension visits, particularly in rural and peri-urban communities.
3. **Promote Productive Use of Credit:** Financial institutions and cooperatives offering agricultural credit should integrate financial literacy and business planning support into their services. This would help farmers utilize loans for productive purposes such as input purchase or value addition, thereby maximizing their potential to enhance household food security.

By addressing these recommendations, stakeholders can strengthen the role of cooperative societies as platforms for inclusive agricultural development and sustainable food security, thereby contributing to national and global development goals.

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