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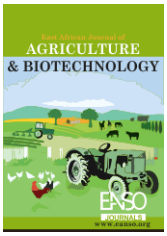

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Original Article

Contribution of Agricultural Organizations to the Smallholder Farmers' Livelihood in Rwanda: Case Study of One Acre Fund-Tubura Rwanda in Kayonza District

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ABSTRACT

Rwanda's smallholder farmers, crucial to the rural economy, face ongoing challenges like low productivity, limited market access, and inadequate resources despite interventions from organizations like One Acre Fund-Tubura Rwanda. These issues threaten food security and poverty reduction, highlighting the need for empirical research on the effectiveness of such interventions, particularly in the Kayonza District. This study examines the contribution of agricultural organizations to smallholder farmers' livelihoods in Rwanda, using One Acre Fund-Tubura in Kayonza District as a case study from 2019 to 2023. Using a descriptive and correlational research design, the study analyzed data from 394 beneficiaries of the program, selected using stratified, random, and purposive sampling techniques. Data were collected through questionnaires and interviews. Data analysis involved descriptive statistics, T-test, and correlation analysis using SPSS for quantitative data. Key findings reveal that 83.8% of farmers have engaged with Tubura for over a decade, accessing critical services such as fertilizers and seeds, which are universally provided, alongside selective interventions like agroforestry seedlings and training. Tubura's support significantly enhanced agricultural productivity, with maize yields increasing by over 2000 kg/ha and corresponding income doubling post-intervention. Farmers reported substantial progress in food security, education, and health, albeit with moderate improvements in asset accumulation. The study highlights a positive correlation between Tubura's interventions and livelihood indicators, particularly in agricultural productivity ($r = 0.752$), emphasizing the impact of sustained engagement. Challenges such as delayed input delivery and limited accessibility to Tubura shops were noted, underscoring areas for improvement to maximize benefits for smallholder farmers. The study recommended expanding the distribution of fertilizers and seeds to sustain and enhance agricultural productivity while also increasing the frequency and scope of training sessions and extension services to offer farmers more comprehensive support.

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INTRODUCTION

Agriculture remains the cornerstone of economic development in many low-income and developing countries, with smallholder farmers playing a central role in food production, poverty reduction, and rural livelihoods. Despite its significance, smallholder agriculture is frequently characterized by low productivity, limited access to agricultural inputs, technology, financing, and market opportunities, as well as heightened vulnerability to climate variability and economic shocks. These challenges have prompted the emergence of agricultural organizations that aim to support farmers through a range of services including input provision, training, credit, and market linkages.

In Rwanda, agriculture contributes approximately 27% to the Gross Domestic Product (GDP) and employs about 70% of the population. However, the sector still faces persistent challenges such as land fragmentation, inadequate infrastructure, and limited market access, which particularly affect smallholder farmers. To address these issues, several agricultural organizations, including One Acre Fund locally known as Tubura have established operations in Rwanda to support smallholder farmers through input provision, training, and extension services. Evidence from organizations like One Acre Fund suggests a positive impact on crop yields and food security; however, the extent to which these interventions translate into broader improvements in livelihoods remains under-researched, especially at localized levels such as the Kayonza District.

Globally and regionally, agricultural development initiatives such as those under the Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), and the African Union's Comprehensive Africa Agriculture Development Programme (CAADP) highlight the importance of strengthening smallholder farming systems to meet Sustainable Development Goals (SDGs) related to hunger eradication, poverty alleviation, and sustainable development. In East Africa and Rwanda in particular, the relevance of such interventions is amplified by the socio-economic dependence on agriculture.

Despite the documented benefits of interventions by organizations like One Acre Fund, smallholder farmers in Rwanda especially those in the Kayonza District continue to experience low productivity and limited economic resilience. This raises important questions about the effectiveness of these agricultural interventions in fostering sustainable

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improvements in smallholder livelihoods. Therefore, it becomes essential to empirically assess how, and to what extent, organizations like One Acre Fund contribute to transforming the lives of smallholder farmers.

This study seeks to examine the contribution of agricultural organizations to smallholder farmers' livelihoods in Rwanda, with a specific focus on One Acre Fund-Tubura in Kayonza District from 2019 to 2023**.** The research investigates the types of services offered by Tubura, the current state of livelihoods among its beneficiaries, and the relationship between Tubura's activities and improvements in those livelihoods. By focusing on a localized case study, the research aims to generate actionable insights for policymakers, development practitioners, and agricultural stakeholders. The central research question guiding this study is: To what extent has One Acre Fund-Tubura contributed to improving the livelihoods of smallholder farmers in Kayonza District between 2019 and 2023?

This study hypothesizes that the interventions of One Acre Fund-Tubura through the provision of agricultural inputs, training, and other services have had a significant positive impact on the productivity, food security, and economic well-being of smallholder farmers in Kayonza District. The purpose of the research is to generate empirical evidence that informs effective strategies for agricultural development and rural poverty reduction in Rwanda and similar contexts.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in Kayonza District, located in Rwanda's Eastern Province, which spans approximately 1,935 km² and had a population of 457,156 as per the 2022 census. The district is predominantly agricultural, with farmers cultivating both staple and cash crops. In terms of land use, the average cultivated land per household is 0.82 hectares, with only 22% of households cultivating less than 0.3 hectares. NISR. (2019). The district faces challenges related to climate change, soil degradation, and socio-economic disparities. MINAGRI (2028). The study specifically targeted smallholder farmers and staff associated with the One Acre Fund-Tubura program, which provides agricultural inputs, training, and other services to enhance the rural livelihoods to more than 24458 farmers in the district. One Acre Fund (2021).

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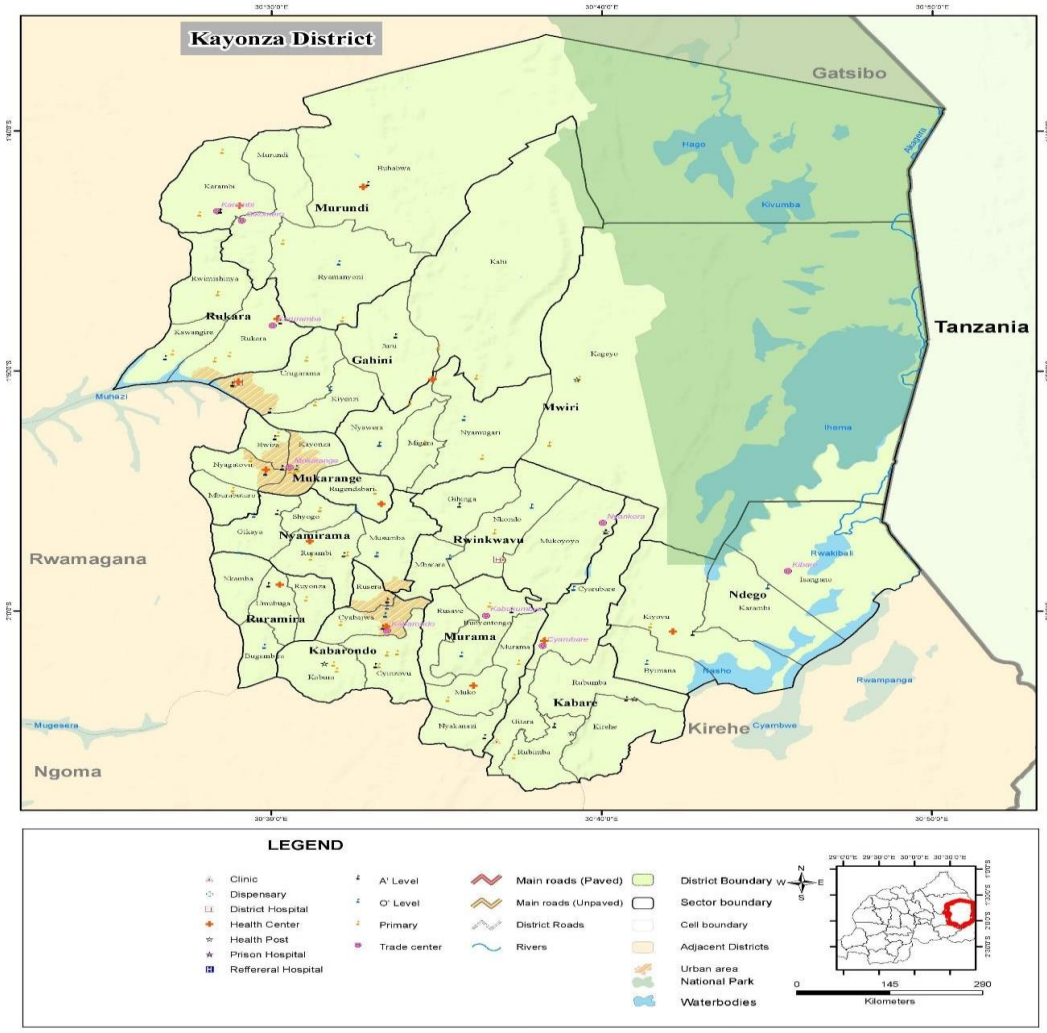

Source: National Institute of Statistics, 2019

Research Design, Sample Size Determination, Data Collection and Analysis

The study used a descriptive and correlational research design to examine the impact of One Acre Fund-Tubura interventions on the livelihoods of smallholder farmers. Both quantitative and qualitative methods were employed, combining descriptive statistics and correlation analysis to derive meaningful insights. The choice of a descriptive and correlational research design is justified as it allows for a comprehensive understanding of current conditions and the relationships between variables without manipulating them, which is ideal for assessing real-world interventions such as those by One Acre Fund (Creswell, 2014).

The research targeted 24,458 farmers working with Tubura as from the Tubura report 2021 and 50 staff members in Kayonza District, with a sample of 394 farmers calculated using the Yamane formula and selected through cluster and random sampling, and 2 staff members chosen purposively. Data collection involved structured questionnaires for farmers, semi-structured interviews with staff, and a review of secondary sources like reports and government publications. The combination of structured questionnaires, semi-structured

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interviews, and document review was chosen to ensure data triangulation, enhance validity, and capture both quantifiable trends and in-depth perspectives (Patton, 2002).

Face-to-face surveys were conducted by trained enumerators to ensure data accuracy, while interviews offered deeper insights into staff views on the program. Quantitative data were analyzed using SPSS, and qualitative responses were thematically analyzed to support and enrich the statistical results.

RESULTS

This section summarizes research findings aligned with the study's objectives, focusing on the impact of One Acre Fund-Tubura's interventions on smallholder farmers' livelihoods in Kayonza District, Rwanda. It is organized around three specific objectives: evaluating the organization's activities, assessing farmers' livelihood status, and analyzing the relationship between interventions and livelihood outcomes.

Objective 1: Evaluation of Activities Undertaken by One Acre Fund-Tubura in Kayonza District

Farmers' Experience with One Acre Fund Tubura

This section examines the farmers' experience with One Acre Fund Tubura, focusing on the number of years they have been working with the organization. This helps to understand the depth of their engagement and the potential impact of long-term involvement with the program.

Table 1: Farmers' Experience with Tubura

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Above 10 years	330	83.8	83.8	83.8
	5 to 10 years	64	16.2	16.2	100.0
	Total	394	100.0	100.0	

Source: *Primary data, 2024*

The data indicates that most farmers (83.8%) have been engaged with One Acre Fund-Tubura for over 10 years, while 16.2% have participated for 5 to 10 years. This reflects a strong and long-term commitment among the majority of farmers.

One Acre Fund-Tubura interventions in Kayonza District

This section explores the interventions implemented by One Acre Fund-Tubura in Kayonza District, highlighting the specific programs and initiatives aimed at improving agricultural practices and livelihoods in the region.

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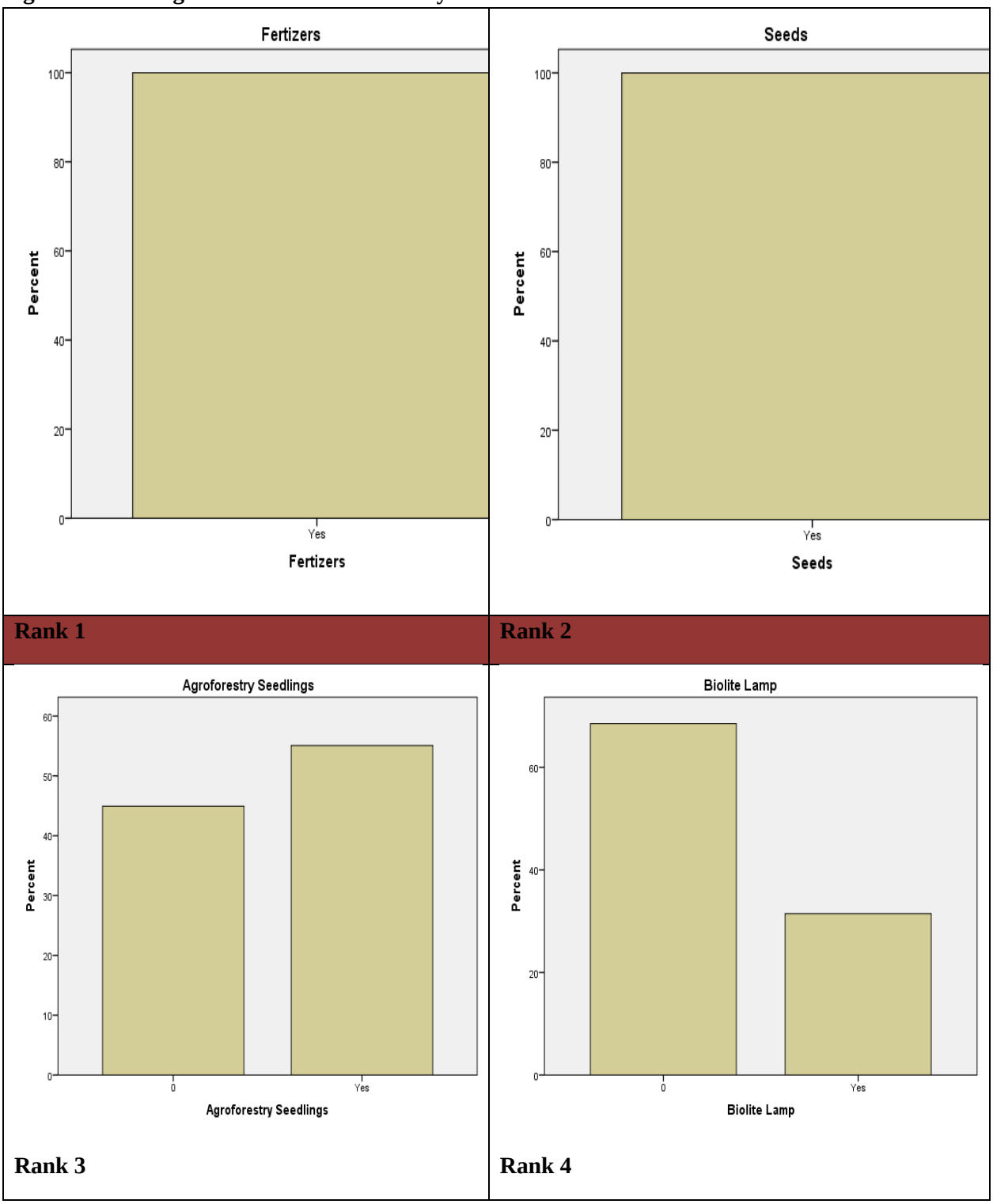
Figure 1: Ranking of Services as Received by Farmers from One Acre Fund



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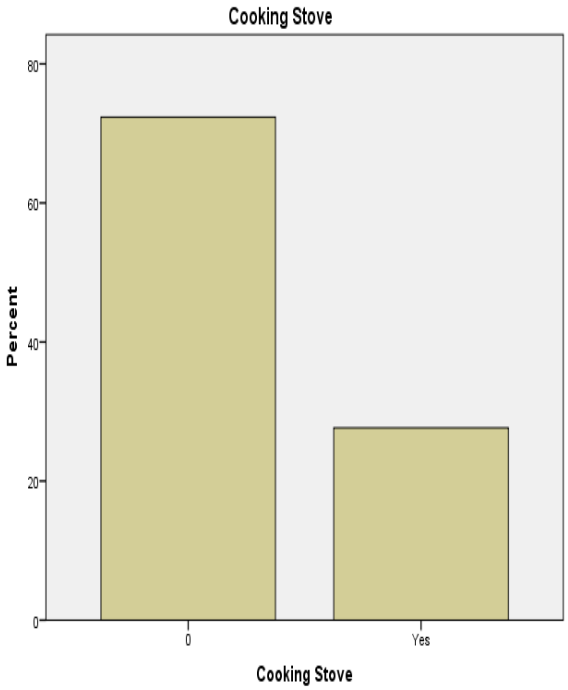

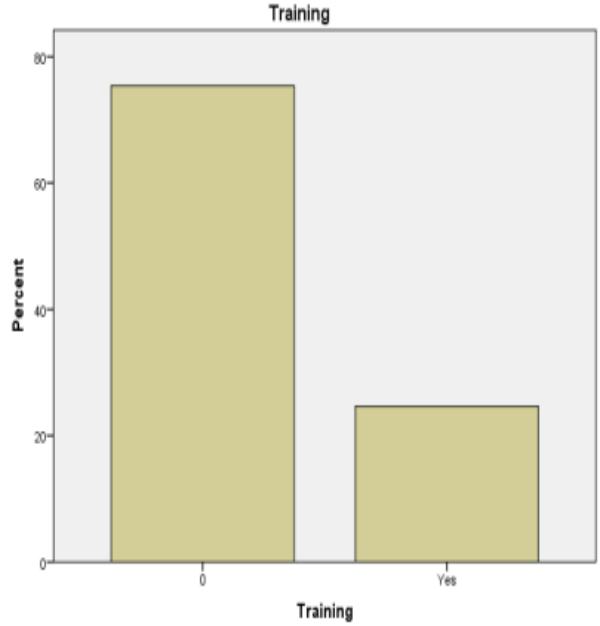

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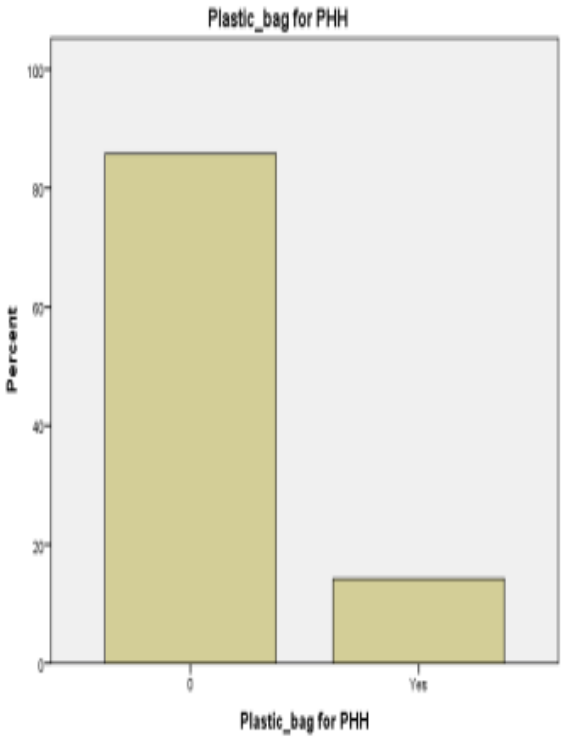

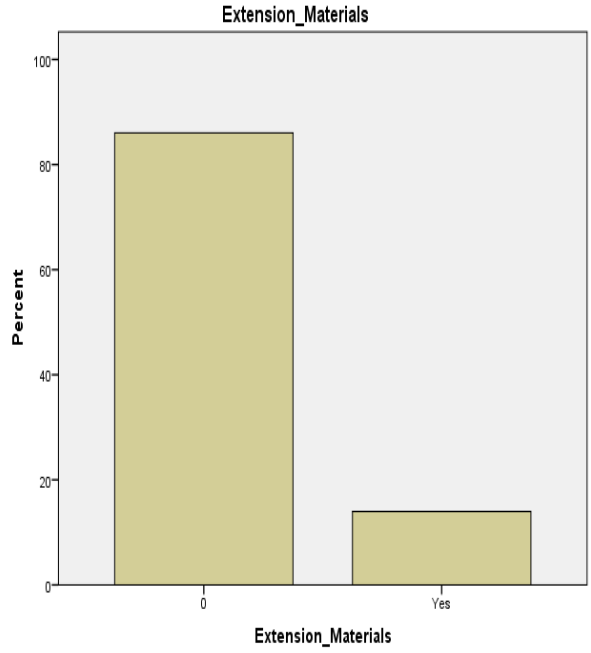

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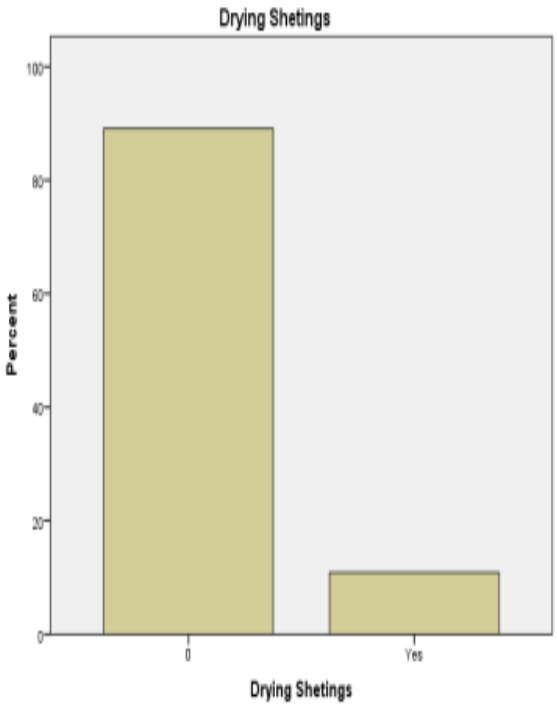	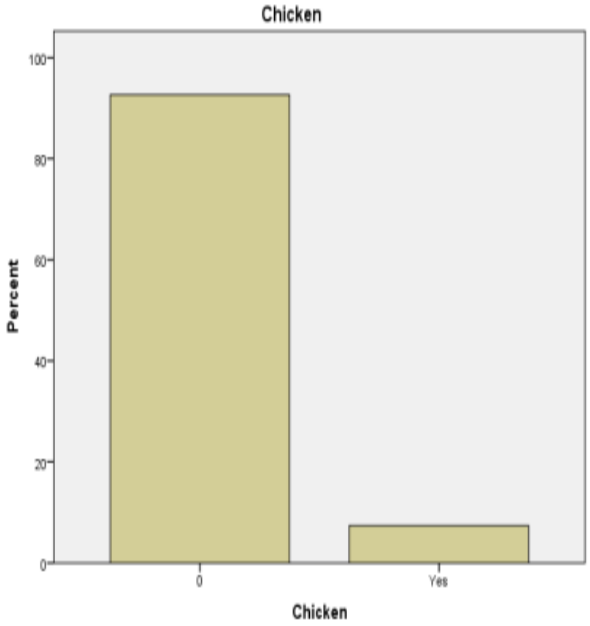
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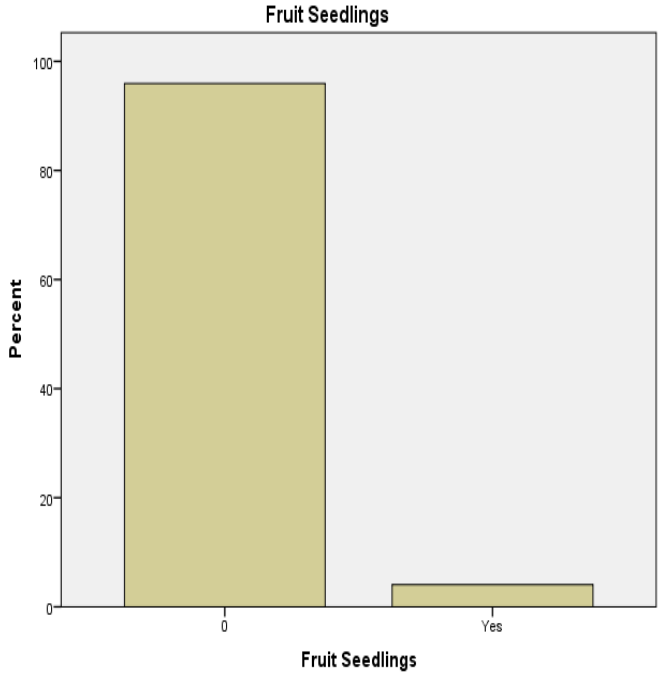

Rank 11

Source: *Primary data, 2024*

Farmers benefited from various services provided by One Acre Fund Tubura, with fertilizers and seeds being the most widely distributed, reaching **100%** of farmers. **Agroforestry seedlings,** received by **55.1%** of farmers, ranked third, highlighting moderate coverage aimed at promoting tree planting. These findings align with interview results, confirming that all Tubura farmers have ordered seeds and fertilizers over the past five years. Services like cooking stoves (27.7%), Biolite lamps (31.5%), and training (24.6%) were less commonly received, while drying sheets (10.9%), plastic bags for post-harvest handling (14.2%), extension materials (14.0%), chickens (7.4%), and fruit seedlings (4.1%) had the lowest coverage. This highlights a focus on universally essential services while selectively providing others based on specific needs or limited resources.

The Number of Interventions Received by Farmers from One Acre Fund

This section examines the various interventions received by farmers from One Acre Fund, focusing on the types and frequency of support provided to enhance agricultural productivity and livelihoods.

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Table 2: Number of Services Received by Farmers during the last five years

Total Number		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	64	16.2	16.2	16.2
	3	116	29.4	29.4	45.7
	4	104	26.3	26.4	72.1
	5	54	13.7	13.7	85.8
	6	36	9.1	9.1	94.9
	7	16	4.1	4.1	99.0
	8	4	1.0	1.0	100.0
	Total	394	99.7	100.0	
Missing	System	1	.3		
Total		395	100.0		

Source: *Primary data, 2024*

The table indicates that farmers received varying numbers of services from Tubura over the last five years. Most farmers received 3 services (29.4%) or 4 services (26.4%). A smaller proportion accessed 2 services (16.2%) or 5 services (13.7%), while fewer farmers received 6 (9.1%), 7 (4.1%), or 8 services (1.0%). This distribution shows that the majority of farmers benefited from multiple services, with the most common range being 3 to 4 services.

Frequency of Services Received by Farmers from One Acre Fund

This section investigates the frequency with which farmers receive services from One Acre Fund, aiming to understand how often they benefit from Tubura's support. The frequencies have been categorized as monthly, seasonal, annually, and multi-yearly to provide a clearer picture of the service delivery schedule.

Table 3: How Often Farmers Receive Tubura Services

	N	Minimum	Maximum	Mean	Std. Deviation
How often Farmers receive Fertilizers	394	2	3	2.91	.281
How often Farmers receive Seeds	394	2	3	2.91	.281
How often Farmers receive Training	97	1	3	2.33	.554
How often Farmers receive Extension materials	55	2	3	2.29	.458
How often Farmers receive plastic bags for PHH	56	1	2	1.41	.496
How often Farmers receive chicken from	29	1	1	1.00	.000
How often Farmers receive Agro-forestry seedlings	217	1	2	1.56	.497
How often Farmers receive Fruit seedlings	16	1	2	1.13	.342
How often Farmers receive Drying sheetings	43	1	2	1.12	.324
How often Farmers receive Biolite lamp	124	1	2	1.02	.126
How often Farmers receive cooking stove	109	1	2	1.02	.135
Valid N (listwise)	0				

Source: *Primary data, 2024*

The table shows the frequency with which farmers receive different services from One Acre Fund (OAF), with higher mean values indicating more frequent receipt (1: Multi-Yearly, 2: Annual, 3: Seasonal while 4 stands for monthly). **Fertilizers** and **seeds** are the most frequently received services, with a mean of 2.91, suggesting that farmers typically receive these items seasonally or annually.

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Training (mean = 2.33) and **extension materials** (mean = 2.29) are also received quite frequently, usually on a seasonal and annul basis. On the other hand, services such as **plastic bags for PHH** (mean = 1.41), **agro-forestry seedlings** (mean = 1.56), **chickens** (mean = 1.00), **fruit seedlings** (mean = 1.13), and **drying sheetings** (mean = 1.12) are received less frequently, typically on annual or multi-yearly basis, with **chickens** being the least frequent service. **Biolite lamps** and **cooking stoves** (mean = 1.02) are also among the least frequently received services, with a multi-yearly distribution. The data indicates that services related to agricultural inputs are received more frequently than those involving other items like livestock or household tools.

Farmers' Perception of the Importance of Tubura Interventions

This section explores farmers' perceptions of the significance of One Acre Fund-Tubura's interventions. It highlights how farmers view the impact of Tubura's support on their agricultural practices, livelihoods, and overall well-being. Understanding these perceptions provides valuable insights into the effectiveness and relevance of Tubura's programs from the beneficiaries' perspective.

Table 4: Descriptive Statistics of the Product's Importance Ranking

	N	Minimum	Maximum	Mean	Std. Deviation
Importance for Fertilizers	394	1	2	1.01	.087
Importance for Seeds	394	1	1	1.00	.000
Importance for Training	394	1	3	2.70	.661
Importance for Extension Materials	394	1	4	2.98	.285
Importance for Plastic Bags	394	1	3	2.68	.718
Importance for Chicken	394	1	4	2.99	.311
Importance for Agro-forestry Seedlings	394	1	3	2.57	.590
Importance for Fruits Seedlings	394	1	2	1.98	.132
Importance for Drying Sheetings	394	2	3	2.96	.198
Importance for Biolite Lamp	394	1	3	2.51	.558
Importance for Cooking Stove	394	1	3	2.88	.422
Valid N (listwise)	394				

Source: *Primary data, 2024*

The table presents how farmers rank the importance of various products and services, with rankings from 1 (Critical importance) to 4 (Low importance). Seeds received the highest ranking with a mean of 1.00, indicating that all farmers consider them critically important. Fertilizers followed closely with a mean of 1.01, showing a strong consensus among farmers about their critical importance, with minimal variation (standard deviation = 0.087). Fruit Seedlings also received a relatively high ranking (mean = 1.98), though with a slightly more variable view among farmers (standard deviation = 0.132), suggesting a bit of difference in opinion, but still considered important.

Other products and services such as Training (mean = 2.70), Extension Materials (mean = 2.98), and Plastic Bags (mean = 2.68) were ranked with moderate importance, indicating some diversity in how they were perceived by the farmers. Chicken (mean = 2.99) and Agro-forestry Seedlings (mean = 2.57) had similar moderate rankings with slightly more variation in farmers' views (standard deviations of 0.311 and 0.590, respectively). Drying Sheetings (mean = 2.96) and Biolite Lamp (mean = 2.51) were considered less important but still valued, with relatively low variation. Cooking Stove (mean = 2.88) also falls into this category with moderate importance but some disagreement among farmers (standard deviation = 0.422).

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Overall, products like seeds and fertilizers are viewed as most critical, while other services and products show moderate to low importance.

Challenges Faced by Farmers

Table 5: Challenges Faced by Farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inputs Delay	247	62.7	66.0	66.0
	High Cost of Tubura Products	3	.8	.8	66.8
	Difficult Enrollment Procedures	16	4.1	4.3	71.1
	Accessibility of Tubura Shops	89	22.6	23.8	94.9
	Bad Service on Tubura Hotline	3	.8	.8	95.7
	High Basic Payment	16	4.1	4.3	100.0
	Total	374	94.9	100.0	
Missing	System	72	18.2		
Total		446	1		

Source: *Primary data, 2024*

The table indicates that farmers encounter several challenges when working with Tubura, with the most significant being delays in receiving inputs, reported by 66.0% of respondents. Limited accessibility to Tubura shops is another notable issue, affecting 23.8% of farmers. Additionally, 4.3% of farmers cited difficult enrolment procedures and high basic payments as challenges. Smaller percentages mentioned the high cost of Tubura products (0.8%) and poor service on the Tubura hotline (0.8%). These findings highlight key areas for improvement to enhance farmers' experience with Tubura services.

Objective 2: The Level of Livelihood of Smallholder Farmers Beneficiaries of One Acre Fund-Tubura in Kayonza

This section examined the livelihood levels of smallholder farmers who are beneficiaries of One Acre Fund-Tubura in Kayonza. It focuses on how Tubura's support has influenced their economic status, access to resources, and overall quality of life. This analysis helps to assess the extent to which Tubura's interventions have contributed to improving the livelihoods of these farmers.

The level of Farmer's Livelihood Improvement

This section evaluates the level of improvement in farmers' livelihoods, focusing on key areas such as agricultural productivity, education, health, food security, household income, and asset accumulation. These dimensions provide a comprehensive understanding of the impact of One Acre Fund-Tubura's interventions on the well-being of smallholder farmers.

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Table 6: The Level of Farmers' Improvement

	Very High Improvement	High Improvement	Moderate Improvement	Low Improvement	No Improvement	Decline
Agricultural Productivity	27.9%	55.8%	16.2%	0.1%	0.0%	0.0%
Food Security	8.1%	45.3%	45.6%	1.0%	0.0%	0.0%
Education	3.0%	31.3%	62.4%	3.3%	0.0%	0.0%
Health	5.0%	35.9%	57.9%	1.2%	0.0%	0.0%
Income	2.5%	22.2%	74.1%	1.2%	0.0%	0.0%
Assets accumulation	1.9%	15.2%	81.8%	1.1%	0.0%	0.0%

Source: *Primary data, 2024*

The table indicates that Tubura farmers have experienced significant improvements in their livelihoods, particularly in agricultural productivity, where 83.7% reported high or very high improvement. Food security also improved for most farmers, with 53.4% reporting high or very high improvement, though 45.6% saw only moderate gains. These results align with the interview findings which confirmed that the agricultural productivity, food security and health conditions for farmers have considerably increased.

In education, health, and income, the majority of farmers reported moderate improvement (over 57% in each category), with a smaller proportion experiencing high or very high progress. Asset accumulation showed the slowest growth, with only 17.1% reporting high or very high improvement, while 81.8% saw only moderate progress.

Overall, Tubura farmers have experienced significant improvements in productivity and food security over the past five years, while progress in income, education, health, and asset accumulation has been more gradual.

Farmer's Agreement on Their Current Comparative Ability

This section explores farmers' perspectives on their current comparative abilities in different areas of their livelihoods. It focuses on how they assess their capacity to achieve improved outcomes after receiving support from One Acre Fund-Tubura.

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Table 7: Farmers' Level of Agreement on Their Current Capability After Working with One Acre Fund

		I'm able to pay school fees for my children because I work with Tubura	I'm able to pay health insurance for my family and my relatives because I work with Tubura	My agricultural productivity increased because I work with Tubura	I acquired domestic animals (cows, sheep, goats, pig because I work with Tubura	My household income from agriculture production has been increased over the last five years because I work with Tubura	I bought a piece of land over because I work with Tubura	I started business over the last five years because I work with Tubura	My household savings in financial institutions has been increased over the last five years because I work with Tubura
N	Valid	394	394	394	336	394	366	256	371
	Missing	0	0	0	58	0	28	138	23
Mean		1.61	1.38	1.53	1.98	2.11	2.58	3.20	2.09
Mode		2	1	2	2	2	3	3	2
Std. Deviation		.601	.486	.500	.393	.609	.765	1.073	.596
Minimum		1	1	1	1	1	1	1	1
Maximum		4	2	2	3	4	4	5	5

Source: Primary data

Mean range Legend: *1. Strongly Agree 1.00-1.80-very high, 2. Agree 1.81-2.60 high, 3. Not Sure 2.61-3.40Moderate, 4. Disagree3.41-4.20 low, 5. Strongly Disagree 4.21-5.00 very low; SD≤1: Homogeneity SD, SD>1: Heterogeneity SD*

The table evaluates respondents' perceptions of the benefits derived from working with Tubura across various aspects of their livelihoods. Most respondents strongly agreed or agreed with the statements, as evidenced by the mean values predominantly falling within the "very high" (1.00–1.80) and "high" (1.81–2.60) ranges. For example, the ability to pay school fees for their children (M=1.61, SD=0.601) and health insurance for their families (M=1.38, SD=0.486) received very high agreement. Increased agricultural productivity (M=1.53, SD=0.500) and acquiring domestic animals (M=1.98, SD=0.393) also scored high, with relatively low variability (SD<1), indicating homogeneous responses. Meanwhile, starting a business (M=3.20, SD=1.073) showed a moderate level of agreement, with higher variability suggesting differing experiences among respondents. Overall, the data highlights significant positive impacts of Tubura's support, particularly in education, health, and agricultural productivity, while business-related improvements are less uniformly perceived.

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Comparative Maize Productivity and Farm Income Analysis

This section presents a comparative analysis of maize productivity and farm income. Farmers were asked to provide their maize productivity per area before and after receiving support, and this data was applied to their total land size to calculate their farm income from maize. This comparison highlights the impact of One Acre Fund-Tubura's interventions on productivity and income levels.

Table 8: Descriptive Statistics of Farmers' Maize Productivity and Farm Income Before and After

	N	Minimum	Maximum	Mean	Std. Deviation
Maize Productivity Before Tubura Interventions (Kgs/Ha)	394	800.00	2100.00	1429.4416	353.96150
Maize Productivity AfterTubura Interventions (Kgs/Ha)	394	2500.00	6000.00	3477.6650	1054.61961
Income from Maize Before (Rwf)	394	4800.00	420000.00	70317.7665	71920.25368
Income from maize After (Rwf)	394	15000.00	1200000.00	170822.3350	178735.95493
Valid N (listwise)	394				

Source*: Primary data*

The descriptive statistics highlight significant improvements in maize productivity and farm income after Tubura interventions. Before the intervention, the average maize productivity was 1,429.44 kg/ha, which increased substantially to 3,477.67 kg/ha afterwards. Similarly, the average income from maize rose from Rwf 70,317.77 to Rwf 170,822.34. These results, based on data from 394 farmers, show that Tubura's support led to remarkable increases in both productivity and income, demonstrating the effectiveness of their interventions in enhancing maize farming, the primary crop for all farmers studied.

Objective 3: Relationship between Tubura Agricultural Activities and the Livelihood of Smallholder Farmers Beneficiaries

Tubura Interventions' Impact on Maize Production

This section evaluates the effect of Tubura's interventions on maize production. It examines the difference in farmers' maize productivity before and after benefiting from Tubura's support to determine the interventions' effectiveness. A paired samples t-test was conducted to measure the significance of the changes, offering insights into the role of Tubura's programs in enhancing agricultural outcomes and economic progress.

Table 9: Impact on Maize Productivity Before and After Intervention by the Paired Samples T-test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Maize Productivity Before Tubura Interventions (Kgs/Ha) - Maize Productivity After Tubura Interventions (Kgs/Ha)	-2048.22335	987.43217	49.74611	-2146.02514	-1950.42156	-41.174	393	.000

Source*: Primary data*

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The paired samples T-test compares maize productivity before and after Tubura interventions. The mean difference is -2048.22 Kgs/Ha, indicating that productivity increased significantly after the interventions. The 95% confidence interval ranges from -2146.03 to -1950.42 Kgs/Ha, showing that the true mean difference lies within this range. The standard deviation (987.43 Kgs/Ha) reflects the variability in the differences, while the standard error mean (49.75 Kgs/Ha) provides an estimate of the precision of the mean difference.

The t-value of -41.174 and degrees of freedom (393) indicate a substantial difference between the two groups, with a p-value of .000. This statistically significant result confirms that Tubura interventions had a meaningful positive impact on maize productivity, with an average increase of over 2000 Kgs/Ha.

Tubura Interventions' Impact on Farm Income

The section assesses the impact of Tubura's interventions on maize farm income. By comparing farmers' income before and after receiving Tubura's support, the analysis highlights the effectiveness of the interventions. A paired samples t-test was used to evaluate the significance of changes in income, providing a clear understanding of the contribution of Tubura's programs to economic improvements.

Table 10: Impact on Farm Income Before and After Intervention by the Paired Samples T-test

	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Income from Maize Before (Rwf) - Income from maize After (Rwf)	-100504.56853	116620.79751	5875.27090	-112055.46049	-88953.67657	-17.106	393	.000

The paired samples T-test compares income from maize before and after an intervention. The mean difference is -100,504.57 Rwf, indicating that income significantly increased after the intervention. The 95% confidence interval ranges from -112,055.46 to -88,953.68 Rwf, suggesting that the true average increase in income lies within this range. The standard deviation (116,620.80 Rwf) shows the variability in the income differences, while the standard error mean (5,875.27 Rwf) provides a precise estimate of the mean difference.

The t-value of -17.106, with 393 degrees of freedom, reflects a substantial difference between the two groups. The p-value of .000 confirms that this result is statistically significant, meaning the intervention had a clear and positive impact, increasing maize-related income for farmers.

Correlation Analysis

This section presents a correlation analysis to explore the relationships between key variables impacted by Tubura interventions. Specifically, it examines the correlation between maize productivity and income increase after Tubura support, the relationship between the number of Tubura services received and various livelihood indicators, and the connection between farmers' experience with Tubura and their livelihood outcomes. These analyses provide valuable insights into how Tubura's interventions influence productivity, income, and overall well-being.

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Table 11: Correlation between Maize Productivity and Income Increase After Tubura Interventions

		Maize Productivity After Tubura Interventions (Kgs/Ha)	Income from maize After (Rwf)
Maize Productivity AfterTubura Interventions (Kgs/Ha)	Pearson Correlation	1	.289**
	Sig. (2-tailed)		.000
	N	394	394
Income from maize After (Rwf)	Pearson Correlation	.289**	1
	Sig. (2-tailed)	.000	
	N	394	394

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation table shows a positive relationship between maize productivity after Tubura interventions and income from maize after the interventions, with a Pearson correlation coefficient of **0.289**. This indicates a moderate positive correlation, meaning that as maize productivity increases, income from maize also tends to increase. The p-value (.000) confirms that this correlation is statistically significant at the 0.01 level, based on 394 observations.

Table 12: Relationship between the Number of Tubura Services Received and the Livelihood Variables

		Number of Services Received
Agricultural Productivity	Pearson Correlation	.206**
	Sig. (2-tailed)	.000
	N	393
Food Security	Pearson Correlation	.207**
	Sig. (2-tailed)	.000
	N	393
Education Facilities	Pearson Correlation	.111*
	Sig. (2-tailed)	.027
	N	393
Health Facilities	Pearson Correlation	.207**
	Sig. (2-tailed)	.000
	N	393
Household Income	Pearson Correlation	.207**
	Sig. (2-tailed)	.000
	N	393
Asset Accumulation	Pearson Correlation	.131**
	Sig. (2-tailed)	.009
	N	393

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The analysis of the relationship between the number of Tubura services received and various livelihood variables reveal statistically significant positive correlations. Specifically, the number of services received is significantly correlated with agricultural productivity ($r = 0.206$, $p < 0.01$), food security ($r = 0.207$, $p < 0.01$), education facilities ($r = 0.111$, $p < 0.05$), health facilities ($r = 0.207$, $p < 0.01$),

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household income (r = 0.207, p < 0.01), and asset accumulation (r = 0.131, p < 0.01). This indicates that receiving more services from Tubura is associated with improvements across multiple dimensions of farmers' livelihoods.

Among these variables, the strongest correlation is observed between the number of services and agricultural productivity, suggesting that Tubura's interventions have a direct and substantial impact on enhancing productivity. Similarly, the correlations with food security and household income emphasize the role of Tubura's services in supporting overall well-being and economic stability for farmers. While the correlations with education and health facilities are weaker, they are still significant, pointing to broader social benefits of the services.

Table 3.3.3: Relationship between the Experience with Tubura and the Livelihood Variables

		Farmers' experience with Tubura
Agricultural Productivity	Pearson Correlation	.752**
	Sig. (2-tailed)	.000
	N	394
Food Security	Pearson Correlation	.109*
	Sig. (2-tailed)	.031
	N	394
Education Facilities	Pearson Correlation	.305**
	Sig. (2-tailed)	.000
	N	394
Health Facilities	Pearson Correlation	.109*
	Sig. (2-tailed)	.031
	N	394
Household Income	Pearson Correlation	.109*
	Sig. (2-tailed)	.031
	N	394
Asset Accumulation	Pearson Correlation	.302**
	Sig. (2-tailed)	.000
	N	394
Farmers's experience with Tubura	Pearson Correlation	1
	Sig. (2-tailed)	
	N	394

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The analysis shows that farmers' experience with Tubura (measured by the number of years working with the organization) is significantly correlated with various livelihood factors. The strongest positive relationship is observed between farmers' experience and agricultural productivity (r = 0.752, p < 0.01), indicating that longer engagement with Tubura is associated with substantial improvements in productivity. Similarly, experience with Tubura is moderately correlated with education facilities (r = 0.305, p < 0.01) and asset accumulation (r = 0.302, p < 0.01), suggesting that extended participation supports better access to education and enhanced household assets.

Significant correlations are noted also with food security, health facilities, and household income (all r = 0.109, p < 0.05). These results suggest that longer engagement with Tubura contributes to incremental improvements in these areas. Overall, the findings emphasize that sustained collaboration

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with Tubura positively impacts multiple aspects of farmers' livelihoods, with the most notable effects seen in agricultural productivity.

DISCUSSION

One Acre Fund-Tubura has established a long-term presence in Kayonza district, with 83.8% of farmers participating for over 10 years. This strong commitment is reflected in the wide distribution of essential services, particularly fertilizers and seeds, which were received by 100% of the farmers. These findings corroborate the study by Staver et al. (2016), who highlight the role of input provision in enhancing agricultural productivity. However, other services such as cooking stoves (27.7%), Biolite lamps (31.5%), and training (24.6%) were less commonly received, indicating that while Tubura's core agricultural support is robust, certain supplementary services are less accessible or prioritized. This selective distribution is consistent with Khatri-Chhetri et al. (2017), who argue that complementary services, though valuable, often face challenges in scaling up.

Farmers in Kayonza district have experienced notable improvements in their livelihoods, particularly in agricultural productivity and food security. Over 80% of farmers reported high improvements in these areas, echoing the findings of studies such as that of Fafchamps and Minten (2017), who assert that access to quality agricultural inputs is critical in enhancing food security. Moreover, while other areas like education, health, and asset accumulation showed more gradual improvements, the data aligns with findings by Savadogo et al. (2018), who observed that agricultural interventions typically have the most immediate effects on food security and income, with longer-term impacts on other aspects like education and asset growth.

The relationship between Tubura's agricultural activities and the livelihoods of smallholder farmers is robust, with significant correlations found between the number of services received and improvements in agricultural productivity ($r = 0.206$, $p < 0.01$), food security ($r = 0.207$, $p < 0.01$), and household income ($r = 0.207$, $p < 0.01$). These findings are consistent with those of Bernard et al. (2019), who emphasize that a multifaceted approach combining inputs, training, and extension services can significantly enhance productivity and household income. Furthermore, the experience of farmers with Tubura is positively correlated with agricultural productivity ($r = 0.752$, $p < 0.01$), underscoring the long-term benefits of sustained engagement with agricultural support organizations. This finding is consistent with a study by Diagne et al. (2017), which found that longer-term involvement with agricultural extension services leads to sustained productivity gains.

In conclusion, the results indicate that Tubura's activities in Kayonza district have had a profound positive impact on farmers' agricultural productivity and food security, while also contributing incrementally to other livelihood dimensions. The findings suggest that the organization's core interventions, particularly in seed and fertilizer distribution, have been highly effective, though there is room for improvement in providing supplementary services more uniformly across all farmers. This research provides valuable insights into the importance of sustained agricultural support and its multifaceted impacts on rural livelihoods.

CONCLUSION

The first objective of the research was to evaluate the activities undertaken by One Acre Fund-Tubura in Kayonza District from 2019 to 2023. The findings reveal a comprehensive range of services provided to smallholder farmers, with fertilizers and seeds being universally distributed (100%), while agroforestry seedlings (55.1%) and other services like cooking stoves, Biolite lamps, and training had moderate to lower coverage. Farmers typically received three to four different services, with agricultural inputs being the most frequent, often provided seasonally or annually. Services like

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chickens, fruit seedlings, and drying sheets were received less frequently, reflecting a selective approach based on specific needs or resource constraints. Farmers ranked seeds and fertilizers as critically important, underscoring their pivotal role in agricultural productivity, while other interventions were moderately valued, such as training and extension materials.

The second objective aimed to assess the level of livelihood among smallholder farmer beneficiaries. The data showed significant improvements in agricultural productivity, with maize yields increasing from an average of 1,429.44 kg/ha to 3,477.67 kg/ha after Tubura's interventions. Farmers reported substantial enhancements in food security, health, education, and household income, although these were predominantly moderate. For example, maize-related income rose significantly from Rwf 70,317.77 to Rwf 170,822.34. Farmers also reported better access to health insurance and education facilities for their children, indicating that Tubura's support extended beyond agricultural productivity to positively influence broader aspects of livelihood.

The third objective sought to analyze the relationship between Tubura's agricultural activities and farmers' livelihoods. Statistical analysis revealed strong positive correlations between the number of services received and key livelihood indicators, such as agricultural productivity ($r = 0.206$, $p < 0.01$) and food security ($r = 0.207$, $p < 0.01$). Similarly, farmers' length of engagement with Tubura showed significant relationships with agricultural productivity ($r = 0.752$, $p < 0.01$) and asset accumulation ($r = 0.302$, $p < 0.01$), emphasizing the benefits of sustained participation. These findings indicate that Tubura's interventions have not only enhanced productivity but also contributed to improved food security, economic stability, and access to essential services, demonstrating their critical role in uplifting smallholder farmers' livelihoods.

This study examined the contribution of agricultural organizations to smallholder farmers' livelihoods in Rwanda, focusing on One Acre Fund-Tubura's interventions in Kayonza District from 2019 to 2023. The findings highlight Tubura's significant role in enhancing agricultural productivity and income, with notable increases in maize yields and household earnings. Long-term engagement with Tubura was strongly linked to improved farming practices, food security, and better access to education and healthcare. However, moderate progress in non-agricultural aspects and challenges such as delays in input delivery and accessibility constraints indicate areas for further improvement. Overall, the study underscores the vital role of agricultural organizations like Tubura in fostering sustainable livelihood improvements among smallholder farmers.

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