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Influences of Livelihood Support on Food Insecurity among Tanzania's Productive Social Safety Net Beneficiary Households

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Abstract

Food insecurity remains a major development concern worldwide, particularly in sub-Saharan Africa, despite the extensive investment in social safety nets with livelihood support as a mitigation strategy. However, empirical evidence on the effectiveness of livelihood support in improving household food security remains limited and inconclusive. The study assesses the influence of livelihood support under PSSN on household food insecurity using a quasi-experimental design and Propensity Score Matching (PSM). Data were collected from 400 households across four regions in Tanzania, comprising 160 treatment and 240 control households. Using the Household Food Insecurity Access Scale (HFIAS), results show that livelihood-supported households had a lower mean food insecurity score (9.26) than non-supported households (10.21). The estimated ATET of –0.95 is negative; the effect is not statistically significant. The findings suggest the need to strengthen and refine livelihood support under PSSN to advance food security and achieve poverty-reduction objectives.

Keywords: Productive Social Safety Net, Livelihood Support, Food Insecurity, Household Food Insecurity Access Scale, Propensity Score Matching

1. Introduction

Food insecurity remains a serious challenge in many developing countries, with Sub-Saharan Africa (SSA) continuing to bear a large share of the burden. Although considerable efforts have been made to reduce hunger and poverty, many people still struggle to obtain enough nutritious and safe food to meet their daily needs. Sulaiman (2018) estimates that about 767 million people worldwide live in poverty, more than half of whom are found in Sub-Saharan Africa. Recent evidence also shows that moderate and severe food insecurity remain widespread across the region, largely due to the continued exposure of poor households to economic shocks, climate variability, unemployment, and low levels of agricultural productivity (FAO, 2024). In Tanzania, food insecurity remains a concern among both rural and urban households, particularly among low-income groups whose livelihoods depend mainly on rain-fed agriculture and informal economic activities (WFP, 2023).

In response to persistent poverty and food insecurity, many African countries have expanded social protection programmes, particularly social safety nets (SSNs), to support vulnerable households and improve their well-being. These programmes are intended to reduce the effects

of chronic poverty, food shortages and livelihood-related risks through interventions that include cash transfers, public works activities and livelihood support measures. In Tanzania, the government launched the Productive Social Safety Net (PSSN) under the third phase of the Tanzania Social Action Fund (TASAF III) to reduce poverty and strengthen the livelihoods of vulnerable households through conditional cash transfers, public works and livelihood support services (WB, 2019).

Livelihood support has become an important part of productive social safety net programmes because it is intended to achieve more than immediate consumption support. The interventions seek to improve households' ability to earn income and cope with future challenges. They commonly include entrepreneurship training, participation in savings and credit groups, access to agricultural inputs, livestock-related activities and support for small business development. The expectation is that stronger livelihood activities can improve household earning opportunities, increase access to food, and lower the risk of food insecurity over time. Previous studies have reported that combining livelihood support with cash transfer programmes can improve household welfare and contribute to reducing poverty and food insecurity (WB, 2026; WFP, 2023).

Although several studies have assessed the role of social safety nets in reducing poverty and improving household welfare, evidence on the specific contribution of livelihood support to household food security remains limited, especially in Tanzania. Existing research has largely concentrated on cash transfers and public works programmes, with less emphasis on livelihood support interventions and their role in promoting long-term food security outcomes (Jacob and Pedersen, 2018). In addition, there are continuing concerns about whether beneficiary households are able to sustain improvements in food consumption and resilience once programme support is reduced or comes to an end. These gaps in the literature point to the need for further research on the effect of livelihood support interventions on food insecurity among beneficiaries of productive social safety net programmes.

This study therefore, examines the influence of livelihood support on household food insecurity among beneficiaries of the PSSN. More specifically, it investigates whether livelihood support interventions help improve household access to food, strengthen dietary stability, and increase resilience to food-related shocks. The study is expected to add to the growing literature on social protection while also generating evidence that can inform efforts to strengthen livelihood-oriented interventions within social safety net programmes aimed at achieving sustainable food security outcomes.

2. Theoretical and Conceptual Framework

This study draws on the Theory of Change (ToC) and the Sustainable Livelihoods Framework (SLF). Together, these frameworks provide a basis for understanding how livelihood support interventions may influence household food security among beneficiaries of the Productive Social Safety Net (PSSN).

Theory of Change

Theory of Change (ToC) is a framework used to explain how programme activities are expected to produce desired results. It describes the sequence through which programme resources and

interventions lead to outputs, outcomes, and longer-term impacts (Silva et al., 2015). The main idea behind ToC is that well-designed interventions create a chain of changes that eventually contribute to broader development goals. Rather than focusing only on programme inputs and implementation activities, the framework pays attention to the results that are expected to emerge and the pathways through which those results are achieved. This makes it useful for assessing whether a programme brings about meaningful and lasting improvements in the lives of beneficiaries.

Within the PSSN programme, the Theory of Change assumes that cash transfers, public works activities, and livelihood support interventions work together to strengthen household livelihoods. Through these interventions, households are expected to improve their income-earning opportunities, build productive capacity, and become better able to cope with economic shocks. These changes are expected to improve access to food, support better dietary outcomes, and lower the risk of food insecurity. The framework further assumes that when households receive adequate financial and productive support, they are more likely to invest in assets, expand their livelihood options, and gradually reduce their reliance on social assistance. In this way, the Theory of Change provides a useful framework for examining whether livelihood support interventions contribute to the broader goals of poverty reduction and improved food security among PSSN beneficiaries.

Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework (SLF) complements the Theory of Change by offering a broader perspective on the factors that influence household livelihood outcomes. Developed by the United Kingdom's Department for International Development (DFID) during the 1990s, the framework argues that household well-being is shaped by access to and use of five key forms of capital: human, financial, physical, natural, and social capital. It also recognizes that the livelihood choices available to households and the results they achieve are influenced by factors such as vulnerability, institutions, policies, and the wider socio-economic environment in which they live and operate, as shown in Figure 1.

The SLF further suggests that households differ in the assets and capabilities they possess, and these differences affect their ability to take advantage of livelihood opportunities and respond to shocks and stresses. When households have better access to livelihood assets, they are more able to engage in productive activities, diversify their sources of income, and cope with challenges such as droughts, market instability, and economic downturns. As access to these assets improves, households are expected to experience better livelihood outcomes, including higher income levels, lower vulnerability, improved food security, and more sustainable use of resources. In the context of PSSN, livelihood support interventions are intended to strengthen the asset base of beneficiary households through financial support, skills training, savings promotion, and assistance for income-generating activities. By improving access to livelihood assets, the programme aims to strengthen households' ability to meet their food needs and sustain their livelihoods over time. The SLF therefore provides a useful basis for understanding how livelihood support interventions may affect food security among programme beneficiaries.

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Integrations of the Two Frameworks

The combination of the ToC and SLF provides a robust theoretical foundation for the study. While the Theory of Change explains the causal pathways through which PSSN livelihood support interventions are expected to improve food security, the Sustainable Livelihoods Framework identifies the livelihood assets and contextual factors that mediate this relationship. Together, the two frameworks suggest that livelihood support interventions contribute to food security by enhancing households' productive assets, strengthening resilience, expanding livelihood opportunities and enhancing beneficiaries to achieve sustainable improvements in their welfare. Based on these theoretical perspectives, the study hypothesizes that participation in PSSN livelihood support interventions positively influences household food security through improvements in livelihood assets, income generation and resilience to shocks. This proposition forms the basis for examining the effectiveness of livelihood support interventions in promoting sustainable food security among PSSN beneficiary households.

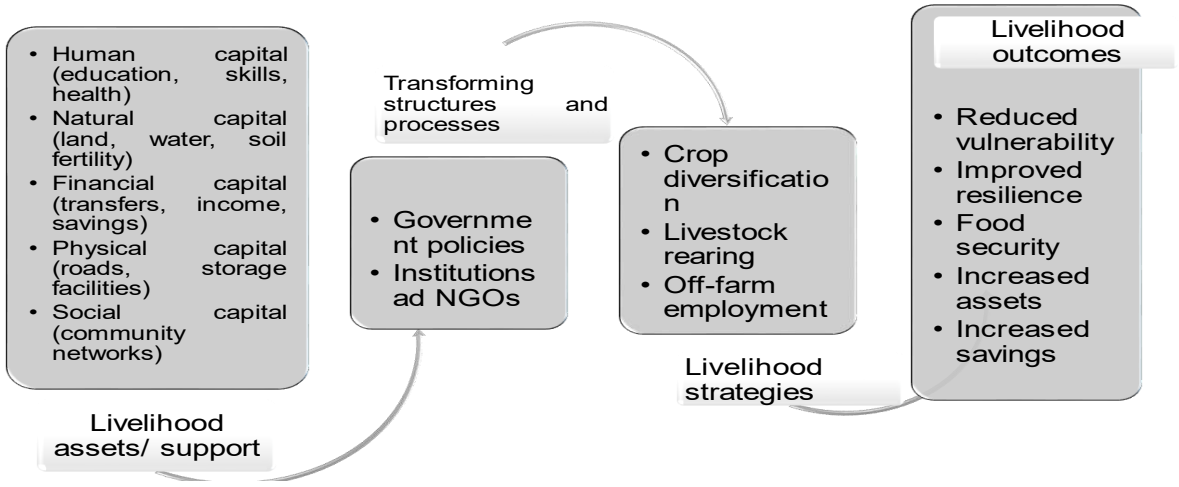


Figure 1: Sustainable Livelihood Framework

3. Literature Review

The reviewed literature indicates that social safety nets play an important role in addressing poverty, vulnerability, and food insecurity among poor households. Evidence from different settings generally shows that social protection programmes can improve household consumption, stabilize incomes, and increase access to food. However, the extent and durability of these benefits vary across programmes and are often influenced by factors such as programme design, implementation quality, transfer size, and the availability of complementary livelihood support interventions.

A key theme emerging from the literature is the difference between traditional cash transfer programmes and integrated cash-plus approaches. Studies by Gilligan et al. (2009), Beegle et al. (2018), and Bahru et al. (2020) report that conventional cash transfer programmes often produce limited or moderate improvements in food security. These outcomes are commonly linked to

challenges such as low transfer amounts, irregular payments, and weak connections to productive livelihood opportunities.

By contrast, evidence from Banerjee et al. (2015), Sulaiman (2018), Kidd and Athias (2019), Mume et al. (2022), and Tadese and Zeleke (2022) shows that programmes that combine cash support with livelihood interventions, skills development, financial inclusion, agricultural assistance, and asset-building activities tend to achieve stronger and more lasting improvements in household welfare and food security. These findings are consistent with the Sustainable Livelihoods Framework, which suggests that strengthening multiple livelihood assets can improve household resilience and reduce exposure to shocks.

Findings from Tanzania present a mixed picture. On the one hand, evaluations of the Productive Social Safety Net (PSSN) programme have reported positive outcomes, including higher household consumption, greater frequency of meals, and lower levels of poor food consumption among beneficiary households (URT, 2019; ATNi, 2025). On the other hand, more recent impact assessments indicate that a considerable number of beneficiaries continue to face food insecurity, with many households reporting meal skipping, food shortages, and poor borderline food consumption scores (URT, 2023). Similarly, Msuha and Kissoly (2024) found only modest reductions in food insecurity among programme participants, suggesting that cash transfers and public works interventions alone may not be sufficient to generate substantial and sustained improvements in food security.

The contrast between reported programme achievements and the continued presence of food insecurity points to an important gap in current knowledge. Much of the existing research has examined the overall effects of social safety nets, especially cash transfers and public works programmes, while giving relatively little attention to the specific role of livelihood support interventions. As a result, it remains unclear whether observed improvements in food security are mainly driven by cash transfers or by livelihood support activities aimed at strengthening productive capacity and promoting self-reliance. In addition, many earlier studies have assessed programme-level outcomes without clearly separating the effects of livelihood support from other programme components.

Existing studies also face several methodological challenges. Although some investigations have applied rigorous approaches such as randomized controlled trials and propensity score matching, few have directly compared households that received livelihood support with similar households that did not receive such support. Differences in programme settings, indicators used to measure outcomes, and intervention designs further complicate efforts to draw clear conclusions about the contribution of livelihood support to food security. These limitations help explain why the available evidence remains mixed and highlight the need for further research.

This study was undertaken to address these gaps by examining the influence of livelihood support on household food insecurity among PSSN beneficiaries. Using Propensity Score Matching to estimate the average treatment effect of livelihood support, the study seeks to provide stronger evidence on whether livelihood-oriented interventions contribute to improved food security beyond the effects of conventional social assistance. The findings are expected to contribute to

the social protection literature and generate policy-relevant evidence for strengthening productive social safety net programmes in Tanzania and similar settings.

4. Study Methodology

4.1 Study Area

The study was carried out in four regions of Tanzania: Dodoma, Morogoro, Singida, and Iringa. These regions were selected to capture different agro-ecological, socio-economic, and livelihood conditions. One local government authority was chosen from each region, namely Chamwino District Council in Dodoma, Kilosa District Council in Morogoro, Singida Municipal Council in Singida, and Mufindi District Council in Iringa. The selected councils contained two categories of PSSN beneficiary households identified through the Tanzania Social Action Fund (TASAF III). The first group consisted of households receiving both cash transfers and livelihood support interventions, while the second group comprised households receiving cash transfers only. Having both groups within the same programme setting provided a suitable basis for establishing a comparison group and examining the effect of livelihood support on household food insecurity.

4.2 Research Design

This study employed a quasi-experimental design and used Propensity Score Matching (PSM) to assess the effect of livelihood support interventions on household food insecurity among PSSN beneficiaries. Quasi-experimental approaches are commonly used in programme evaluations where participants cannot be randomly allocated to intervention and comparison groups (Bryman, 2012; Lane et al., 2012). In such situations, statistical techniques are used to create a comparison group that can be used to estimate outcomes that might have occurred if the intervention had not been received.

Propensity Score Matching was selected because participation in livelihood support interventions was not random. The method helps reduce potential selection bias by matching households with similar observable characteristics. Through this process, households that received livelihood support are compared with similar households that did not receive the intervention, improving the credibility of the estimated programme effects. The analysis focused on the Average Treatment Effect on the Treated (ATET), which estimates the effect of livelihood support among beneficiary households that actually participated in the intervention.

4.3 Study Population

The study population comprised all households participating in the Productive Social Safety Net (PSSN) programme in Tanzania, estimated at 1,371,038 households in 2022 (URT, 2022). Two groups of beneficiaries were included in the study: households that received both cash transfers and livelihood support interventions (treatment group) and households that received cash transfers only (control group). The comparison between these groups was intended to determine whether livelihood support provides additional food security benefits beyond those associated with cash transfers alone. Because both groups belonged to the same programme and were selected through similar targeting procedures, they provided an appropriate basis for comparing programme outcomes.

4.4 Data Sources and Data Collection Methods

The analysis was based mainly on primary data gathered through structured household questionnaires administered to sampled households in both the treatment and control groups. The questionnaire collected information on socio-demographic characteristics, household assets, livelihood activities, access to services, and food security status. In addition, Key Informant Interviews (KIIs) were carried out with council officials, TASAF programme implementers, and community representatives. Information obtained from these interviews was used to provide additional context for interpreting the quantitative results.

4.5 Sampling Procedure and Sample Size Determination

The study combined probability and non-probability sampling approaches. In the first stage, councils were selected purposively based on the presence of both treatment and control households. In the second stage, households were selected from programme beneficiary lists using simple random sampling, giving all eligible households an equal chance of being included in the study. The sample size was calculated using Yamane's (1972) formula:

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$$n = \frac{N}{1 + N(e)^2}$$

Whereby, n=sample size, N=study population, and e=error term usually ranges from 1%-10%. Using a population of 1,371,038 beneficiary households, a 5 percent margin of error, and a 95 percent confidence level, the sample size was estimated as follows: $n = \frac{1{,}371{,}038}{1 + 1{,}371{,}038(0.05)^2}$ = 399.88

Accordingly, a total sample of 400 households was selected. Of these160 households constituted the treatment group while 240 households formed the control group. The large control group was intentionally maintained to improve matching quality and increase the likelihood of identifying suitable comparison observations during the PSM procedures. The study considered matching ratio and power determination of 80 percent assuming they form a matching group which 160 treatments and 160 control. Since is very rarely to have similarly group with close related demographic characteristics normal the control group is constituted by the majority households thus the remaining 20 percent equally to 80 households forms additional to 160 control group and thus becomes 240 households.

4.6 Data Analysis and Measurement of Household Food Insecurity

Quantitative data were coded and analyzed using Stata Version 17. Frequencies and percentages were used to summarize the socio-demographic characteristics of the sampled households. In addition, Chi-square tests were performed to examine whether selected socio-demographic characteristics differed between treatment and control households. The test was used to assess the relationship between treatment status and selected categorical variables (Onchiri, 2013; Ugoni and Walker, 1995).

Household food insecurity was assessed using the Household Food Insecurity Access Scale (HFIAS), a standardized instrument developed by the Food and Nutrition Technical Assistance

(FANTA) Project. The tool comprises nine questions that capture household experiences related to difficulties in accessing food during the 30 days preceding the survey. Responses were scored according to how often each condition occurred. A score of 0 was assigned when the condition did not occur, 1 when it occurred once or twice (rarely), 2 when it occurred three to ten times (sometimes), and 3 when it occurred more than ten times (often) during the reference period.
For each household, the overall HFIAS score was obtained by summing the scores from all nine questions. The resulting score ranged from 0 to 27, where 0 represents the most food-secure situation and 27 represents the highest level of food insecurity. Thus, lower scores indicate better household food security, while higher scores indicate greater food insecurity.

4.7 Period of the Study

Data collection for this manuscript began in October 2024 and continued through February 2025, followed by analysis from March through October 2025. The report writing started in November 2025 and continued through March 2026, followed by submission to various publishers. Ethical approval for this study was obtained in a written form from the appropriate University Research Ethics Committee of Sokoine University of Agriculture before data collection (Ref. SUA/ADM/R.1/8/1239). Permission to conduct the study was also obtained from the relevant national and local authorities, including the President's Office-Regional Administration and Local Government, as well as the respective councils in the study area. This research was conducted in accordance to the guidelines indicated in the approval and permits. All participants were informed of the study's purpose, and informed consent was obtained before participation. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any time without penalty. To ensure confidentiality and anonymity, no personal identifiers were collected, and all data were securely stored and used solely for research purposes.

4.8 Variable Measurement

Dependent Variable

Household Food Insecurity (HFIAS Score)

Household food insecurity was measured using the HFIAS score, which ranges from 0 to 27. Higher scores indicate higher levels of food insecurity, while lower scores indicate better food security.

Independent Variables

The propensity score model included household characteristics that may influence participation in livelihood support interventions and household food security outcomes.

(i) **Age of respondent** - measured in completed years.
(ii) **Sex of respondent** - coded as 0 = Female and 1 = Male.
(iii) **Marital status** - coded as 1 = Married and 0 = Single.
(iv) **Education level** - measured as the highest level of education attained and coded as: 1 = No formal education, 2 = Primary education, 3 = Secondary education, 4 = College education, and 5 = Tertiary education.
(v) **Sex of household head** - coded as 0 = Female and 1 = Male.
(vi) **Household size** - measured as the total number of household members.

(vii) **Occupation** - measured as the respondent's main economic activity and coded as: 1 = Agro-pastoralist, 2 = Business, 3 = Agriculture only, 4 = Regional institutions, and 5 = Labourer.

(viii) **Access to credit** - coded as 1 = Yes and 0 = No.

4.9 Propensity Score Matching Model

A major challenge in impact evaluation is the possibility of selection bias, which occurs when programme participants differ from non-participants in ways that may influence the study outcome. Because participation in livelihood support interventions was not randomly determined, households that received the intervention may differ from those that did not. To address this issue, the study applied Propensity Score Matching (PSM). Rosenbaum and Rubin (1983) define a propensity score as the probability of receiving treatment based on a set of observed characteristics. By matching households with similar propensity scores, PSM creates a comparable treatment and control group, making it possible to estimate programme effects while reducing bias associated with observable characteristics. The propensity scores were estimated using a binary logistic regression model, where participation in livelihood support was coded as 1 and non-participation was coded as 0. The model specification is presented below:

$$.In\frac{pi}{1-pi}=\beta0+\beta1Agei+\beta2Maritali+\beta3Educationi+\beta4Headi+\beta5HHsizei+\beta6Occupationi+\beta7landownd + \beta8Accesscrediti+\beta9Householdsizei$$

Where:

- P_i= probability that household $i$participates in the treatment
- X_i= vector of observed covariates
- β_0= intercept
- $\beta_1 \ldots \beta_9$= coefficients to be estimated
- ϵ_i= error term

The propensity equation

$$PS_i = P(T_i = 1 \mid X_i)$$

$$X_i = (Age_i, Marital_i, Education_i, Head_i, HHsize_i, Occupation_i, Land_i, Credit_i, House_i)$$

$$PSi = \frac{e\text{^}(\beta0 + \beta1X1_i + \beta2X2_i + \beta3X3_i + \beta4X4_i + \beta5X5_i + \beta6X6_i + \beta7X7_i + \beta8X8_i + \beta9X9_i)}{1 + e\text{^}(\beta0 + \beta1X1_i + \beta2X2_i + \beta3X3_i + \beta4x4_i + \beta5X5i + \beta6X6_i + \beta7X7_i + \beta8X8_i + \beta9X9_i)}$$

Where

Psi is the estimated propensity score, the predicted probability that a household ıparticipates in the treatment given its observed characteristics.

X1 to X 9(Age, Marital status, Head, Household size, Occupation, Land ownership, Access to Credit, Education, House ownership).

4.10 Estimation of Treatment Effects

After matching treatment and control households, the Average Treatment Effect on the Treated (ATET) was estimated to determine the effect of livelihood support interventions on household food insecurity. The ATET was computed as follows:

$$\text{ATT= E[Y1−Y0|T=1]}=\frac{1}{NT}\sum_{iTi=1} P\left(Yi - \sum_{jTj=0} wijYj\right)$$

Where:

- Yi*Yi* = observed outcome for treated household (i)
- wij*wij* = matching weight assigned to control household (j) matched to treated household (i)
- NT*NT* = number of treated households

A negative ATET value indicates that livelihood support is associated with lower household food insecurity, while a positive value indicates higher food insecurity. Statistical significance was assessed using standard errors, z-statistics, p-values, and 95 percent confidence intervals.

5. Results and Discussion

5.1 Socio-demographic characteristics

The socio-demographic characteristics of respondents were examined to assess the comparability of treatment and control groups prior to estimating the effect of livelihood support interventions on household food security. Establishing baseline equivalence is critical in impact evaluation because significant differences in observable characteristics may bias treatment effect estimates. The explanation of these socio-demographic characteristics is summarized in Table 1.

5.1.1 Sex Distribution

Female respondents formed the majority of participants in both the treatment and control groups. Women accounted for 86.3 percent of respondents in the treatment group and 82.9 percent in the control group, while men represented 13.7 percent and 17.1 percent, respectively. Results of the Chi-square test showed no statistically significant difference in sex composition between the two groups ($\chi^2 = 0.804$, df = 1, p = 0.370), indicating that the groups were comparable with respect to this characteristic. The observed distribution is consistent with the targeting approach commonly used in many social protection programmes, where women are often prioritized because they face higher levels of poverty and food insecurity and are more likely to direct household resources toward family welfare. The predominance of female respondents may also reflect the gendered nature of poverty in rural communities, where female-headed households frequently face greater socio-economic challenges. A comparable pattern was reported by Nebo (2018) in Ethiopia, who found no significant difference in the sex composition of beneficiary and non-beneficiary households participating in the Productive Safety Net Programme (PSNP). Therefore, the differences observed in household food insecurity between the treatment and control groups are unlikely to be attributable to variations in respondent sex.

5.1.2 Marital Status

Marital status did not differ significantly between the treatment and control groups ($\chi^2 = 6.992$, df = 4, p = 0.136), indicating a relatively balanced distribution. Widowed respondents constituted the

largest category in both groups, control (45.8%) and treatment (40.6%), while married individuals were notably represented, treatment group (40.6%) and (30.0%) control group. The high prevalence of widows may reflect demographic realities within poor rural communities, where loss of spouses often increases household vulnerability through reduced labour availability, lower income and weakened social support networks. Although the treatment group contained a higher proportion of married respondents than the control group, the difference was not statistically significant. This suggests that marital status is unlikely to systematically influence programme participation or treatment outcomes. Nevertheless, the substantial proportion of windowed households underscores the importance of social protection interventions in supporting households that face heightened risks of poverty and food insecurity.

5.1.3 Age of Respondents

The age distribution reveals that nearly half of all respondents were above 55 years of age, while only a small proportion were below 35 years. The absence of statistically significant differences between groups ($\chi^2 = 2.614$, df = 3, $p = 0.455$) confirms comparability in terms of age structure. This finding aligns with studies of social safety net programmes that commonly report a concentration of beneficiaries among older populations due to the programme, focus on vulnerable households with limited productive capacity. The predominance of older respondents may have important implications for livelihood support interventions. Older beneficiaries often possess extensive farming experience and local knowledge but may face physical limitations that constrain participation in labour-intensive economic activities. Similar findings have been reported by Nebo (2018) and Msuha and Kissoly (2024), who observed that productive social safety net programmes frequently serve populations with average ages above 50 years. Consequently, livelihood interventions should consider age-related constraints when promoting productive investments and income-generating activities.

5.1.4 Education Level

Education level was generally low among respondents, with nearly half having no formal education and more than half having only primary education. Secondary education was extremely rare. The lack of significant differences between treatment and control ($\chi^2 = 0.379$, df = 2, $p = 0.827$) indicates that educational attainment was balanced across groups. Low levels of education are common among rural poor households and may limit the adoption of improved agricultural practices, access to market information and participation in entrepreneurial activities. Nevertheless, the comparability of educational levels across groups strengthens the validity of subsequent impact estimates because differences in food security outcomes cannot be attributed to disparities in educational attainment. Similar observations were reported by Habib et al. (2023) in their assessment of the Productive Safety Net Programme in the Somali Regional State of Ethiopia.

5.1.5 Sex of Household Head

Female-headed households constituted approximately two-thirds of the study sample, reflecting the high prevalence of female economic responsibility among vulnerable households. the nearly identical proportions observed between treatment and control groups indicate demographic similarity. Female-headed households are often associated with increased vulnerability due to limited access to productive assets, labour and financial resources. However, evidence from

social protection programmes suggests that women frequently allocate programme benefits toward household consumption, education and nutrition, thereby improving overall welfare outcomes.

5.1.6 Household Size

Household size distributions were remarkably similar across treatment and control groups (χ^2 = 0.211, df = 2, p = 0.900), with most households comprising between one and four members. This finding suggests that household size is unlikely to confound programme impact estimates. Although larger households may benefit from greater labour availability, they also face greater consumption demands, which can increase vulnerability to food insecurity. The findings corroborate Nebo (2018), who reported no significant differences in household size between beneficiary and non-beneficiary households under Ethiopia's Productive Safety Net Programme. The balanced distribution observed in the current study enhances confidence in the comparability of the treatment and control groups.

5.1.7 Occupation

Occupation was the only socio-demographic variable that differed significantly between groups (χ^2 = 11.922, df = 4, p = 0.018). A significantly larger proportion of treatment households engaged in agro-pastoralism, while labour-based occupations were more prevalent among control households.

This difference is noteworthy because occupation directly influences household income generation, asset accumulation and resilience to shocks. Agro-pastoral households may possess greater opportunities to benefit from livelihood support interventions through investments in livestock, agricultural inputs and productive assets. Consequently, occupation represents a potential source of selection bias and justifies its inclusion as a matching covariate in the impact evaluation model. The significant occupational differences observed prior to matching highlight the importance of employing propensity score matching to improve comparability between groups.

5.1.8 Access to Credit

Access to credit was significantly higher among treatment households than among control households (χ^2 = 6.482, df = 1, p = 0.011). This finding suggests that programme participation may be associated with enhanced financial inclusion and improved access to formal or informal credit services. Access to credit is widely recognized as a critical determinant of livelihood improvement because it enables households to invest in productive activities, smooth consumption during shocks and diversify income sources. The finding is consistent with Nebo (2018), who reported significantly higher access to credit among beneficiaries of the Productive Safety Net Programme. Likewise, Sedlmayr et al. (2020) argue that integrated interventions combining cash transfers, training, and mentoring can strengthen financial capability and facilitate access to credit markets. Therefore, improved credit access among treatment households may represent an important mechanism through which livelihood support interventions contribute to improved food security outcomes.

Table 1: Socio-Demographic Characteristics of the Respondents

Variables	Categories	Control (n=240)		Treatment (n=160)		Total (n=		X2	df	p
		n	%	n	%	n	%			
Sex	Female	199	82.9	138	86.3	337	84.3	.804	1	.370
	Male	41	17.1	22	13.8	63	15.7			
Marital status	Single	21	8.8	14	8.8	35	8.8	6.992	4	.136
	Married	72	30.0	65	40.6	137	34.3			
	Divorce	34	14.2	13	8.1	47	11.8			
	Widow	110	45.8	65	40.6	175	43.8			
	Co-parenting	3	1.3	3	1.9	6	1.5			
Age	2 0- 35	16	6.7	17	10.6	33	8.3	2.614	3	.455
	36 – 45	45	18.8	28	17.5	73	18.3			
	46 – 55	64	26.7	36	22.5	100	25.0			
	More than 55	115	47.9	79	49.4	194	48.5			
Education level	No formal education	110	45.8	74	46.3	184	46.0	.379	2	.827
	Primary	127	52.9	85	53.1	212	53.0			
	Secondary	3	1.3	1	0.6	4	1.0	.087	1	.768
Sex of head of household	Female	148	61.7	101	63.1	249	62.3			
	Male	92	38.3	59	36.9	151	37.7			
Household size	1 - 4	141	58.8	96	60.0	237	59.3	.211	2	.900
	5 - 8	90	37.5	57	35.6	147	36.7			
	More than 8	9	3.8	7	4.4	16	4.0			
Occupation	Agro-Pastoralist	152	63.3	121	75.6	273	68.3	11.922	4	.018
	Business	37	15.4	23	14.4	60	15.0			
	Agriculture Only	37	15.4	14	8.8	51	11.7			
	Religious Institutions	1	0.4	1	0.6	2	0.5			
	Labour	13	5.4	1	0.6	14	3.5			
Access to credit	No	224	93.3	137	85.6	361	90.3	6.482	1	.011

	Yes	16	6.7	23	14.4	39	9.7			

5.2 Covariate Balance after Matching

To estimate the causal effect of livelihood support interventions more accurately, propensity score matching was employed to reduce observable differences between treatment and control households. The effectiveness of the matching procedure was assessed using standardized mean differences (SMDs) and variance rations.

Overall, the results demonstrate substantial improvements in covariate balance following matching. Prior to matching, several variables exhibited notable imbalance, particularly marital status, occupation and access to credit. After matching, most standardized mean differences fell below the commonly accepted threshold of 0.10, indicating satisfactory balance between treatment and control groups. These findings support Rosenbaum and Rubin's (1983) proposition that conditioning on propensity scores can effectively remove biases arising from observable covariates.

5.2.1 Improvement in Key Covariates

Age and education exhibited only minor imbalances before matching and achieved excellent balance afterward. Similarly, occupation, which initially showed a significant imbalance, improved substantially following matching, reducing the standardized difference from 0.2122 to 0.0309. This improvement is particularly important because occupation was identified as a significant baseline difference and could otherwise bias programme impact estimates, as shown in Table 2.

Access to credit also experienced considerable improvement, with the standardized difference declining from 0.2900 to -0.0692. Given the significant pre-matching differences in financial access, this reduction indicates that matching successfully minimized one of the most important potential sources of selection bias, as shown in Table 2.

Marital status demonstrated substantial improvement as well, although the post-matching standardized mean difference remained slightly above the conventional threshold. Nonetheless, the reduction from 0.3474 to -0.1204 indicates that most of the observed imbalance was successfully addressed, as shown in Table 2.

5.2.2 Residual Imbalances

Despite the overall success of the matching procedure, minor residual imbalances remained for household headship and land ownership. In particular, land ownership exhibited a post-matching standardized mean difference of -0.1416 and a variance ratio substantially below unit. Since land is a critical productive asset in rural livelihoods, residual differences in land ownership could still influence household food security outcomes. Therefore, impact estimates should be interpreted cautiously, and sensitivity analyses should be conducted to assess the robustness of the results to potential unobserved heterogeneity.

5.2.3 Implication for Impact Evaluation

The observed improvements in covariate balance indicate that the matched sample more closely approximates the conditions of a non-randomized experiment. Consequently, subsequent

comparisons of food security outcomes between treatment and control households are more likely to reflect the effects of livelihood support interventions rather than pre-existing differences in household characteristics. The findings therefore provide a strong empirical basis for proceeding with causal analysis using the matched dataset.

Overall, the balance diagnostics demonstrate that propensity score matching effectively reduced observable selection bias and improved validity of programme impact estimates. While some residual imbalance remains, particularly for land ownership and household headship, the magnitude of the differences is relatively small and unlikely to substantially compromise the credibility of the impact evaluation results.

Table 2: Covariate Balance after Matching

Covariate	Standardized Difference (Raw)	Standardized Difference (Matched)	Variance Ratio (Raw)	Variance Ratio (Matched)
Age	0.111	0.070	1.067	1.059
Marital status	0.3474	–0.1204	1.3253	0.9649
Education	0.1105	–0.0105	1.0673	1.0574
Head	0.0422	–0.1360	1.0274	0.9469
Household size	0.0432	–0.0534	0.7817	0.8636
Occupation	0.2122	0.0309	0.6301	0.9227
Size of land owned	0.0798	–0.1416	0.4940	0.4442
Access to credit	0.2900	–0.0692	2.1510	0.8844
House ownership	0.1001	–0.0384	0.7856	1.1136

5.3 Influence of Livelihood Support Interventions on Household Food Insecurity

The effect of livelihood support interventions on household food insecurity was assessed using Propensity Score Matching (PSM) and the Average Treatment Effect on the Treated (ATET). Results presented in Table 3 show that households that received livelihood support recorded a lower mean Household Food Insecurity Access Scale (HFIAS) score (9.26) than households that did not receive livelihood support (10.21). Since lower HFIAS scores indicate better food security, the estimated ATET coefficient (-0.95) suggests that participation in livelihood support interventions was associated with lower levels of household food insecurity.

However, the estimated effect was not statistically significant ($z = -0.73$, $p = 0.466$). In addition, the 95 percent confidence interval (-3.50 to 1.60) includes zero, indicating that the observed difference between the two groups cannot be conclusively attributed to livelihood support interventions.

The quantitative findings are supported by evidence from the Key Informant Interviews (KIIs), which provide important contextual explanations for the observed differences in household food insecurity. Across the four study councils, informants consistently reported that households participating in the graduation support component were gradually improving their capacity to secure food through productive investments rather than relying solely on cash transfers for immediate consumption. A TASAF Council Coordinator from Mufindi District Council explained

that *"beneficiaries are increasingly investing part of their transfers in poultry, goats and small crop production, but these investments require time before they begin contributing to household food consumption."* Similarly, a Livelihood Ehnancement Facilitator in Kilosa observed that *"most households initially experienced little change in food availability because the enterprises they establish are still developing and have not yet started generating sufficient income."* These narratives help explain why treatment households recorded lower average HFIAS scores than the comparison group despite the absence of a statistically significant programme effect.

Table 3: Average Treatment Effect on the Treated (ATET) for Household Food Insecurity (HFIAS)

HFIAS	Coefficient	std. err.	Z	P>z	[95% conf. interval]	
ATET Treatment vs Control)	-.9485816	1.302633	-0.73	0.466	-3.501696	1.604533

Although households that participated in livelihood support activities recorded slightly lower food insecurity scores, the estimated difference was not large enough to demonstrate a statistically significant programme effect. This result indicates that participation in livelihood support activities alone may not necessarily lead to immediate improvements in household food security during the study period. Improvements in food security often depend on a combination of factors, including sustained investment, accumulation of productive assets, access to markets, and sufficient time for livelihood activities to generate benefits. As a result, the contribution of livelihood support interventions may take longer to become evident and may not be fully captured through a cross-sectional assessment.

The KIIs further revealed that livelihood support interventions primarily strengthened households' productive capacity and resilience rather than providing immediate improvements in food access. Informants consistently emphasized that beneficiaries first accumulate productive assets before experiencing meaningful improvements in food security. As one Community Management Committee member in Chamwino explained, *"people are encouraged to save first, invest second, and expect food security later. A household that buys goats today cannot expect immediate improvements in food availability because the animals must first reproduce or be sold."* Likewise, a Village Executive in Singida Municipal Council noted that *"the programme is helping households build livelihoods gradually, but most beneficiaries are still in the early stages of the graduation process."* These qualitative insights reinforce the quantitative finding that the programme's effects on household food security are likely to emerge progressively overtime rather than immediately after participation.

The findings can also be interpreted within the broader framework of the Theory of Change underpinning productive social protection programmes. The theory assumes that combining cash transfers with livelihood support enhances productive capacity, increases income-generating opportunities, strengthens resilience, and ultimately improves food security. However, this pathway depends on effective programme sequencing, adequate transfer values, access to

productive resources, functioning markets, and complementary support services. Where these enabling conditions are weak, the anticipated long-term food security outcomes may not materialise despite programme participation. The current findings, therefore, suggest that livelihood support interventions under PSSN may not yet have reached the threshold necessary to generate substantial improvements in household food security.

The KIIs also confirmed several assumptions underlying the Theory of Change. Informants consistently indicated that livelihood training, entrepreneurship coaching, and continuous mentoring had improved beneficiaries' financial planning, business management skills, and confidence to engage in productive investments. According to one Livelihood Enhancement Facilitator IN Mufindi District Council, *"before the training, many beneficiaries spent almost the entire transfer on immediate household needs, but now they plan their expenditures and invest part of the money in income-generating activities."* Similarly, a TASAF Council Coordinator reported that *"the livelihood component has changed beneficiaries' attitudes from depending on transfers toward creating sustainable sources of income."* Nevertheless, nearly all informants emphasized that the transformation process requires sustained support, adequate capital, and sufficient time before measurable improvements in household food security become evident. These observations provide qualitative support for the theoretical expectation that livelihood support contributes to food security through gradual improvements in productive capacity and household resilience.

The findings partly contradict the earlier evaluation of PSSN in Tanzania. The PSSN Midline Impact Evaluation (URT, 2019) reported increased household consumption and a 6.2 percentage point reduction in the likelihood of poor food consumption among beneficiary households. Similarly, ATNi (2025) documented substantial improvements in meal frequency, with the proportion of households consuming three meals per day increasing significantly following programme participation. These studies suggest that PSSN has the potential to improve food access and consumption among poor households. However, unlike the present study, these evaluations assessed the overall programme effect rather than isolating the specific contribution of livelihood support interventions. Consequently, the positive outcomes observed in previous studies may reflect the combined influence of cash transfers and public works rather than the independent effect of livelihood enhancement activities.

The current findings are more consistent with recent evidence indicating that food insecurity remains prevalent among PSSN beneficiaries despite programme participation. The impact evaluation conducted by URT (2023) revealed that many beneficiary households continued to experience food-related hardships, including worrying about food shortages, reducing meal sizes, skipping meals and running out of food. Similarly, Msuha and Kissoly (2024) reported only modest reductions in food insecurity vulnerability among households participating in the conditional cash transfers and public works components of PSSN. These findings suggest that while social safety nets may improve short-term consumption smoothing, their capacity to generate sustainable food security outcomes remains limited unless accompanied by stronger livelihood transformation mechanisms.

The findings also resonate with evidence from other African social protection programmes. Gilligan et al. (2009), in their evaluation of Ethiopia's Productive Safety Net Programme (PSNP), found limited average impact on food security due largely to inadequate transfer levels. However, households that combined programme participation with agricultural support services demonstrated better food security outcomes that those receiving transfers alone. This observation supports the argument that productive support interventions are more likely to generate meaningful welfare gains when implemented alongside complementary services such as agricultural extension, financial inclusion, access to markets and business development support.

Conversely, the present findings differ from studies that reported significant positive impacts of integrated cash-plus programmes. Tadesse and Zeleke (2022) found that participation in Ethiopia's PSNP significantly increased household consumption expenditure, calorie intake, and annual income. Likewise, Banerjee et al. (2015) demonstrated across multiple countries that combining cash transfers with training and productive asset grants generated sustained improvements in income, consumption, and food security. The discrepancy between these findings and the present study may be attributed to differences in programme intensity, implementation quality, beneficiary characteristics, duration of programme exposure, and methodological approaches used to assess outcomes.

Methodological differences may also partly explain variations in findings. While this study employed Propensity Score Matching and ATET estimation based on HFIAS scores, previous studies have used different indicators of food security, including Food Consumption Scores (FCS), calorie intake, dietary diversity, consumption expenditure, and meal frequency. Because food security is a multidimensional concept encompassing availability, access, utilization, and stability, different indicators may capture different dimensions of household welfare. Consequently, variations in measurement approaches can lead to differing conclusions regarding programme effectiveness.

The qualitative findings further explain why the present results differ from studies reporting statistically significant improvements in food security. Across the study councils, key informants identified several contextual constraints that limited programme effectiveness despite observed behavioural changes among beneficiaries. The most frequently cited challenges include prolonged droughts, declining agricultural productivity, livestock diseases, fluctuating food prices, weak market access and inadequate start-up capital for livelihood enterprises. A Ward Executive in Chamwino explained that "many households have learned improved farming and livestock practices, but prolonged drought has reduced harvests and pasture, making it difficult for these investments to translate into better food security." Likewise, a TASAF Council Coordinator in Kilosa stated that "beneficiaries often establish small businesses, but limited markets and low purchasing power reduce the income they earn." These contextual barriers suggest that external environmental and market conditions continue to constrain the capacity of livelihood support interventions to generate significant improvements in household food security.

Another important theme emerging from the KIIs was the role of Community Savings and Investment Promotion (COMSIP) groups in strengthening household resilience. Informants reported that participation in savings group had increased beneficiaries' access to small loans,

encouraged regular saving and improved their ability to cope with temporary food shortages without selling productive assets. According to a Community Management Committtee member in Chamwino, *"COMSIP groups help households borrow money during difficult periods instead of selling livestock or productive assets, allowing them to recover more quickly."* However, informants also emphasized that savings groups remained financially weak because beneficiaries had limited income and irregular cash flows. Consequently, while COMSIP groups contributed to improving financial resilience, their capacity to substantially reduce household food insecurity remained constrained. These qualitative observations complement the quantitative findings by demonstrating that livelihood support has begun strengthening resilience mechanisms, although the magnitude of these improvements has not yet translated into statistically significant reductions in HFIAS scores.

Overall, the convergence between the quantitative and qualitative findings presents a coherent interpretation of programme effectiveness. While the Propensity Score Matching results indicate that livelihood support interventions were associated with lower household food insecurity, the estimated reduction was not statistically significant. The KIIs demonstrate that this result does not necessarily imply programme ineffectiveness; rather, they suggest that livelihood support has initiated important behavioural and economic changes, including increased productive investment, improved financial planning, greater participation in savings groups, and enhanced livelihood diversification. However, these gains continue to be constrained by climatic shocks, inadequate investment capital, weak market integration, livestock diseases and the relatively short period over which programme impacts were assessed. Taken together, the findings indicate that livelihood support under the Productive Social Safety Net Programme is strengthening the foundations for improved household food security, but achieving statistically significant improvements will likely require sustained programme implementation, stronger complementary services, enhanced market linkages, and long-term follow-up to capture the full effects of productive livelihood transformation.

6. Conclusion

This study assessed the influence of livelihood support interventions provided through the Productive Social Safety Net (PSSN) programme on household food insecurity in selected councils of Tanzania. The analysis compared households that received both cash transfers and livelihood support interventions with households that received cash transfers only. A quasi-experimental design employing Propensity Score Matching (PSM) was used to compare 160 treatment households and 240 control households drawn from Chamwino, Kilosa, Mufindi, and Singida Municipal Council.

The results showed that households participating in livelihood support interventions recorded lower average Household Food Insecurity Access Scale (HFIAS) scores than households that received cash transfers alone, indicating slightly better food security outcomes. The estimated Average Treatment Effect on the Treated (ATET) suggested a reduction in household food insecurity of approximately 0.95 points among livelihood support beneficiaries. However, this estimated effect was not statistically significant, indicating that the observed difference could not be conclusively attributed to participation in livelihood support interventions.

The findings indicate that while the cash-plus approach may contribute to improved household welfare, the livelihood support component of the PSSN programme had not yet produced measurable improvements in food security within the study period. The evidence therefore provides only limited support for the argument that livelihood support interventions alone are sufficient to generate significant improvements in household food security among programme beneficiaries.

These results add to the growing body of evidence on productive social protection programmes in Sub-Saharan Africa. While several studies have reported positive effects of cash-plus interventions on household consumption, income, asset accumulation, and food security (Banerjee et al., 2015; Tadesse and Zeleke, 2022; URT, 2019), the findings of this study are more consistent with research showing that food security outcomes are often modest, context-specific, and influenced by programme design and implementation quality (Gilligan et al., 2009; URT, 2023; Msuha and Kissoly, 2024). The results therefore support the view that livelihood support interventions do not automatically translate into improved food security and that factors such as market access, productive assets, financial inclusion, institutional support, and programme intensity are important in shaping programme outcomes.

From a theoretical perspective, the findings provide only partial support for the assumptions underlying the Theory of Change and the Sustainable Livelihoods Framework. Both frameworks suggest that combining cash transfers with livelihood support should strengthen productive capacity and contribute to improved welfare outcomes. However, the absence of a statistically significant effect suggests that the relationship between livelihood support and food security may be more complex than commonly assumed and may require longer implementation periods, stronger complementary services, and greater programme intensity before measurable impacts become evident.

The study also makes a methodological contribution by applying Propensity Score Matching to isolate the specific influence of livelihood support among PSSN beneficiaries rather than assessing the combined effects of programme components. This addresses an important gap in the existing literature, where many studies focus on the overall effects of social protection programmes without distinguishing the contribution of livelihood support interventions. Nevertheless, the study remains subject to limitations associated with observational impact evaluation methods, including the possibility of unobserved factors that cannot be fully addressed through matching procedures. Future studies should consider longitudinal data and experimental or mixed-method approaches to better understand how livelihood support interventions influence household food security over time.

Overall, the study concludes that participation in livelihood support interventions under the PSSN programme was associated with modest improvements in household food security, but the available evidence does not demonstrate a statistically significant impact. Achieving sustainable improvements in food security among poor and vulnerable households may therefore require a broader and more integrated approach that extends beyond livelihood support interventions alone.

7. Policy Implications and Recommendations

The findings of this study provide useful lessons for the planning, implementation, and assessment of productive social protection programmes in Tanzania and other similar settings.

First, the results indicate that livelihood support interventions should not be considered a single solution to household food insecurity. Although households that participated in livelihood support activities recorded lower levels of food insecurity than households receiving cash transfers only, the observed difference was not statistically significant. This suggests that policymakers should be cautious about expecting livelihood support interventions alone to produce substantial improvements in food security. Rather, such interventions should form part of broader poverty reduction and rural development efforts that address multiple constraints facing vulnerable households.

Second, the findings highlight the need to strengthen the productive inclusion component of the PSSN programme. In line with the graduation approach, livelihood support interventions should be complemented by additional services such as access to financial services, savings groups, agricultural extension support, productive assets, business development services, and market linkages. Evidence from graduation programmes implemented in different countries shows that integrated support packages are generally more effective in promoting sustainable welfare improvements than stand-alone interventions. Strengthening these complementary services may improve the ability of beneficiary households to convert livelihood opportunities into meaningful improvements in food security.

Third, programme implementation should be guided by a clearly articulated Theory of Change that specifies the sequence through which programme inputs are expected to generate intermediate and long-term outcomes. Cash transfers should provide immediate consumption support and reduce vulnerability, while livelihood interventions should progressively build productive capacity, asset accumulation, financial inclusion, and resilience. Ensuring that these interventions are delivered in a coordinated and sequenced manner is essential for achieving sustainable graduation from poverty and food insecurity. Frangmented implementation may weaken the causal mechanisms through which programme impacts are expected to occur and reduce the effectiveness of public investments.

Fourth, greater attention should be given to improving financial inclusion among programme beneficiaries. The study identified significant differences in access to credit between treatment and control households, indicating that financial services may contribute to household resilience and productive investment. Expanding access to affordable credit, savings opportunities, and financial literacy programmes could strengthen the effectiveness of livelihood support interventions by enabling households to invest in productive economic activities and build more sustainable sources of income.

Fifth, the high proportion of female-headed households among programme beneficiaries underscores the importance of adopting gender-responsive interventions. Future livelihood support initiatives should include measures to strengthen women's economic participation by improving access to productive resources, developing entrepreneurship, expanding financial services, and supporting women-owned enterprises. Such measures could contribute to better household food security outcomes while also advancing gender equality and social inclusion.

Finally, future programme evaluation should adopt more rigorous impact assessment frameworks that capture long-term programme effects. Given that livelihood interventions often require time to influence productive capacity and food security outcomes, longitudinal studies that track households over multiple years would provide more robust evidence regarding programme effectiveness.

In conclusion, the study recommends that future investments in PSSN and related social protection programmes should prioritise integrated, well-sequenced, and adequately resourced graduation pathways rather than relying solely on cash transfers or isolated livelihood interventions. Such an approach is more likely to strengthen household resilience, enhance productive capacity, and contribute to sustainable food security among poor and vulnerable populations.

8. Ethical Approval

This study was conducted in accordance with the ethical principles and relevant guidelines governing research involving human participants. Ethical approval was obtained from the appropriate Soikone University of Agriculture Research Ethics Committee before data collection, and all research procedures complied with the approved ethical protocol (Ref. SUA/ADM/R.1/8/1239) and applicable institutional regulations as outlined in the Guidelines for Preparation and Submission of Dissertations/Thesis/Research Reports/Research Papers and Other Scientific Publications of 2022.

9. Consent to Participate

Verbal informed consent was obtained from all participants before data collection. Verbal rather than written consent was prioritized because some participants had limited literacy, and requesting signatures could have caused discomfort or discouraged participation. In addition, the study posed minimal risk to participants, and the ethics review organs approved the use of verbal informed consent. Before data collection, prospective participants were provided with a detailed explanation of the study's purpose, procedures, and the authorization granted by the relevant authority to conduct the study and collect data from the selected households. Participants were then asked whether they were willing to participate, and verbal consent was obtained before data collection commenced. Verbal consent was not audio-recorded instead, a mark was put in questionnaire, because recording could have made participants uncomfortable and potentially influenced their willingness to participate. Participants were free to decline or withdraw from the study without penalty. Copies of the authorization issued by the relevant authority have been attached as supplementary materials in English and in the original language of the country in which the study was conducted.

10. Consent to Publish: This section is not applicable

11. Data Availability: "The data that support the findings of this research are available from the corresponding author (JC), up on reasonable request."

12. Conflict of Interest Statement: The authors declare that they have no conflicts of interest related to this work.

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