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IMPACT OF AGRICULTURAL POLICIES ON FOOD SECURITY IN RWAMAGANA DISTRICT

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ABSTRACT

Agricultural policy plays a crucial role in shaping food security by influencing agricultural productivity, market stability, and household access to food resources. Recognizing food security as a multidimensional concept encompassing availability, access, and stability, this study assessed how agricultural policies affect food security in Rwamagana District. The main objective was to assess the impact of agricultural policies on food security, while the specific objectives were to assess food availability status, examine existing agricultural policies, and determine their impact on food security in the district. The study adopted a mixed-methods approach, combining quantitative data collected from 397 farming households using structured questionnaires and qualitative data obtained from interviews with farmers and local leaders. Data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviation) and inferential statistics, including Pearson correlation, ANOVA, and regression analysis. The findings revealed that agricultural policies have a positive and significant effect on food security in the study area. Specifically, 78.6% of respondents reported increased crop production, 66.5% indicated improved household food security, and 75.8% reported increased income from agricultural activities. Pearson correlation results showed a strong positive relationship between agricultural policies and food security ($r = 0.68$, $p < 0.001$), while regression analysis confirmed that agricultural policies significantly predict food security outcomes ($R = 0.68$, $R^2 = 0.46$, $\beta = 0.68$, $p < 0.001$), explaining 46% of the variation in food security. However, the study also found persistent challenges, including unequal access to agricultural inputs, moderate extension service coverage, and seasonal food shortages affecting 33.5% of households. The study concludes that although agricultural policies significantly improve food security, their full impact is constrained by implementation gaps and structural limitations. It recommends strengthening input distribution systems, improving extension service coverage, and enhancing market access to ensure sustainable food security in the district.

Keywords: Agricultural policies, Food security, Food availability, Rural households, Rwamagana District

1 INTRODUCTION

Food security is recognized globally as a critical development priority. In this regard, the United Nations Sustainable Development Goals (SDGs) specifically aim to eliminate hunger and ensure universal access to adequate food by the year 2030. Despite various international and national interventions, food insecurity continues to pose a significant challenge, particularly in developing countries, with Africa being one of the most affected regions (United Nations,

2018). According to the Food and Agriculture Organization (FAO), approximately 21% of the African population experienced severe hunger in 2020, a rate that is considerably higher than in other regions of the world (FAO, 2021). The situation is especially critical in West and East Africa, where more than 68% and 65% of the population, respectively, experience moderate to severe food insecurity (FAO, 2021). Overall, over half of the population in these regions is affected, contributing significantly to the global burden of food insecurity estimated at 2.37 billion people (Gebre, 2021; World Health Organization, 2019).

In this context, agricultural policy plays a central role in shaping food systems and influencing food security outcomes. Agricultural policies consist of various regulations, incentives, and institutional frameworks that govern agricultural production, distribution, and consumption. These policies directly affect productivity levels, market access, resource allocation, and investment in the agricultural sector. As such, they are crucial in determining the extent to which populations can access sufficient and affordable food. Food security itself is defined as a situation in which all people, at all times, have physical, social, and economic access to adequate, safe, and nutritious food necessary for a healthy and active life. Therefore, understanding the relationship between agricultural policy and food security is essential for informing effective development strategies (Hans, 2025).

In developed contexts, food security outcomes tend to be relatively stronger, although challenges still exist. For instance, in the United States, approximately 86.5% of households were food secure throughout 2023, meaning they had consistent access to sufficient food for an active and healthy life. However, 13.5% of households experienced food insecurity at some point during the year, a slight increase compared to 2022. More severe cases, classified as very low food security, where households experience reduced food intake and disrupted eating patterns due to financial constraints, affected about 5.1% of households in both 2022 and 2023. These figures illustrate that even in high-income countries, food insecurity remains a persistent challenge, reinforcing the importance of effective agricultural policies in strengthening food systems globally (Rabbit et al., 2024).

In many African contexts, agricultural productivity and food availability are influenced by a combination of environmental, economic, and structural factors. For instance, in countries such as Ghana, agricultural production patterns vary significantly across regions due to differences in rainfall distribution, with southern areas benefiting from two rainy seasons while northern regions experience only one. According to the Ministry of Food and Agriculture in Ghana (2010), farmers face multiple constraints including climate change, low commodity prices, inadequate infrastructure, limited access to credit, weak market systems, post-harvest losses, insufficient technical knowledge, unsustainable farming practices, rural-urban migration, and weak policy implementation. These challenges collectively reduce agricultural productivity and negatively affect food security outcomes.

In this context, Rwanda has implemented several agricultural policy frameworks aimed at transforming the agricultural sector and improving food security outcomes. Among these, the Strategic Plan for the Transformation of Agriculture (PSTA 5), covering the period 2024–2029, was launched in Kigali under the theme *“Building Resilient and Sustainable Agri-Food Systems.”* This strategic plan was developed with the participation of more than 100 key stakeholders in the agriculture and food systems sector, reflecting a collaborative approach to addressing food system challenges.

PSTA 5 builds on the achievements of previous strategies, particularly PSTA 4, which focused on agricultural transformation and wealth creation. However, PSTA 5 advances this agenda by adopting a more comprehensive agri-food system approach that places nutrition at the center of agricultural development. It emphasizes sustainability, resilience, and improved nutritional outcomes as key pillars for national development. The strategy envisions modernizing crop and livestock production, reducing post-harvest losses, strengthening market systems, increasing export capacity, and ensuring food and nutrition security for all Rwandans.

Furthermore, the policy prioritizes the use of technology, the promotion of climate-smart agriculture, and the creation of employment opportunities for youth and women within the agri-food sector. It also emphasizes the production and accessibility of nutrient-rich and biofortified foods, alongside the adoption of nutrition-sensitive and environmentally sustainable agricultural practices (MINAGRI, 2024). These efforts are aligned with Vision 2050 and the National Strategy for Transformation (NST2), which collectively aim to build a resilient and sustainable agricultural sector that supports economic growth and food security.

Despite these policy efforts, food insecurity continues to persist in several parts of the country, including Rwamagana District. Smallholder farmers, who form the backbone of agricultural production, often continue to experience limited productivity, inadequate market access, and vulnerability to climate variability. This raises an important concern regarding the extent to which agricultural policies effectively translate into improved food security outcomes at the household level. It is against this background that this study seeks to examine the impact of agricultural policies on food security in Rwamagana District, with a view to understanding how policy interventions influence food availability, access, and utilization among smallholder farming households.

administrative reports (Rwamagana, 2025), various agricultural policies such as land consolidation, input subsidies, and extension services have been introduced to improve productivity and enhance food security outcomes. However, the level of impact varies across different households depending on access to resources and adoption of improved farming practices.

2.2 Research Design

The nature of this study is a cross-sectional study. It explained the existing agricultural policies in Rwamagana district, impact of agricultural policies on food security in Rwamagana district, assess food availability status in Rwamagana district. For this reason, the designs are both descriptive and explanatory. This study is quantitative as there is some information that are described mathematically. This study is qualitative as there is some information that were difficult or impossible to be quantified mathematically and showed the behaviours of the farmers and the reasons why they behaved like that.

2.3 Study population and sample size determination

The population of this study is made of farmers of Rwamagana District. There are 60,735 households which are farmers and approved in Smart Nkunganire System (Rwamagana, 2025). As the population seems to be large, thus in place of conducting field questionnaire assessment to 60,735 farmers, only 397 farmers obtained by using the following Toro Yamane formula are needed and the findings were estimated to the overall population.

$$n = \frac{N}{1+N(e)^2} = \text{Sample People};$$

where:

n is sample size,

N is total population,

e is margin error which may be 0.10, 0.05, 0.01 but here we used 0.05.

$$n = \frac{60,735}{1+60,735 (0.05)^2} = 397.3 \approx 397$$

Thus, in place of assessing all 60,735 farmers of Rwamagana District, only 397 farmers were consulted and survey results were generalised to the whole farmers.

Table 1: Sample size by Sector

Sector	Approved in SNS	Sample size
Gishali	4,618	30
Kigabiro	3,033	20
Karenge	6,822	45
Nyakaliro	5,484	36
Muyumbu	4,791	31
Nzige	3,405	22
Rubona	5,566	36
Muhazi	4,307	28
Fumbwe	3,437	22
Musha	4,410	29
Munyaga	2,882	19
Munyiginya	3,162	21
Mwulire	3,154	21
Gahengeri	5,664	37
Total	60,735	397

2.4 Sampling techniques

The researcher used random selection and purposive sampling to reach to 397 farmers. The random selection was used for the farmers that have been approved in Smart Nkunganire System because are those who occupy a big number of farmers in Rwamagana district. The purposive sampling was applied to farmers with best practices in agriculture and their local leaders.

2.5 Source of Data

The study utilized both primary and secondary sources of data. Primary data were collected directly from smallholder farmers, cooperative members, and local leaders in Rwamagana District through questionnaires, interviews, and discussions. These data provided firsthand information regarding agricultural policies and their influence on food security. Secondary data were obtained from existing sources such as textbooks, journal articles, government reports, policy documents, previous research studies, and online publications. The combination of primary and secondary data enhanced the comprehensiveness and credibility of the study.

2.6 Data Analysis Methods

Quantitative data were analyzed using descriptive and inferential statistics. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' characteristics and describe the levels of agricultural policy implementation and food security. Bivariate correlation analysis was conducted to examine the relationship between agricultural policies and food security outcomes among smallholder farmers. The results were used to determine the strength and direction of associations and to test the study hypotheses.

Qualitative data obtained from interviews, discussions, and open-ended questionnaire responses were analyzed using thematic analysis. Responses were organized into categories and themes based on the study objectives. Recurring patterns and viewpoints were identified and interpreted to provide deeper insights into the influence of agricultural policies on food security. Relevant quotations from participants were used to support and enrich the interpretation of findings.

2.7 Ethical Considerations

All participants were informed about the purpose of the study, its objectives, and the procedures involved in data collection. Information provided by participants was treated as strictly confidential. Prior to data collection, authorization was sought from relevant local authorities in Rwamagana District. The study also complied with institutional ethical guidelines for research involving human subjects.

3 FINDINGS

Table 2: Demographic Characteristics of Respondents (n = 397)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	228	57.4
	Female	169	42.6
Age Group	21–31	92	23.2
	31–41	138	34.8
	41–50	97	24.4
	50+	70	17.6
Marital Status	Single	68	17.1
	Married	241	60.7
	Widowed	41	10.3
	Separated	23	5.8
	Divorced	17	4.3
	Other	7	1.8
Education Level	No formal education	49	12.3

	Primary	176	44.3
	Secondary	118	29.7
	TVET	21	5.3
	Special courses	17	4.3
	Masters and above	9	2.3
	Other	7	1.8
Vulnerability status to food security	None	278	70.0
	Orphan	39	9.8
	Disabled	46	11.6
	Widowed	28	7.1
	Other	6	1.5
Years in Agriculture	0–2 years	54	13.6
	2–5 years	103	25.9
	5–10 years	146	36.8
	10+ years	94	23.7
Main Livelihood sources	Crop farming	189	47.6
	Livestock farming	61	15.4
	Both	112	28.2
	Non-farm	27	6.8
	Other	8	2.0
Relation to Farm Owner	Owner	236	59.4
	Spouse	58	14.6
	Child	36	9.1
	Sibling	21	5.3
	Parent	12	3.0
	Relative	9	2.3
	In-law	8	2.0
	Neighbor	6	1.5
	Manager	7	1.8
	Other	4	1.0
Land Size (ha)	<0.5	121	30.5
	0.5–1	146	36.8
	1–2	87	21.9
	>2	43	10.8

The findings show that agriculture in Rwamagana District is practiced by both men and women, with males constituting 57.4% of respondents and females 42.6%. Most respondents were aged between 31–41 years (34.8%), followed by those aged 41–50 years (24.4%). Regarding marital status, 60.7% of respondents were married. In terms of education level, the majority had primary education (44.3%), followed by secondary education (29.7%). The findings also revealed that 70.0% of respondents reported no vulnerability status. Concerning farming experience, 36.8% of respondents had between 5 and 10 years of farming experience. Land ownership results indicated that 36.8% of respondents owned between 0.5 and 1 hectare of land, while 30.5% owned less than 0.5 hectares. These findings show that most respondents were smallholder farmers operating on relatively small land sizes.

3.1 Food Availability Status in Rwamagana District

Table 3: Food Availability Status Indicators (Likert Scale Responses) (n = 397)

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree	Mean	Std. Dev
My household has enough food throughout the year	48 (12.1%)	72 (18.1%)	61 (15.4%)	146 (36.8%)	70 (17.6%)	3.29	1.29
Food availability has improved in recent years	31 (7.8%)	64 (16.1%)	58 (14.6%)	169 (42.6%)	75 (18.9%)	3.49	1.18
Agricultural policies have increased food availability in my household	28 (7.1%)	59 (14.9%)	66 (16.6%)	171 (43.1%)	73 (18.4%)	3.51	1.15
I rarely experience food shortages	66 (16.6%)	91 (22.9%)	57 (14.4%)	121 (30.5%)	62 (15.6%)	3.06	1.33
I am able to meet my household's daily food needs	39 (9.8%)	68 (17.1%)	63 (15.9%)	154 (38.8%)	73 (18.4%)	3.39	1.22

The findings indicate that 54.4% of respondents agreed or strongly agreed that their households have enough food throughout the year, while 30.2% disagreed. The mean score for this indicator was 3.29.

Regarding changes in food availability over time, 61.5% of respondents agreed that food availability has improved in recent years, with a mean score of 3.49. Similarly, 61.5% agreed that agricultural policies have contributed to increased food availability in their households, yielding a mean score of 3.51. Concerning food shortages, 46.1% of respondents agreed that they rarely experience food shortages, whereas 39.5% disagreed. The mean score for this statement was 3.06. The findings further show that 57.2% of respondents agreed that their households are able to meet daily food needs, with a mean score of 3.39.

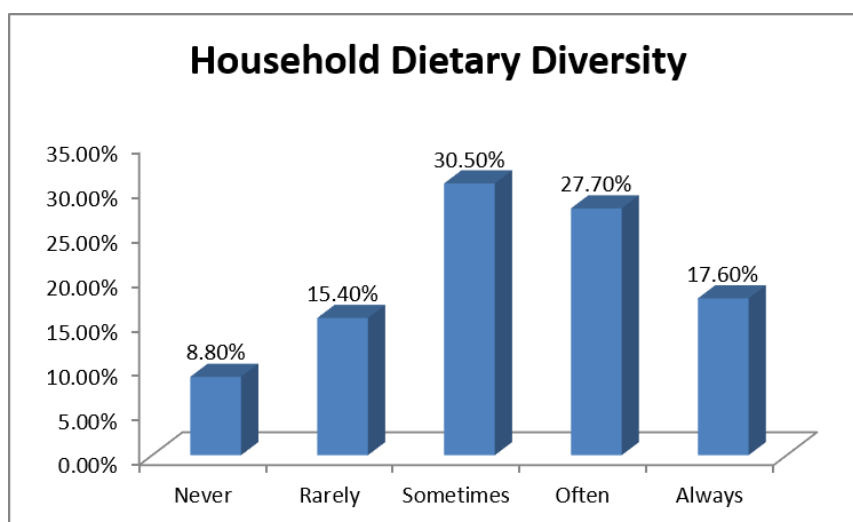


Figure 2: Household Dietary Diversity (n = 397)

The findings show that dietary diversity among households in Rwamagana District varies across respondents. A total of 30.5% of respondents reported that they sometimes consume a diverse diet consisting of cereals, vegetables, fruits, and animal products, while 27.7% indicated that they often consume a diverse diet. Additionally, 17.6% reported that they always consume a diverse diet. On the other hand, 15.4% of respondents stated that they rarely consume a diverse diet, and 8.8% reported that they never consume a diverse diet. Overall, the results indicate varying levels of dietary diversity among households in the study area.

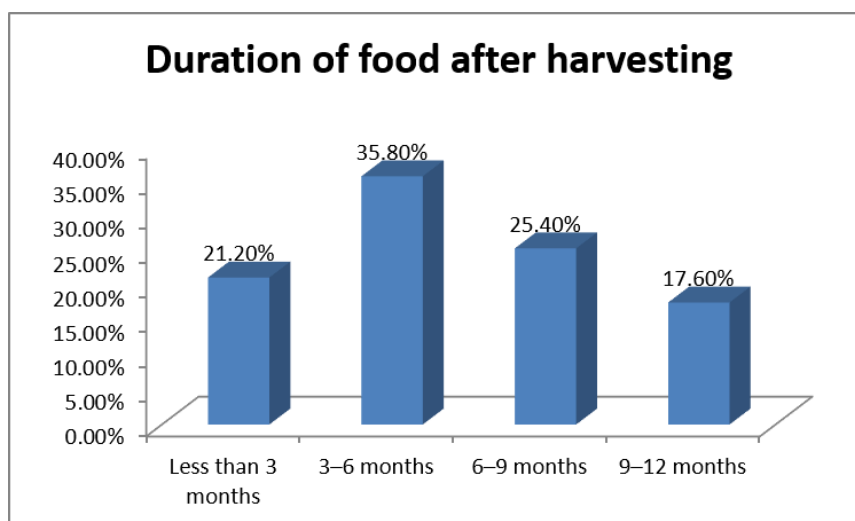


Figure 3: Duration of food after harvesting (n = 397)

The findings indicate that in Rwamagana District, the duration for which harvested food lasts at household level varies considerably among respondents. The majority of households (35.8%) reported that their harvested food lasts between 3 and 6 months, while 25.4% indicated that it lasts between 6 and 9 months.

A smaller proportion of respondents (21.2%) reported that their food stocks last for less than 3 months, indicating a high level of vulnerability to food shortages shortly after harvest. On the other hand, only 17.6% of respondents stated that their food lasts between 9 and 12 months, suggesting that a limited number of households achieve year-round food self-sufficiency.

The qualitative findings from interviews with local leaders and farmers provided important contextual insights that support the quantitative results on food availability in Rwamagana District. Respondents explained that although agricultural policies such as subsidies, land consolidation, and extension services have contributed to improved agricultural production, their implementation at the local level is not always consistent or evenly accessible.

3.2 Agricultural Policies in Rwamagana District

Table 4: Awareness and Understanding of Agricultural Policies (n = 397)

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree	Mean	Std. Dev
I am aware of government agricultural policies in my area	34 (8.6%)	62 (15.6%)	71 (17.9%)	158 (39.8%)	72 (18.1%)	3.43	1.18
I clearly understand how these policies work	41 (10.3%)	74 (18.6%)	69 (17.4%)	147 (37.0%)	66 (16.6%)	3.31	1.23
Agricultural extension services provide adequate information	38 (9.6%)	66 (16.6%)	73 (18.4%)	156 (39.3%)	64 (16.1%)	3.36	1.19

The findings indicate that 57.9% of respondents agreed or strongly agreed that they are aware of government agricultural policies, while 24.2% disagreed or strongly disagreed. The mean score for this indicator was 3.43. Regarding understanding of agricultural policies, 53.6% of respondents agreed or strongly agreed that they clearly understand how these policies work, whereas 28.9% disagreed or strongly disagreed. The mean score recorded for this statement was 3.31. Concerning agricultural extension services, 55.4% of respondents agreed or strongly agreed that extension officers provide sufficient information on agricultural policies, while 26.2% disagreed or strongly disagreed. The mean score for this indicator was 3.36.

Table 5: Access to Agricultural Inputs and Support Services (n = 397)

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree	Mean	Std. Dev
I have easy access to improved seeds	45 (11.3%)	78 (19.6%)	64 (16.1%)	152 (38.3%)	58 (14.6%)	3.26	1.22
Fertilizers are affordable and available	52 (13.1%)	81 (20.4%)	59 (14.9%)	143 (36.0%)	62 (15.6%)	3.21	1.28
Government subsidies have improved my access to inputs	39 (9.8%)	70 (17.6%)	66 (16.6%)	157 (39.5%)	65 (16.4%)	3.35	1.18
I receive adequate support from extension officers	41 (10.3%)	73 (18.4%)	61 (15.4%)	154 (38.8%)	68 (17.1%)	3.34	1.21

The findings indicate that 52.9% of respondents agreed or strongly agreed that they have easy access to improved seeds, while 30.9% disagreed or strongly disagreed. The mean score for this indicator was 3.26.

Regarding fertilizer availability and affordability, 51.6% of respondents agreed or strongly agreed that fertilizers are available and affordable, whereas 33.5% disagreed or strongly disagreed. The mean score recorded was 3.21. Concerning government subsidies, 55.9% of respondents agreed or strongly agreed that subsidies have improved their access to agricultural inputs, while 27.4% disagreed or strongly disagreed. The mean score for this statement was 3.35. The findings further show that 55.9% of respondents agreed or strongly agreed that they receive adequate support from agricultural extension officers, whereas 28.7% disagreed or strongly disagreed. The mean score for this indicator was 3.34.

Table 6: Market Access and Income Effects (n = 397)

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree	Mean	Std. Dev
I have reliable access to agricultural markets	42 (10.6%)	71 (17.9%)	65 (16.4%)	154 (38.8%)	65 (16.4%)	3.32	1.21
Agricultural policies have improved my income	39 (9.8%)	69 (17.4%)	63 (15.9%)	160 (40.3%)	66 (16.6%)	3.37	1.19
Stable prices for crops help ensure food availability	35 (8.8%)	66 (16.6%)	61 (15.4%)	168 (42.3%)	67 (16.9%)	3.42	1.17

The findings indicate that 55.2% of respondents agreed or strongly agreed that they have reliable access to agricultural markets, while 28.5% disagreed or strongly disagreed. The mean score for this indicator was 3.32. Regarding income improvement, 56.9% of respondents agreed or strongly agreed that agricultural policies have improved their household income, whereas 27.2% disagreed or strongly disagreed. The mean score recorded for this statement was 3.37. Concerning price stability, 59.2% of respondents agreed or strongly agreed that stable crop prices help ensure food availability, while 25.4% disagreed or strongly disagreed. The mean score for this indicator was 3.42.

Table 7: Overall Implementation and Satisfaction with Agricultural Policies (n = 397)

Statement	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree	Mean	Std. Dev
Agricultural policies are effectively implemented	44 (11.1%)	72 (18.1%)	63 (15.9%)	152 (38.3%)	66 (16.6%)	3.31	1.22
Policies address the needs of smallholder farmers	40 (10.1%)	68 (17.1%)	66 (16.6%)	156 (39.3%)	67 (16.9%)	3.36	1.19
Overall, I am satisfied with agricultural policies	47 (11.8%)	74 (18.6%)	61 (15.4%)	148 (37.3%)	67 (16.9%)	3.29	1.24
Agricultural policies are relevant to my farming needs	38 (9.6%)	70 (17.6%)	65 (16.4%)	160 (40.3%)	64 (16.1%)	3.36	1.18

The findings indicate that 54.9% of respondents agreed or strongly agreed that agricultural policies are effectively implemented, while 29.2% disagreed or strongly disagreed. The mean score for this indicator was 3.31. Regarding whether agricultural policies address the needs of smallholder farmers, 56.2% of respondents agreed or strongly agreed, whereas 27.2% disagreed or strongly disagreed. The mean score recorded for this statement was 3.36. Concerning overall satisfaction with agricultural policies, 54.2% of respondents agreed or strongly agreed that they were satisfied with the policies, while 30.4% expressed dissatisfaction. The mean score for this indicator was 3.29. The findings further show that 56.4% of respondents agreed or strongly agreed that agricultural policies are relevant to their farming needs, whereas 27.2% disagreed or strongly disagreed. The mean score for this statement was 3.36.

Table 8: Policies under implementation (n = 397)

Program	Yes (n)	Yes (%)	No (n)	No (%)
Crop Intensification Program (CIP)	284	71.5	113	28.5
Fertilizer and seed subsidy	301	75.8	96	24.2
Irrigation schemes	186	46.8	211	53.2
Extension services	327	82.4	70	17.6
Post-harvest programs	214	53.9	183	46.1
Livestock programs (e.g., Girinka)	256	64.5	141	35.5

The findings indicate that agricultural extension services were the most widely accessed government agricultural program, with 82.4% of respondents reporting that they had benefited from these services, while 17.6% had not. Fertilizer and seed subsidy programs were accessed by 75.8% of respondents, whereas 24.2% reported that they had not benefited from these programs. Similarly, 71.5% of respondents indicated that they had participated in the Crop Intensification Program (CIP). Regarding livestock support, 64.5% of respondents reported benefiting from the Girinka program, while the remaining respondents had not participated. Post-harvest handling programs benefited 53.9% of respondents, indicating moderate participation. The findings further show that irrigation schemes had the lowest level of participation, with 46.8% of respondents reporting that they had benefited from these services, while 53.2% reported no access.

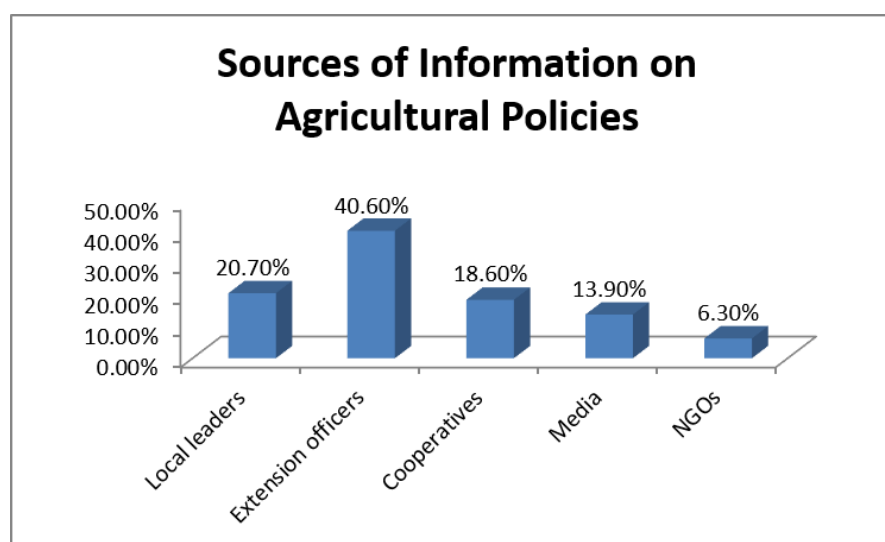


Figure 4: Sources of Information on Agricultural Policies (n = 397)

The findings indicate that extension officers were the primary source of information on agricultural policies for 40.6% of respondents. Local leaders were identified as a source of information by 20.7% of respondents, while 18.6% reported receiving information through cooperatives. Media channels, including radio, television, and social media, were reported as sources of information by 13.9% of respondents. Non-governmental organizations (NGOs) were the least cited source, accounting for 6.3% of responses.

The qualitative findings from interviews with local leaders and farmers in Rwamagana District provided deeper insights into how agricultural policies are implemented and accessed at community level. Respondents indicated that although various agricultural policies such as subsidies, extension services, and crop intensification initiatives are available, their

effectiveness is influenced by administrative and logistical challenges. Farmers explained that awareness of agricultural policies is generally moderate, but understanding of how to fully benefit from them remains limited among some households.

Table 9: Impact of Agricultural Policies on Food Security (n = 397)

Indicator	Response Category	Frequency (n)	Percentage (%)
Crop production increase after participation in agricultural policies	Yes	312	78.6
	No	85	21.4
Degree of change in crop production	Increased significantly	146	36.8
	Increased moderately	138	34.8
	No change	79	19.9
	Decreased	34	8.6
Effect of agricultural inputs on productivity	Improved significantly	162	40.8
	Improved moderately	144	36.3
	No change	68	17.1
	Worse	23	5.8
Household food security improved due to agricultural policies	Strongly agree	78	19.6
	Agree	186	46.9
	Neutral	62	15.6
	Disagree	48	12.1
Frequency of household food shortages per year	Strongly disagree	23	5.8
	Never	96	24.2
	Once	121	30.5
	2–3 times	112	28.2
Change in household food security compared to before programs	More than 3 times	68	17.1
	Much better	104	26.2
	Better	178	44.8
	The same	78	19.6
Household income increased from agriculture	Worse	37	9.3
	Yes	301	75.8
Household dietary diversity	No	96	24.2
	Never	35	8.8
	Rarely	61	15.4
	Sometimes	121	30.5
	Often	110	27.7

	Always	70	17.6
Overall impact of agricultural policies on food security	Very high	82	20.7
	High	168	42.3
	Moderate	96	24.2
	Low	39	9.8
	Very low	12	3.0

The findings indicate that 78.6% of respondents reported an increase in crop production after participating in agricultural policies, while 21.4% reported no improvement. Regarding the degree of change in crop production, 36.8% of respondents reported a significant increase, 34.8% a moderate increase, 19.9% no change, and 8.6% a decrease. In relation to agricultural inputs, 40.8% of respondents indicated that improved seeds and fertilizers significantly increased productivity, 36.3% reported a moderate increase, while 22.9% reported no change or a negative effect.

The findings further show that 66.5% of respondents agreed or strongly agreed that agricultural policies have improved household food security, 15.6% were neutral, and 17.9% disagreed. Regarding food shortages, 24.2% of respondents reported never experiencing shortages, 30.5% experienced shortages once per year, 28.2% experienced shortages 2–3 times per year, and 17.1% experienced shortages more than three times per year. In terms of changes in household food security compared to the period before agricultural policies, 71.0% of respondents reported improvement (26.2% much better and 44.8% better), while 19.6% reported no change and 9.3% reported deterioration.

The findings also indicate that 75.8% of respondents reported an increase in household income from agriculture, while 24.2% reported no increase. Regarding dietary diversity, 75.8% of respondents reported consuming a varied diet at least sometimes or more frequently, while 24.2% reported rare or no dietary diversity. Finally, 63.0% of respondents rated the overall impact of agricultural policies as high or very high, 24.2% as moderate, and 12.8% as low or very low.

3.3 Inferential Statistics: Regression Analysis (Impact of Agricultural Policies on Food Security)

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error
1	0.68	0.46	0.45	0.52

a. Predictors: (Constant), Agricultural Policies (Awareness, Access to Inputs, Extension Services, Market Support)
b. Dependent Variable: Food Security (Food Availability)

The results show that the correlation coefficient ($R = 0.68$) indicates a strong positive relationship between agricultural policies and food security. The coefficient of determination ($R^2 = 0.46$) implies that 46% of the variation in food security is explained by agricultural policies, while 54% is explained by other factors not included in the model.

Table 11: ANOVA (Overall Model Significance)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	102.48	1	102.48	150.32	0.000
Residual	120.05	395	0.304		
Total	222.53	396			

a. Predictors: (Constant), Agricultural Policies (Awareness, Access to Inputs, Extension Services, Market Support)
b. Dependent Variable: Food Security (Food Availability)

The ANOVA results show that the regression model is statistically significant ($F = 150.32$, $p < 0.001$). This indicates that agricultural policies significantly predict food security outcomes in Rwamagana District. Since the p-value is less than 0.05, the model is considered reliable and the null hypothesis is rejected.

Table 12: Coefficients of Regression Analysis

Variable	Unstandardized Coefficient (B)	Std. Error	Beta	t	Sig.
(Constant)	1.21	0.18	—	6.72	0.000
Agricultural Policies	0.62	0.05	0.68	12.26	0.000

a. Dependent Variable: Food Security (Food Availability)

The coefficients table indicates that agricultural policies have a positive and statistically significant effect on food security ($B = 0.62$, $p < 0.001$). This means that a one-unit improvement in agricultural policies leads to a 0.62 increase in food security index.

The standardized beta value ($\beta = 0.68$) confirms a strong positive influence, meaning agricultural policies are a strong predictor of food security in the study area. The t-value (12.26) also confirms the statistical significance of the relationship.

Overall, the combined results from correlation, ANOVA, and regression analysis confirm that agricultural policies have a strong, positive, and statistically significant impact on food security in Rwamagana District. Therefore, the null hypothesis is rejected, and the study concludes that agricultural policies significantly improve food security outcomes.

The qualitative findings from interviews with farmers and local leaders in Rwamagana District provide strong contextual evidence supporting the quantitative results that showed a significant positive impact of agricultural policies on food security ($R = 0.68$, $\beta = 0.68$, $p < 0.001$). Respondents explained that agricultural policies such as subsidies, extension services, and crop intensification initiatives have contributed to improved crop yields, better access to inputs, and increased household income, which in turn have enhanced food availability at household level. One farmer noted that “after joining government programs, my harvest increased and I can now feed my family for a longer period compared to before.” Similarly, a local leader emphasized that “agricultural support programs have helped many households move from food shortage to food self-sufficiency, especially those who actively participate in cooperatives and extension trainings.” However, some respondents also pointed out that the impact is not uniform, as households with limited access to inputs or extension services still experience food shortages. These qualitative insights reinforce the statistical findings by showing that while agricultural policies have a strong overall positive effect on food security, their impact varies depending on the level of access, participation, and implementation effectiveness at the local level.

4 DISCUSSION OF FINDINGS

The findings of this study show that food availability in Rwamagana District is generally moderate, with 66.5% of respondents reporting improved household food security, while 33.5% still experience food insecurity, particularly seasonal shortages. In addition, 54.4% of households reported having enough food throughout the year, while 45.6% indicated insufficient year-round food availability. Furthermore, 35.8% of households reported that food stocks last only 3–6 months after harvest, while only 17.6% can sustain food for 9–12 months, indicating seasonal vulnerability in food availability.

The findings are consistent with previous studies showing persistent food insecurity in rural East Africa, where Gebre GG (2021) reported that about 52% of rural households experience moderate to severe food insecurity due to climate variability and weak agricultural resilience systems. Similarly, Bowden (2023) found that 29% of households globally experience periodic food insecurity, closely aligning with the 28.2% of households in this study reporting shortages two to three times per year. In contrast, Coleman-Jensen et al. (2020) reported much lower food insecurity levels (10.5%) in the United States, highlighting the influence of stronger economic systems, social protection, and advanced agricultural technologies in developed countries. Dunga and Grobler (2017) also reported that over 40% of rural households in South Africa experience seasonal food insecurity, which closely matches the findings of this study.

Further supporting these results, Holleman et al. (2017) emphasized that rural food availability in Africa is constrained by structural factors such as limited access to productive land, weak policy implementation, and inadequate rural infrastructure. Overall, these comparisons show that while food availability in the study area has improved, levels of food insecurity remain similar to other Sub-Saharan African contexts and significantly higher than in developed countries, indicating structural and systemic challenges.

The findings also show that agricultural policies have a generally positive effect on productivity and income, with 78.6% of respondents reporting increased crop production and 75.8% reporting improved household income. These results are consistent with Bilal Hassan (2024), who found that agricultural policies typically improve productivity and income by 60%–80% in developing countries. Idachaba (2006) also reported yield increases of 30%–70% from effective

agricultural policies, which aligns with the productivity gains observed in this study, where 36.8% of respondents experienced significant increases and 34.8% moderate increases.

However, differences remain when compared to developed countries, where Coleman-Jensen et al. (2020) reported much lower food insecurity levels due to stronger economic stability and social protection systems. Bowden (2023) further notes that Sub-Saharan Africa continues to experience food insecurity in 25%–50% of rural households, which corresponds with the 28.2% reporting seasonal shortages in this study. Adeyemo and Kuhlmann (2009) also found productivity gains of 20%–45% in well-supported agricultural systems, similar to the 40.8% of farmers in this study reporting significant productivity improvements from improved inputs.

Overall, these comparisons indicate that agricultural policies in Rwamagana District have contributed meaningfully to improved productivity and food security, but their impact is still constrained by structural and implementation challenges, placing the study area within the broader Sub-Saharan African context of moderate agricultural transformation.

The regression results for Objective Three show a strong positive and statistically significant relationship between agricultural policies and food security ($R = 0.68$, $R^2 = 0.46$, $\beta = 0.68$, $p < 0.001$), indicating that improvements in agricultural policies are associated with improved food security outcomes. These findings are consistent with Bilal Hassan (2024), who reported similar correlation ranges ($R = 0.50$ – 0.75) in developing contexts. Holleman et al. (2017) also found comparable regression coefficients ($\beta = 0.40$ – 0.70), supporting the strong effect observed in this study.

In contrast, Coleman-Jensen et al. (2020) reported weaker associations between agricultural policy and food security in developed countries ($R < 0.30$), reflecting the role of stable incomes and social protection systems rather than direct agricultural interventions. Bowden (2023) highlights that in Sub-Saharan Africa, agricultural policies tend to have stronger effects ($R = 0.45$ – 0.70), consistent with the present findings. Adeyemo and Kuhlmann (2009) similarly observed moderate-to-strong relationships (around $R = 0.55$), reinforcing the conclusion that agricultural policies significantly improve food security in agrarian economies.

5 CONCLUSION OF THE STUDY

The study concludes that agricultural policies have a significant and positive impact on food security in Rwamagana District. The findings from both descriptive and inferential analyses indicate that improved access to agricultural inputs, extension services, market support, and policy awareness contribute to increased crop production, higher household incomes, and improved food availability. However, despite these positive outcomes, food insecurity still persists among some households due to challenges such as unequal access to inputs, limited extension coverage, and seasonal fluctuations in food supply. The statistical results ($r = 0.68$, $R^2 = 0.46$, $\beta = 0.68$, $p < 0.001$) confirm that agricultural policies are a strong predictor of food security, explaining a substantial proportion of variation in food availability outcomes. Overall, while agricultural policies are effective in improving food security, their full potential has not yet been achieved due to implementation gaps at the local level.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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The authors declare no conflicts of interest regarding this manuscript.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Author Contributions

- Conceptualization: Pie NZEYIMANA
- Data curation: Pie NZEYIMANA
- Formal analysis: Pie NZEYIMANA
- Methodology: Pie NZEYIMANA
- Writing – original draft: Pie NZEYIMANA
- Writing – review & editing: Pauline NIYOMUGABO and Révérien HAKIZIMANA
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